Facilitator's Guide

Cloverville needs your help!

Learn about food science and have fun while you crack Cloverville Detective Agency's hardest cases.

The *Cloverville Detective Agency Mysteries* were originally designed for online use by families. The mysteries use the *Cooking Up Confidence!* cookbook from North Carolina 4-H and inexpensive, everyday materials for the science projects.

Each case includes

- a setup to capture youths' interest
- three levels of puzzles to solve
- documents that can be used as reading materials or as scripts for readers' theatre
- images of the "crime scene"
- one or more hands-on science activities
- one or more related food prep activities.

Recommended Ages

The Case of the Orange Intruder is easily accessible to children as young as 5 as long as it is acted out or other kinds of reading support are provided. The remaining cases may work better with youth aged 10 to 14 or in cross-age groupings such as family settings. See each case for more information.

Case 1: The Case of the Orange Intruder

Challenge Level: Beginner

The Case of the Orange Intruder is easily accessible to children as young as 5 as long as it is acted out or other kinds of reading support are provided. Although young children may not fully grasp the idea of microbes, they can observe how washing hands helps to prevent disease.

Science Concepts:

Microbiology and Epidemiology

Healthy Living Concepts:

Food Safety, Hand Hygiene, Disease Prevention

Materials:

- Bag of orange cheese puff snacks
- *Cooking Up Confidence!* cookbook
- Optional: Detective's Notebook

Story Setup:

The phone rings.

"Hello, you've reached the Cloverville Detective Agency," *you say.*

"Oh, I am so glad I reached you," *comes a panicked voice on the other end. You immediately recognize the voice as belonging to Colleen Sandy, the owner of your favorite restaurant, Cloverville Chicken and 'Que.*

"Ms. Sandy, is everything ok?" *you ask.*

"There's been a break-in at the restaurant."

Mystery Structure:

Level 1.

Read the Introduction PDF. Then explore the images. Each of the images on the website can be enlarged by clicking on it. You can open the images in any order. Ask youth to describe their observations and to name potential clues they notice in the images.

- Image of the food prep area in the restaurant
- Image of the stove handles

- Image of the sink area and food safety poster
- Image of the refrigerator

The clue for the Level 2 password is at the end of the introduction PDF. The answer is **clean-separate-cook-chill**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 2 document. This is due to the website architecture.

Level 2.

Level 2 contains 4 PDF documents, each password protected with the same password: **clean-separate-cook-chill**.

- Instructions
- Interview with Shawn
- Interview with Hector
- Interview with Mae

Read the instructions first. The interview transcripts with the suspects can be read in any order. Youth should form hypotheses as they read the interviews and be able to point to specific clues in the text to support their ideas.

The clue for Level 3 is located at the end of the instructions, The answer is **hectormaeshawn**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 3 document. This is due to the website architecture.

Level 3.

Level 3 contains 2 PDF documents, each password protected with the same password: **hectormaeshawn**.

- Instructions
- *Go Away, Germs!* Science Activity

Youth will use their cheese puff snacks to complete the *Go Away, Germs!* Science Activity. There are links to videos about proper handwashing and to information about human skin that you can explore with youth.

The clue for the solution is located at the end of the instructions, The answer is **washyourhands**.

Solution.

The solution contains a single PDF, password protected with the password: **washyourhands**.

The Science Behind the Story:

Salmonellosis is a serious food-borne illness that affects millions of people each year. Symptoms, including fever, diarrhea, stomach cramps, and vomiting, can lead to severe dehydration, infections of the heart, brain, or bones, and even death. It is especially dangerous to young children, the elderly, and immunocompromised individuals.

The disease is caused by a **bacterium**, a single-celled organism that is too small to see without a microscope. Of the more than 2,500 types of *Salmonella* bacteria, fewer than 100 are **pathogens** (dangerous to humans). Although most frequently associated with poultry, disease-causing *Salmonella* are easily spread when fecal matter from an infected animal contaminates water or soil. Thus, multi-state *Salmonella* outbreaks have been linked to a wide range of other foods such as seafood, salad greens, deli meats, cashew brie cheese, peaches, onions, and tahini. Pets such as reptiles and birds have also been linked to cases of salmonellosis.

