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Food for Thought Summer Camp 2022 Evaluation Report

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About this report

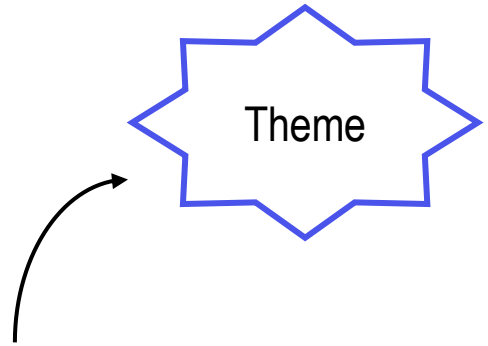
- This report covers the highlights from the observations of each classroom activity and cooking demonstration, as well as from the interviews and take-home notes.

- The purpose of this report is to inform planning of future CMC summer camps.

Data sources

- Observations of classroom activities & cooking demonstrations
- Pulse interviews with campers throughout week
- Take-home notes completed by campers with their grown-ups

About the observations



On each slide, the theme for that day is highlighted in the upper right corner

- During camp, data collectors observed some of the camp activities by using a structured observation instrument and others by taking naturalistic notes
- For the purposes of this report, for all observations, analysis focused on:
  - The observed activity's connections to that day's theme and/or other camp activities
  - Differences in the activities for the two camp groups
  - Camper reactions and evidence of learning
  - Logistical considerations, if major

Classroom Activities

See activity lesson plans in Appendix A

Bean Necklace

Enzymatic Browning

- This activity was not tied to the day's theme of enzymatic browning. That said, it served as a good introduction to the scientific method, including making hypotheses/predictions, making observations, and journaling. One camp group experimented further, creating additional bean necklaces, one without water and one without light.
- This activity was something campers had prior experience with. Many campers shared examples of times they planted seeds or of classroom experiments with growing plants.
- The activity served as a through line over the course of the week as students wore and continued to observe their necklaces. On Thursday, some noticed sprouts, but even on Friday others still did not have any. The campers that did have sprouts were excited (e.g., "*Oh my gosh! Look at this!*").
- Suggestions from camp instructors to promote sprouting were to have softer string that campers might be more willing to wear (thus providing the bean with heat) and adding some extra water during the week.

Banana Tattoos

Enzymatic Browning

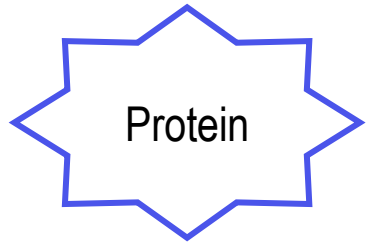
- The banana tattoos were a clear, visual representation of enzymatic browning, and something that campers could see happen quickly (e.g., *“Mine’s already browning*,” “*It’s turning brown so fast!*”).
- Campers were able to make connections to bananas browning naturally over time and other foods that go brown. One camper even showed leftover apple slices from their lunch that day that were starting to brown.
- Some campers experimented and made predictions of what they thought would happen (e.g., seeing if the stem will also brown when poked with a toothpick or if an orange from their lunch could be tattooed like the bananas).
- Observing the banana tattoos later in the week allowed for continued review of enzymatic browning, but the bananas themselves began to smell and attracted fruit flies.

Apple Browning

Enzymatic Browning

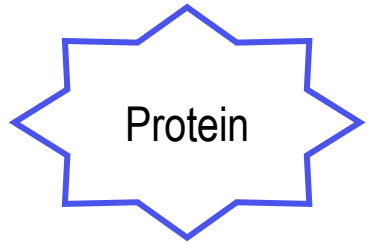
- The apple browning activity built well off the banana tattoo activity where the enzymatic browning was more rapid, but the same concepts applied.
- The activity was also another opportunity for campers to practice making hypotheses of what they thought would happen. Campers in both groups made predictions about which liquids would slow the apples browning and which would make them brown the fastest.
- One camp instructor structured the activity more of a demo, with one set of cups of the apple slices/liquids for the whole group. The other had campers each make their own set of cups.
- Again, making observations later in the week allowed for practice of observation skills and review of enzymatic browning. However, the premise of how you can slow your fruit from browning (e.g., in a lunch box) was lost after several days. All of the apples went beyond what someone would realistically want to eat, but the liquid where they were least brown was baby oil, presenting some confusion among campers (as that is not a practical application).

Jell-O & Pineapple



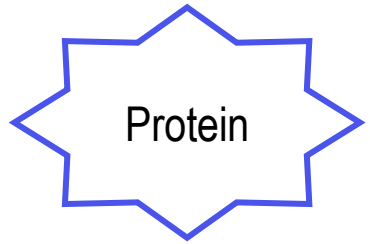
- There was clear connection to the day's theme of protein, and a call back to the previous day's theme with the discussion of the enzyme found in pineapples.
- While the campers were familiar with Jell-O, the explanation of how the gelatin sets in regular Jell-O and how the pineapple acts against it was difficult for them to understand. Even with the instructor saying that we don't expect the regular pineapple Jell-O to set, campers still made hypotheses to the contrary (e.g., "*they will all be the* same"). An instructor suggested having a visual aid to help illustrate the process.
- Campers seemed to understand the Jell-O activity better once they saw the Jell-O after time in the fridge. They were generally able to respond to the instructor's prompts while observing the differences between the different Jell-Os. The educator running the cheese making demo did reference the Jell-O and pineapple activity, so that also may have helped reinforce these concepts for campers.
- There were some logistical challenges. One instructor did not have the right materials (e.g., measuring spoons, heat-proof cups) to make the Jell-O. One camp group got distracted making fortune tellers as the instructor waited for the water to heat and many campers did not re-engage with the activity once it was ready.

Strawberry DNA



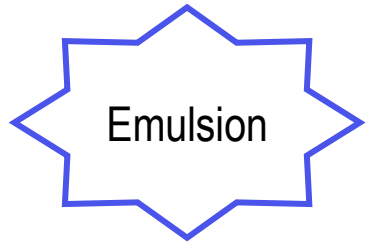
- There is a potential for this activity's connection to the protein theme to be stronger. One camp group watched a short video about DNA that referenced amino acids and proteins, but the other camp group just talked about how strawberries have DNA like humans do.
- Campers were able to use a number of tools/techniques during the activity (e.g., pipettes, cheese cloth, measuring, mixing). Some campers said that the activity made them feel like a scientist.
- Campers expressed excitement about the activity, happily showing off their tubes of DNA to their instructors and fellow campers. This also seemed to be a unique activity for campers, with some commenting that they've never seen DNA before or being surprised that they didn't need a microscope to do so.

Rubber Egg



- Neither camp group did this activity when it was on the schedule. One group did it at the beginning of Tuesday alongside the Jell-O and pineapple activity. The other group did not get to it until Wednesday morning. For the former, it was an introduction to the day's theme of protein, while the latter focused more on the chemical reaction between the shell and vinegar.
- Instructors were able to connect the chemical reaction between the eggs and vinegar to the baking soda and vinegar activity when the campers observed the eggs at the end of the week.
- One of the instructors also connected the activity to campers' lives and broader camp by talking about how acidic foods affect teeth.

Density Towers



- This activity served as an example of how some liquids don't want to mix together, which is related to the day's theme. However, there was some potential for confusion as the term "emulsion" was introduced, but one was not actually made during the activity. One instructor even said, "*All of these are not going to naturally mix together – it's an emulsion*."
- One instructor asked campers to predict the next layer before each pour (i.e., which remaining liquid they thought would be the most dense). This made the activity more interactive and gave campers a chance to practice predicting, as opposed to just following the instructions of the correct order to pour in.
- Some campers in one group had done the activity before. Overall, campers still seemed excited as they observed the different layers and which items sank or floated.

Salting Out

Emulsion

- Instructors made a number of connections during the salting out activity. They connected the different density of the beads to the density towers and shaking the bottle/mixing the liquids to the day's theme of emulsions. They also made a food connection, comparing the activity to shaking/mixing salad dressing.
- One camp group had a single example bottle. While campers were excited to try shaking it, some lost interest after it was their turn or expressed that they wanted their own bottle.
- However, the other group tried making their own and it did not work because they did not have the right density of beads. The instructor did take it as an opportunity to say "*that's real science*," and explain that when you have an idea, you try it, and if it does not work you change your question or try something else.