Proper handwashing with soap is one of the best techniques for reducing the spread of pathogens like Salmonella bacteria. Food safety techniques, including proper food storage and preparation, also are critical to reduce the risk of disease. Learn more about *Salmonella* from the Centers for Disease Control (https://www.cdc.gov/salmonella/index.html). You can also explore the world of microbes using the North Carolina 4-H Microbiology curriculum, available for grades 5, 8, and high school at http://nc4hcurriculum.org. An article that was written by the Microbiology developers for youth is freely available online at https://kids.frontiersin.org/articles/10.3389/frym.2021.611302.

Some Ways to Extend This Lesson:

- Invite a food safety inspector to speak with youth about careers in food safety and proper food handling techniques.
- Talk to a restaurant owner or school cafeteria manager about steps they take to ensure food safety for their customers.
- Create posters, pamphlets, or other materials to raise awareness of salmonellosis and safe food handling practices in your community.

Case 2: The Ice Cream Explosion

Challenge Level: Beginner/Intermediate

The Ice Cream Explosion may be successful with youth as young as 8 as long as the emphasis is on the observable characteristics of solids, liquids, and gasses. It may be more difficult for young children to understand energy transfer and the particulate nature of matter. These concepts are often taught to youth aged 10-14.

Science Concepts:

States of Matter, Physical Change, Energy Transfer

Healthy Living Concepts:

Food Science, Finding Healthier Alternatives to Favorite Foods, Ways to Manage Anxiety and Stress

Materials:

- Coconut oil
- *Cooking Up Confidence!* cookbook
- Optional: Detective's Notebook

Story Setup:

"It's been another good day at the Cloverville Detective Agency," *you think as you lock the door behind you. The hot summer air feels like an oven, and for a brief moment, you think about spending the night in the air-conditioned agency rather than making the long trip home in all the heat.*

A piece of paper on the sidewalk catches your eye. You pick it up, planning to recycle it when you get home. You notice that the paper is actually a flier for the Ice Cream Experts' Annual Conference and Competition that will take place tomorrow at the Cloverville Grand Hotel. "Ice cream sounds wonderful for such a hot night," *you say to yourself. You tell yourself that maybe you should stop at the store and pick some up, although you wonder whether the ice cream would make it home or just melt along the way.*

BOOM! A loud explosion interrupts your thoughts. You turn towards the sound and realize it came from the Cloverville Grand Hotel. You see people streaming out the door. The hotel manager runs towards you. "Help! The hotel has been bombed!"

You unlock the agency door and invite the manager inside. Maybe you will be sleeping at the office after all.

Mystery Structure:

Level 1.

Read the Introduction PDF. Then explore the images. Each of the images on the website can be enlarged by clicking on it. You can open the images in any order. Ask youth to describe their observations and to name potential clues they notice in the images..

- Image of the hotel lobby/reception area
- Image of the hotel hallway
- Image of the hotel ballroom

The clue for the Level 2 password is at the end of the introduction PDF. The answer is **ballroom**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 2 document. This is due to the website architecture.

Level 2.

Level 2 contains 4 PDF documents, each password protected with the same password: **ballroom**.

- Level 2 Instructions
- Interview with Simona Robinson
- Interview with Grier Jones
- Interview with Edward Reddington

Read the instructions first. The interview transcripts with the suspects can be read in any order. Youth should form hypotheses as they read the interviews and be able to point to specific clues in the text to support their ideas.

The clue for Level 3 is located at the end of the instructions, The answer is **fruitjuice**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 3 document. This is due to the website architecture.

Level 3.

Level 3 contains 2 PDF documents, each password protected with the same password: **fruitjuice**.

- Level 3 Instructions
- *What's the Matter?* Science Activity

Level 3 also contains two unlocked multimedia items. The first item is a video clip. The second is an interactive simulation from the University of Colorado-Boulder's PhET program.