Electric Dough

Emulsion

- There was not a connection between the activity and the theme of emulsions. Some campers even commented that they activity was not food related. One instructor connected the activity to camp by asking campers to share different kitchen appliances that run off electricity.
- There were some issues with the materials. Campers were confused when the bulbs wouldn’t light if the circuit was wrong or the lightbulb was bad (there were several instances of both).
- One of the camp groups got frustrated, lost interest, and started just playing with their playdough. The other group was more invested in the activity, trying different ways to build their circuits as encouraged by their instructor.

Blindfold Miracle

Taste Perception

- This activity had a clear connection to the day's theme, exploring how sight and the miracle berry affects taste. One instructor suggested going further and getting nose clips to explore how smell affects taste as well.
- One instructor explained the five taste profiles our tongues can detect and used these as a way for the campers to describe the foods they were tasting. This instructor also explained the proteins on our tongues that determine taste, which was important to how the miracle berries work and a call back to Tuesday's theme of proteins.
- Some campers did not want to try the miracle berries or were unable to let it dissolve fully. Those that were able to reacted to how the foods tasted differently (e.g., describing a lime as tasting like candy).
- Instructor suggestions included not scheduling this activity right before lunch and having a 5 minute video to distract the campers as the berries dissolve.

Super Taste Testing

Taste Perception

- This activity also had a clear connection to the day's theme, describing how everyone has different taste perceptions. Campers in one group connected this to a moment earlier in the week when one camper liked onions but others did not.
- When tasting as a group and discussing aloud, many campers agreed with or repeated what another camper said about how a strip tasted. Those that said they did not taste anything expressed disappointment ("*I want to be able to taste it!*").
- This activity would likely be more accurate if completed individually/quietly and then discussed as a group.

Banana Makey Makey

Taste Perception

- There was no connection between this activity and the theme of taste perception. However, instructors were able to connect it back to the electric dough activity from the previous day. Banana Makey Makey was more of an example of using food to do a STEM activity than a “food science” activity.
- Instructors had a lot of trouble setting up the makey makey device. They lost some of the campers’ attention during the long set up.
- Once the activity was set up, the focus turned into playing/ competing in the video games. And with only one device, some campers became antsy while others were playing.

Popcorn and Thermoception

Taste Perception

- This activity had a clear connection to the day's theme of taste perception. Instructors also connected it back to the idea from the super taster activity that people taste food differently. For example, when a camper called the popcorn "*really spicy*," the instructor explained "*some people have more tolerance for spicy food*."
- One camp group made hypotheses before tasting the two popcorns. After tasting, both camp groups described the mint popcorn as tasting cold and the chili pepper popcorn as tasting hot.

pH Potions

Acids & Bases

- The activity was a good example of the day's theme as pH measures how acidic or basic something is. Instructors also connected it to the larger camp, explaining that foods have different pH levels.
- Campers made predictions before adding different liquids. After testing a few, campers seemed to be able to tell if a liquid was acidic or basic depending on the color the tea turned. For example, after adding milk, a camper noted the tea "*didn't turn purple*" and when their instructor asked if they think it's acidic, they responded "*no, basic*."
- Campers experimented to see if they could get their tea to turn certain colors. As examples, one camper tried to turn their tea as purple as possible by adding all of the acidic liquids, and another added basic liquids to their purple tea to turn it back to blue.
- One class was particularly excited by the fantasy element of the "potions" activity (e.g., "*I've got a potion of healing*").

Acids & Bases

Baking Soda & Color Play

- This activity built upon the introduction to acids and bases from the pH potions activity.
- Instructors connected the activity to baking soda volcanos, which campers were familiar with. Campers were able to make fairly accurate hypotheses about what they thought would happen when they added the colored vinegar to the baking soda (e.g., bubbles, minor chemical reaction, change colors). They then observed the reaction between the baking soda and vinegar (e.g., "*It's bubbling and changing colors!*", "*I've got a big one*!").
- In one group, campers kept calling the vinegar water, even after the instructor explained the importance of vinegar being an acid multiple times.
- One camper identified the activity as something they could do at home.

Owl Pellet Dissection

Acids & Bases

- There was no connection between the dissection and the day's theme. A couple of campers questioned the activity's connection to camp (C1: "*I thought this was science camp, not owl vomit camp.*" C2: "*I thought it was food camp*." C3: "*It's about what owls eat!*"). One instructor did connect it to the fossils in Dino Hall, which the group visited during their museum exploration time.
- One of the instructors explained how owls digest their food differently than humans (i.e., that we don't have a gizzard). While neither of the instructors mentioned it, stomach acid could be a way to connect this explanation and activity with the day's theme.
- Most campers were engaged with the dissection, finding bones and trying to identify them (e.g., "*I think I found a shrew jaw*").

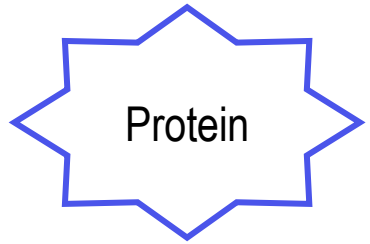
Cooking Demonstrations

Knife Skills & Fruit Salad

Enzymatic Browning

- On Monday, the morning activities were not directly related to enzymatic browning. Therefore, only the later camp group had an introduction to enzymatic browning before this demo.
- In the earlier camp group, the first mention of enzymes was in response to a camper's question about why we don't eat kiwi skins. The educator did talk about browning while the campers were making their fruit salads.
- In the later group, the educator did a review of the apple browning activity near the start and again at the end of the demo. Some campers still listed all of the liquids used as ways to stop browning, but this was before the classroom observations of the apple browning.
- Campers appeared excited about learning knife skills. During instruction, they were observed mimicking the educator's "tuck the knuck" / "bear claw" technique. At the end, when the educator asked if campers had fun and learned new skills, they responded yes.

Cheese Making



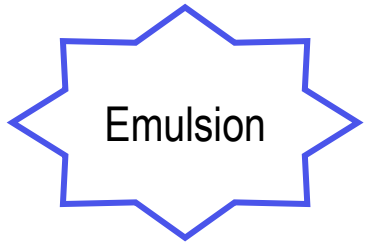
- The educator connected back to the Jell-O and pineapple activity to help introduce the topic of denaturing proteins to make cheese. Campers also recognized the cheese cloth from the strawberry DNA activity that day, which was another example of denaturing protein.
- A connection to the previous day's theme of enzymatic browning was that rennet is an enzyme.
- Campers seemed engaged and excited by the demo. Some were observed mimicking the educator's hand gestures as he explained proteins. They made connections and talked about the different foods that use mozzarella cheese (e.g., pizza, meatballs, lasagna). Most wanted to try eating the cheese they made in class, and one mentioned that they wanted to get an at-home-cheese making kit.

French Toast

Proteins

- There were many connections to the day's theme of proteins. The educator introduced eggs as a good source of protein, and asked campers to identify the two parts of the egg (yolk & white). He also talked about denaturing proteins and creating a uniform mixture while demonstrating whisking the eggs.
- As with the knife skills for fruit salad, the French toast demo covered important kitchen safety skills around using a burner/stove.
- Campers were eager to cook the French toast. For example, one camper was heard asking "*Can we put the bread on now?*" Campers also seemed to enjoy eating the French toast.
- Near the end of the demo, the educator encouraged campers to make French toast at home with their grown-ups.