- Video clip (liquid nitrogen)
- Simulation: https://phet.colorado.edu/en/simulation/states-of-matter-basics

Make sure to read the instructions first. The instructions will prompt you to complete the Science Activity, watch the video, and use the simulation at specific points. The clue for the solution is located at the bottom of the instructions. The answer is **edwardreddington**.

Solution.

The solution contains a single PDF, password protected with the password: edwardreddington.

Bonus Science!

There is a video that focuses on healthy eating and vegetables following the solution. No passwords are needed.

The Science Behind the Story:

Everything you see (and many things you can't see) is what scientists call **matter**. Matter is made up of the building blocks of our universe, which scientists call **atoms**. A **substance** is a particular kind of matter made by atoms arranged in a certain way. Water is a substance. Air is a substance. Gold is a substance. Even you are a substance (or rather, many substances all working together)!

Substances can change. Sometimes, substances break apart or combine to form different substances, like how sodium and chlorine gas combine to form salt. This is called a **chemical change** or **chemical reaction**. Other times, substances change how they behave. For example, water can pour and slosh around, but ice cannot move in the same way. In this case, the substance stays the same, but the behavior has changed. This is called a **physical change**.

When water changes from sloshing liquid to solid ice, scientists say that it changes **state**. A **state of matter** describes how the atoms of a substance are moving at that moment. On Earth, we usually encounter matter in one of three states: solid, like ice, liquid, like water, or gas, like water vapor.

In general, when a substance is in a **solid** state, the atoms are close together and do not move much. This is why solids do not pour or move like liquids. Scientists say that a solid has a definite **shape** and a definite **volume** (the amount of space something occupies).

When a substance is heated, energy is **transferred** from the heat source to the substance. The atoms of the substance start to move more and spread away from each other. This is called a liquid state. Liquids can pour and slosh around because the atoms are moving more and are able to slide around..

A **liquid** does not have a definite shape of its own. It conforms to the shape of its container. A liquid does have a definite volume, however.. Imagine that you have a pitcher that contains a gallon of water. If you try to pour the entire gallon of water into a tiny cup, it will not fit. Some of the gallon will go into the cup and the rest of the gallon will go on the table or floor. Likewise, if you pour a gallon of water into a bathtub, it will not completely fill the bathtub. You will end up with a gallon of water and a mostly dry bathtub. The volume does not change because the atoms are able to move around a little and take up a little more space, but they do not have enough energy to move very far away from each other.

If more energy is transferred, the atoms move very far apart from each other and very quickly. This is called a **gas** state. We can't see oxygen gas in our air because the atoms are so tiny, so far away from each other, and moving around so quickly. When a substance is behaving as a gas, it does not have a definite shape or a definite volume. A gas can fill whatever space is available. If nothing stops it, a gas will continue to spread out and **expand**, especially if heated. A gas can also be **compressed** into a smaller container as long as there is space available for the atoms to move. However, in a sealed container, compressing a gas without cooling it can cause an explosion.

Water is special because it is the only substance on Earth that exists in three states under normal conditions. This makes it very easy to observe how substances can change state when enough energy is added or removed. However, most substances have a greater volume as a liquid than as a solid, whereas water actually decreases in volume when it changes from a solid to a liquid. (This is why ice floats in water.) This means that water can be a confusing model for youth who are trying to learn that atoms move further apart as substances change from solid to liquid to gas. For this reason, we suggest that you use the PhET visualization linked in the curriculum and follow the instructions provided in the PDF to introduce youth to states of matter.

Some Ways to Extend This Lesson:

- Explore how each of the characters handles stress and anxiety. Identify positive stress-management techniques.
- Measure the mass and volume of different substances before and after freezing.
- Make vegan ice cream or chocolate-covered banana pops.
- Focus on energy transfer by building catapults. Simple catapults can be made using plastic spoons, craft sticks, and rubber bands. Youth can observe the effects of energy transfer from the catapult to a mini-marshmallow.
- Dry ice (frozen carbon dioxide) **sublimates**, or shifts from solid immediately to gas, at room temperature. Use dry ice, an empty 1-liter plastic bottle, and a balloon to demonstrate gas expansion. Dry ice can be obtained from many grocery stores. Make sure to follow proper safety precautions when using dry ice, including wearing goggles, protective clothing, and heavy gloves. Use tongs to handle dry ice instead of touching it.
- Invite a community member who uses liquid nitrogen in their daily work to make ice cream with youth. While local science museums and high school or college science departments are a good starting point, you can also talk to people in other professions (e.g., welders, dermatologists, veterinarians, other medical/dental personnel, bartenders, chefs,

commercial fishing operators, etc.) who may have the materials, expertise, and access to safely demonstrate liquid nitrogen.

- Research other states of matter beyond solids, liquids, and gasses.

Case 3: The Case of the Science Fair Swindler

Challenge Level: Beginner to Intermediate

The *Case of the Science Fair Swindler* uses a young child as an unexpected hero, so it may appeal to younger children. Although younger children may recognize observable differences connected to chemical reactions (e.g., bubbles/formation of a gas) it may be difficult for them to grasp the molecular-level science concepts. This can lead to confusion about chemical reactions versus physical changes or misconceptions about matter conservation. Such concepts are often introduced to youth aged 10-14. If you choose to use this lesson with younger children, watch for misconceptions forming. Furthermore, this is the only story in the series with a true criminal. The character's backstory and motive may be upsetting to some younger children.

Science Concepts:

Chemical Changes, Cellular Respiration, Fermentation

Healthy Living Concepts:

Food Science, Cultural Influences on Diet

Materials:

- Cooking Up Confidence! cookbook
- Mug Cake Mix
- Mug
- Optional: Detective's Notebook
- Optional: baking soda, vinegar, balloon, clean empty bottle

Story Setup:

The phone rings.

"Hello, you've reached the Cloverville Detective Agency," *you say.*

"Hi. Can I talk to the detective?" *The voice on the other line sounds like it belongs to a child.*

"I'm the detective," *you respond.* "How can I help you?"

"I need you to catch a bad guy, please," *the caller says. The voice clearly belongs to a child. You become worried.*

"Who is this? Are you okay? Are you somewhere safe? Have you called the police?" *you ask.*

“Yes.” *The child’s voice sounds annoyed.* “I already asked Mom for help and she said the police were too busy to help me with my science fair project. So I called you.”

You are relieved that the child does not seem to be in danger, but you are also a little confused. “You’re catching a bad guy as your science fair project?”

“No! I want you to catch the bad guy who ruined my science fair project.”

You sit quietly for a moment, thinking about how best to respond. This is certainly the strangest request you have had in a while, and science fair shenanigans are outside of your area of expertise. You are about to politely decline when you hear a woman’s voice in the background. It is a voice you recognize immediately.

“Sal? Salvatore Leroy Kimbrell-Brown, I told you to let it go. I talked to your teacher and they said I can help you make a new display tonight since the judging isn’t until tomorrow afternoon. Here, give me the phone. Hello, I am so sorry--”

“Hey, Chief,” *you say cheerfully. Over the years, you have worked closely with Lavonne Kimbrell, the Chief of the Cloverville Police Department, to crack the most difficult cases.*

“Oh, hey,” *Chief Kimbrell laughs.* “I was just about to give you a call. Got a moment?”

Mystery Structure

Level 1.

Level 1 contains 2 PDFs, an image, and an optional video.

- Introduction PDF
- Image of Sal’s Science Fair project
- Fun with Fizz Science Activity optional PDF
- Fun with Fizz optional video

Read the Introduction PDF. There is a prompt in the instructions for you to look at Sal’s Science Fair project. The diagram on the image shows the reaction C6H12O6 --> 2 C2H5OH + 2 CO2. This is the reaction that happens when yeast breaks down glucose molecules from flour. Ask youth to describe their observations and to name potential clues they notice in the image.