Salad Dressing & Salad Making



- This demo connected back to Monday's fruit salad demo by reviewing the "tuck the knuck" cutting technique and general knife safety.
- Both camp groups had already done the density tower activity before this demo, so it served as a point of reference for talking about emulsions.
- In the later group, the educator reviewed emulsion at the beginning of the demo, while in the earlier camp group it wasn't introduced until the ranch making. Both groups reviewed it again at the end of the demo.
- Some campers struggled with the term "emulsion" or needed extra prompting, but overall they seemed to understand the general idea of mixing liquids that would not want to do so otherwise. As an example, one camper explained, "*Water and oil do not combine, milk puts them together.*"

Ice Cream

Taste Perception

- Less of a clear connection to the day's theme (taste perception) than previous cooking demos. One camper did mention that their favorite ice cream flavor is mint chip, which the educator connected back to thermoception.
- In the later camp group, the instructor found out that ice cream is an emulsion. The ice cream demo could be an opportunity to review that concept again. Other science concepts covered by this demo were the interaction between ice and salt and the need for motion to create the ice cream.
- Mixing the ice cream (in the bags especially) was a long process for some of the campers, but they were excited to eat the ice cream. The educator reviewed the process at the end of the demo so the campers knew they could make it at home.

Dippin Dots

Acids & Bases

- Similarly to the ice cream demo, the dippin dots demo had no connection to the day's theme, but was fun for campers and something they really wanted to eat.
- Campers were engaged watching the liquid nitrogen demonstrations. For example, a camper predicted that the strawberry was "*going to become an ice cube!,*" and another camper excitedly showed their instructor a piece of the racquetball that was rubbery again.
- The educator made comparisons to the previous day's ice cream demonstration, timing how long the liquid nitrogen ice cream took to make. As one camper exclaimed, "*this is going so fast!*"

Interviews

Monday

Did you choose this camp on food science or did someone choose it for you? (n=17)

- Most campers said a parent selected the camp for them. A couple of these campers noted that their parents asked them if they'd like to attend and they said yes.
- A few campers said they picked the camp themselves.

Monday

What are you hoping to do and discover this week? (n=17)

- Most responses were about cooking. Specific foods/demos from camp mentioned included ice cream, dippin dots, salad, and knife skills. A few mentioned learning how to cook more generally. One camper said they wanted to learn how to cook with their parents, and another said they wanted to learn how food can be scientific.
- A couple of campers were looking forward to seeing specific museum exhibits (Dinosaur Hall and The Woods).
- One camper responded “science experiments.”

Tuesday – Thursday

What do you think about camp so far? (n=10)

- All of the campers who responded shared positive reactions to camp. Several said they liked it, loved it, or were having fun. One camper noted it was even better than Girl Scout camp and another said they wanted their parent to sign them up for it again.
- A few campers specifically noted that they were learning "*new things*" or about food and science during camp. One camper highlighted learning during the strawberry DNA activity.
- A couple of campers mentioned enjoying the museum exhibits.

Tuesday – Thursday

What have you done that was really cool (if anything)? Why was that cool? (n=13)

- The activity mentioned most frequently throughout the week was strawberry DNA. Campers described it at fun, cool, and exciting. A couple were surprised that they could see DNA (they thought it would be too small). One said it made them "*feel like a scientist*."
- Other classroom activities mentioned by campers were apple browning, density towers, Jell-O & pineapple, electric dough, and banana makey makey.
- A couple of campers mentioned the demos, specifically fruit salad and French toast. These campers appreciated learning how to cut things and use burners.

Tuesday – Thursday continued

What do you think your instructors want you to learn from camp? (n=12)

- The most common responses to these questions were general comments about food, science, and food science. As examples, *“things about food, not just that you can eat it*,” and “*to learn about how the food processing is scientific*.”
- A few campers said that their instructors wanted them to learn how to cook or how to be a good cook.
- Other responses included what happens when you put eggs in vinegar, that in science you can make mistakes and try again, and to pay attention.
- A couple of campers said they didn’t know.

Tuesday – Thursday continued

What is the most important thing you think you've learned so far? Why? (n=10)

- Again, the most frequently mentioned activity was strawberry DNA, though a couple of the campers specifically emphasized that it was fun ("*I don't know if it was the most important, but it was the most fun"*).
- Other activities mentioned included the apple browning ("*not all the same things make the same mixture and brownness for the apple"*), and the protein-based activities (though that camper called them "*tricky*").
- One camper said they learned how to be safe around an oven and knives. Another camper talked about creativity, cooking, and food science. One camper responded, "*eggs are the main base of every meal*."
- A couple of campers said they didn't know.