The clue for the Level 2 password is at the end of the introduction PDF. The answer is **carbondioxide**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 2 document. This is due to the website architecture.

Level 2.

Level 2 contains 5 PDF documents, each password protected with the same password: **carbondioxide**. Level 2 also contains one video that does not need a password to view.

- Level 2 Instructions
- Video clip (bread)
- Interview with Makayla Baker
- Interview with Martin Lyons
- Interview with Stevie Smith
- *Become a Baker* Science Activity

Read the instructions first. The instructions will prompt you when to watch the video. Afterwards, interview Makayla Baker. The remaining interview transcripts with the suspects can be read in any order. Youth should form hypotheses as they read the interviews and be able to point to specific clues in the text to support their ideas.

When the interviews are complete, conduct the *Become a Baker* Science Activity.

The clue for Level 3 is located at the end of the instructions, The answer is **bakingsoda**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 3 document. This is due to the website architecture.

Level 3.

Level 3 contains 1 PDF and 3 images. The PDF is password protected by the password **bakingsoda**.

- Level 3 instructions
- Image of the bakery kitchen
- Image of Stevie's workstation
- Image of Martin's workstation

Read the Introduction PDF. Then explore the images. Each of the images on the website can be enlarged by clicking on it. You can open the images in any order. Ask youth to describe their observations and to name potential clues they notice in the images. You can help them by referring to the ingredients in the *Cooking Up Confidence!* cookbook for the Mini Martian Muffins and the Berry Blast Bars.

The clue for the solution is located at the bottom of the instructions. The answer is **martinlyons**.

Solution.

The solution contains a single PDF, password protected with the password: **martinlyons**.

Bonus Science!

There are also two Bonus Science activities and a video following the solution. No passwords are needed for these.

- The first Bonus Science Activity is an interactive simulation from the University of Colorado-Boulder's PhET program. The simulation is designed to help youth learn that matter is always conserved in chemical reactions.
- The second Bonus Science Activity is a link to the Wild Sourdough citizen science project headed by Dr. Erin McKenney at North Carolina State University. Additional materials to support 4-H families who wish to participate in this project are available in the Shared Google Drive "North Carolina 4-H Curriculum". Talk with your agent about getting access to these materials if you are interested in completing this project.
- Finally, there is a video that focuses on proper measuring techniques for baking.

Note: If youth are not familiar with matzah, here are some recipes to make your own:

https://leitesculinaria.com/84910/recipes-homemade-matzoh.html

https://cooking.nytimes.com/recipes/1013086-olive-oil-matzo

https://www.onceuponachef.com/recipes/chocolate-toffee-matzo-crack.html

You can also try making Makayla's Madeleines from the video using a recipe like this one: https://sallysbakingaddiction.com/madeleines/

The Science Behind the Story:

Everything you see (and many things you can't see) is what scientists call **matter**. Matter is made up of the building blocks of our universe, which scientists call **atoms**. A **substance** is a particular kind of matter made up by atoms arranged in a certain way. Water is a substance. Air is a substance. Gold is a substance. You are even a substance (or rather, many substances all together)!

Substances can change. Sometimes, substances change how they behave. For example, water can pour and slosh around, but ice cannot move in the same way. The substance stays the same, but the behavior has changed. This is called a **physical change**. Other times, substances break apart or combine to form different substances, like how sodium and chlorine gas combine to form salt. This is called a **chemical change** or **chemical reaction**.

A chemical reaction happens when **reactants** (two different substances) interact. During a reaction, the atoms in the reactants get arranged differently to produce one or more substances

called **products**. To an observer, it might look like the reactants “disappeared” and a new substance is “created,” but this is not accurate. **Matter never disappears and never is created.** The same atoms in the reactants are the same atoms in the products.

Chemical reactions can produce substances that are in different states of matter from the reactants. For example, **baking soda** (sodium bicarbonate) is available in a solid state, while **vinegar** (acetic acid) is available in a liquid state. However, combining baking soda and vinegar produces a liquid (water), a solid (sodium acetate), and a gas (carbon dioxide). The **carbon dioxide gas** causes the bubbles you see during this reaction. Baked goods like cakes or cookies rise because of the carbon dioxide bubbles produced through a chemical reaction between baking soda or baking powder and some type of acid.

Chemical reactions are essential to life on Earth. For example, plants use a chemical reaction called **photosynthesis** to capture energy from the sun and store it as chemical energy in sugars (**glucose**). Cells use chemical reactions called **respiration** to break apart sugars and get the energy they need.

In our bodies, cells usually use **aerobic respiration**. During aerobic respiration, cells use **oxygen** gas and sugars as the reactants to release stored energy. This reaction produces carbon dioxide and water as products. When you are exercising, your cells need more energy. To get the energy, your cells need oxygen gas to do aerobic respiration. Your body needs to get rid of the carbon dioxide and water the cells produce. This is why you breathe more heavily and sweat when you exercise.

Sometimes, if you exercise too much, your cells do not have enough oxygen gas to do aerobic respiration. In this case, your cells can do **anaerobic respiration**. Anaerobic respiration does not release as much energy, but it does not need oxygen gas either. The reactants in this case are the sugars and special proteins the cell makes called **enzymes** and the products are carbon dioxide and **lactic acid**. Lactic acid is what makes your muscles ache when you have exercised too much. It is also what turns milk into yogurt.

Yeasts are **microbes** (tiny organisms that are too small to see without a microscope) that bakers use when they are baking bread. Like the cells in your body, yeast cells also do anaerobic respiration to get energy. When yeasts do anaerobic respiration, it is called **fermentation**. Fermentation is a process that produces carbon dioxide and alcohol. The carbon dioxide bubbles help the bread dough to rise while the alcohol affects its taste. The tangy flavor of sourdough bread comes from the alcohol produced during fermentation.

Some Ways to Extend This Lesson:

- Observe fermentation. Mix a tablespoon of molasses with a tablespoon of warm water in a zippered plastic sandwich bag. Add a teaspoon of yeast. Quickly press the air out of the bag and zip it close. The bag will inflate with carbon dioxide produced during the fermentation reaction. Open a corner of the bag when it is fully inflated to prevent an explosion and dispose of the materials in the trash.

- Bake bread using a variety of different leavening techniques or yeasts.
- Talk to a baker about different ways to make baked goods rise.
- Bake small batches of the Martian Mini-muffins, Berry Blast Bars, or another easy recipe. Systematically vary the leavening agent in each. What happens when no baking soda is added? When too much baking soda is added? When baking powder is used instead of baking soda?
- Have youth engage in timed periods of physical activity at different levels of intensity. Have them measure and graph their breathing rates. Connect their breathing to cellular respiration.
- Have youth act out the processes of cellular respiration and fermentation. Point out how the number of atoms never changes, even though the arrangement of atoms does.

Case 4: The Ghost in the Garden

Challenge Level: Intermediate

The science activity in *The Ghost in the Garden* is accessible to youth as young as 5, However, the characters and story are more complex than in prior mysteries and the treatment of grief and loss may be too mature for young children.

Science Concepts:

Plant Life Cycles, Plant Structures and Function, Photosynthesis

Healthy Living Concept:

Planning meals with MyPlate

Materials:

- Plastic bag
- Cotton ball
- Basil seeds
- Yarn
- *Cooking Up Confidence!* cookbook
- Optional: Detective's Notebook

Story Setup:

The doorbell rings.

"Welcome to the Cloverville Detective Agency," *you say as you open the door.* "Come on in."

In walks an old man. He nervously twists his hat in his hands and glances around the office. He is silent.

Suddenly, you recognize him as Giorgio Cuoco, owner of Mama Vitale's Italian Bistro, although he looks nothing like you remembered. He has lost so much weight that his skin seems to sag, and the twinkle in his eyes has dulled with sadness. The man before you now seems but a shell of the prosperous businessman you once knew.