Tuesday – Thursday continued

What is the most useful thing you've done? Why? (n=8)

- Most of the campers mentioned learning how to cook or making specific foods like French toast, cheese, and ice cream. Some of these campers noted that they made or want to make these foods at home with their parents too.
- A few of the campers' responses had to do with kitchen safety, including knife skills and cleaning up.
- One camper mentioned making new friends as a useful part of camp.

Tuesday – Thursday continued

Have you talked about what you did or learned at camp at home? What did you talk about? (n=8)

- The activity campers were most likely to say they shared at home was the strawberry DNA. Not only was this a highlight for campers, it also included the tube they could take home and show their family.
- The cooking demo campers were most likely to say they shared with their parents was French toast. It was described as "*fun*" and an example of sharing about "*the food I like*."
- A couple of campers shared more general responses ("*a lot of things*" and "*what I did, what I learned*").
- One camper said they did not talk about what they learned at camp at home.

Tuesday – Thursday continued

What do you think is the relationship between food and science? (n=7)

- A few campers mentioned specific activities as examples of the relationship between food and science. One camper explained that "*food can be used for science*" like using real dough for the electric dough activity. Another said you can *"mix it with other things to make food science*" like pineapple and Jell-O.
- One camper described how everything centers around science, explaining "*science makes food good*." Another camper noted yeast as an example of science.
- One camper said they didn't know.

Friday

In ONE sentence, tell me what this camp is about. (n=13)

- About half of the campers said the camp was about "*food science*" or the "*science behind food*." A couple of campers said the camp was about "*science and food*."
- A few campers said the camp was about food, making food, or cooking.
- A few campers said the camp was about science or experiments.
- A few campers also said the camp was about having fun.

Friday

What do you think you might do differently at home now after camp? (n=14)

- Half of the campers mentioned cooking at home after camp. Examples of such comments include being "*able to cook*" and "*making all of the food that we learned how to cook here*." A few of these campers specifically mentioned helping their parents cook or helping to make dinner.
- Some campers mentioned specific foods from the cooking demonstrations that they want to try making again including, French toast, dippin dots, fruit salad, and salad dressing. One camper demonstrated how they will cut from now on (i.e., "tuck the knuck").
- A few campers mentioned classroom activities they want to do again including baking soda and color play and banana tattoos. For the campers that cited the baking soda activity, one wanted to try it with another liquid and one wanted to try it with crackers.
- A couple of campers were unsure of what they would do differently after camp.

Take-home Notes

Monday

What is something you really want to try cooking? Why? (n=14)

- Foods campers shared included: Pizza (x3), s'mores, bacon, salmon, donuts, French fries, potato chips, fruit tarts, cupcakes, chicken alfredo, hamburgers, soufflé, dippin dots, and French toast.
- The most common reason campers gave for wanting to cook that food was because they love it or think it's delicious.
- Other reasons shared included wanting to know how something is made (e.g., how a fruit tart can be hard on the bottom but soft inside), thinking something would be fun to make, and wanting to decorate (cupcakes).

Tuesday

What is something you did at camp today that you want to try again? Why? (n=14)

- Over half of the campers that responded said they wanted to try one of Tuesday's food demonstrations again. Most of these campers specifically mentioned French toast because they thought it was fun and tasted good. One of the campers wanted to make cheese again because it was delicious.
- Just under half of the campers said they wanted to try one of the classroom activities again. Unsurprisingly, most of these campers specifically referenced the strawberry DNA activity, describing it as cool and fun. One camper explained that they would like to try it with different fruits. The other activity mentioned by one camper was the bean necklace.

Wednesday

Look around the kitchen. Find something you think about in a new way because of camp. Tell me about it. (n=9)

- A third of the campers who responded mentioned knives. One noted that they feel more comfortable using a knife now, and another said they were afraid before camp but enjoyed learning those skills.
- A couple of campers mentioned other kitchen utensils. One noted how a fork can be used as a whisk, and another how a soup pot can be used to make cheese.
- A few campers mentioned appliances like the stove and fridge, and all the different types of food you can cook on or store in them.
- A couple of campers mentioned foods they think about in different ways. One camper mentioned how bananas can also be "*used for tattoos*" and another described the process of turning milk into cheese.