You realize that the last time you saw Mr. Cuoco was at his wife's funeral last January. Since their only child, Toni, had just deployed overseas, Mr. Cuoco had to scale back operations at Mama Vitale's until he could hire help. Then, the pandemic hit, and the bistro was completely shuttered until Toni finally returned home last week.

"Mr. Cuoco?" *you say gently.* "Is everything okay?"

He whispers something so softly that you can barely hear him, but the words are unmistakable.

“I’ve seen a ghost.”

Mystery Structure:

Level 1.

Level 1 contains 2 PDFs, an image, and an optional video.

- Introduction PDF
- *Basil Seed Germination Necklace* Science Activity
- *Seed Germination* video

Read the Introduction PDF. Then complete the *Basil Seed Germination Necklace* Science Activity. The clue for the Level 2 password is at the end of the introduction PDF. The answer is **temperature**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 2 document. This is due to the website architecture.

Level 2.

Level 2 contains 4 PDF documents, each password protected with the same password: **temperature**.

- Level 2 Instructions
- Interview with Hannah Nickerson
- Interview with Bess Carson
- Interview with Marvin Drew

The clue for Level 3 is located at the end of the instructions, The answer is **mozzarella**.

Note: Entering the password for one document does not automatically unlock the others at that level. You will have to enter the password each time you try to unlock a Level 3 document. This is due to the website architecture.

Level 3.

Level 3 contains 1 PDF and 3 images. The PDF is password protected by the password **mozzarella**.

- Level 3 Instructions
- Image of some of the greenhouses in the garden
- Image of the inside of a greenhouse

- Image of a shoeprint in the mud

Read the Introduction PDF. Then explore the images. Each of the images on the website can be enlarged by clicking on it. You can open the images in any order. Ask youth to describe their observations and to name potential clues they notice in the images.

The clue for the solution is located at the bottom of the instructions. The answer is **toni**.

Solution.

The solution contains a single PDF, password protected with the password: **toni**.

The Science Behind the Story:

Youth often know that plants "come from" seeds, but may not know much else about them. Most seeds are made up of three parts: an **embryo**, an **endosperm**, and a **seed coat**. The embryo is the baby plant, just like a chick embryo is a baby chicken. The endosperm provides the embryo with nutrients, just like a yolk provides a chick embryo with the nutrients it needs. The seed coat protects the seed, just like an eggshell protects the chick embryo inside. And, just like a chicken, a plant embryo needs oxygen, the right amount of moisture, and the right temperature to grow.

Different seeds have different requirements. For example, some seeds have coats that respond to specific amounts of oxygen in the environment at specific times of the year. Other seeds have coats that are so hard that they need heavy seasonal rains to soften it before they can grow. Some seeds even need to go through fire before they can break through the seed coat.

When conditions are right, the plant will send its first root, called a **radicle**, down into the soil. The radicle will help anchor the plant in place while a shoot grows up toward the soil surface. If the seed is planted too deep in the soil, it may run out of nutrients from the endosperm before the shoot breaks through into the sunlight. Although light is not essential for most seeds to germinate, sunlight is absolutely essential for the growing plant to survive. Photosynthesis is the process in which plants capture the energy in sunlight and store it in sugar.

Learn more about germination through the North Carolina 4-H curricula *Soil Solutions* (elementary school) and *Soil to Seed* (high school), available at http://nc4hcurriculum.org.

Some Ways to Extend This Lesson:

- Trace the flow of matter and energy in an ecosystem through photosynthesis and cellular respiration.
- Use plastic cupcake containers or other recycled containers to plant a windowsill herb garden with several different types of herbs. Use MyPlate to plan healthy meals that incorporate your herbs.
- Create a community teaching garden or volunteer at an existing garden.
- Talk to the owner or chef at a farmer-owned restaurant about their unique challenges and benefits compared to a conventional restaurant.

- Explore reflection and refraction of light.
- Research corvid behavior.
- Locate resources in your community that could help Mr. Cuoco and Toni with their grieving.