Thursday

Complete the following sentence: *Before camp I never thought I could _____, but now I know I can.* Tell me about your answer. (n=9)

- Most of the campers that responded to this prompt mentioned cooking. A couple of the campers said cooking in general, with one noting it was fun to make all the different foods and another saying they made breakfast for dinner. Specific food items campers said they can make now include ice cream (x3), fruit salad, and French toast.
- A couple of the campers had more science-related responses. One said “stick protein together,” and described the process of heating milk proteins to make cheese. Another mentioned making “strawberry DNA syrup.”

Recommendations

Consider ways to…

- …make the connections between the activities and the themes more explicit for instructors in the lesson plans/training. This will help them support their campers in making these connections.
- …intentionally create through lines during the week. This could be through connecting activities to previous activities or themes, or through consistent use of tools/techniques (e.g., journaling, observations).
- …share recipes with campers each day of camp. Some campers mentioned cooking food from camp (e.g., French toast) or the cookbook at home, and having those recipes sooner might encourage more campers to cook at home with their grown-ups too.
- …incorporate other elements of the Food for Thought project (e.g., the wh-questions).

Activities that worked particularly well

- Strawberry DNA was a real highlight for campers. It was a unique and unexpected experience that campers both enjoyed and seemed to understand. Having a take home item was an added bonus.
- All of the cooking demos were foods that campers were excited to cook and that most campers were excited to eat. The demos also served as opportunities to review content from that day's classroom activities.

Activities to consider cutting

- Banana Makey Makey – Setting up the activity was challenging for instructors and playing the video games became more of a focus for campers than the science content.
- Super Taste Testers – This did not work well as a group activity, and some campers ended up feeling left out (even if statistically most people are not super tasters).
- Electric Dough – There was not a clear connection to the camp's theme and issues with the equipment led to some confusion among campers.
- Salting Out – The demonstration bottle could be part of another activity to help illustrate emulsions, but it did not work well as a stand alone activity.
- Jell-O and Pineapple – While campers eventually seemed to understand the activity, it may be a little complex for this age group. The activity probably could be modified to work, but the cheese demo more successfully covers similar concepts (e.g., denaturing proteins).

Appendix A

Cincinnati Museum Center

Bean Necklace

Objectives/Key Concepts

Guests will discover what is required for a seed to germinate by creating a wearable bean ne

Set Up:

- Select 1-2 beans for your necklace.
- Cut a piece of paper towel to fit inside the plastic bag, spray with water (not dripping) and place at the bottom of the bag.
- Place the bean(s) on top of the paper towel, making sure you can see the bean through the bag.
- Seal the bag closed and punch two holes in the top and tie a string to create a necklace.
- If worn under the shirt, the body heat and moisture will help to germinate the seed.
- You can wear the bean necklace until it germinates or place it in a warm environment. Once it sprouts, it can be planted if desired.

Presentation/Procedures:

Clean Up:

Background Information

All flowering plants come from seeds. Plants are important for many reasons, they produce the fruits, vegetables, and grains that we eat. They also feed the animals that produce dairy and meat. Plants produce oxygen, which humans and animals need to breathe. We inhale oxygen and exhale carbon dioxide, which plants need. Each seed contains a tiny plant waiting for the right conditions to germinate and start to grow. These plants need water, and most prefer a warm environment to germinate. During its early stages of growth, the seed relies on the food stored within itself to grow. As it develops, the roots push down and anchor the plant in the soil. The stem begins to push up towards the light and once above ground, the germination stage is over. At this point, the plant can no longer rely on its own stored food and will grow leaves which it uses to produce food through a process called photosynthesis.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

- Dried Lima beans
- Small plastic ziplock bags (2”x3” or similar)
- Hole punch
- Paper towels or paper napkins
- Squirt bottle with water
- String (Not Itchy)

Vocabulary Words to Learn:
Germinate to sprout or develop
Photosynthesis Combining CO2+Sunlight+water to create O2

Safety:

Bibliography:

Program Created: November 2021
Program Last Edited/Editor’s Name: Jacob Cason

Cincinnati Museum Center

Banana Tattoo

Objectives/Key Concepts

Visualize the process of oxidation through the browning of a banana

Set Up:

Students can practice drawing on paper first if needed as you cannot erase the dots once they are pierced. You can create templates from these drawings or other images to guide your mark making. If using a template, cut out the image and tape to the banana. Follow the lines by creating small holes with your piercing tool as you go. You do not have to puncture the banana very deep. When you are finished, remove the template, and fill in any holes you may have missed.

Presentation/Procedures:

Give each guest a banana and a piercing tool. Ask students if they have ever eaten/seen a brown banana. Ask questions like, "why do you think bananas turn brown?" or "what other differences do you notice besides the color?" when discussing the chemical reactions taking place. Let them know they will get to speed up this chemical reaction by piercing the skin and rupturing the cell membranes of a banana. The small holes will allow oxygen in, speeding up the enzymatic browning process and creating a cool "tattoo" on the fruit.

Clean Up:

Leave the bananas out for the next few days (Throw away before they get stinky)

Background Information

As a banana ripens, it goes through a series of chemical reactions that turn it from yellow to brown. This process is called **enzymatic browning.** The enzyme responsible for the browning is called polyphenol oxidase (or PPO). In the presence of oxygen the PPO enzyme changes substances known as phenolic compounds through a process of oxidation, into different compounds called quinones. The quinones then react with other compounds to form melanin. Melanin is the same dark brown pigment that colors hair, skin and the irises of our eyes. It also turns fruit and vegetables brown. As the banana ripens, the membranes in the cell start to weaken. The enzymes cause the phenolic compounds to quickly oxidize. This reaction produces melanin which gives the ripening banana its brown spots.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

Banana
Template
Tacks

Vocabulary Words to Learn:

Safety:

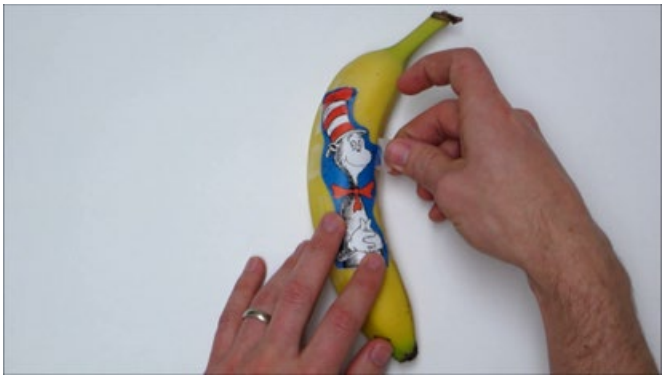
Careful with toothpicks and thumb tacks

Bibliography:

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Banana Tattoo



Questions to Ask Visitors:

- Why do you think a banana turns brown?
- How does the smell, texture and taste change as the banana browns?
- Why do the small holes turn brown so quickly?
- What other fruits do you think may brown in a similar way?

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Apple Browning

Objectives/Key Concepts:

- Introduce the concept of oxidation through an apple browning experiment.
- Experiment with delaying oxidation using various household ingredients

Background Information:

Enzymic browning is an oxidation reaction that takes place in some foods, mostly fruits and vegetables, causing the food to turn brown. Foods are made up of lots of different molecules, including some called enzymes. Enzymes are special proteins which can speed up chemical reactions. Fruits and vegetables normally keep enzymes trapped in their tissues, however when it is sliced or squashed, the enzymes come in contact with oxygen in the air. This reaction, called oxidation, causes the fruit to turn brown. In this lesson, we will observe oxidation by slicing an apple while also trying to prevent oxidation by submerging slices in different household ingredients. The enzyme in question is known as polyphenol oxidase (PPO). This enzyme is used by the fruit to protect itself from damage. When some fruit is damaged the presence of oxygen causes PPO activity to increase. This increase in activity causes the tissue to change color to brown. With the use of common household goods, you can limit the interaction with oxygen to prevent browning.

Set Up

Pre-slice apples with the apple slicer and distribute 1 sliced apple on a plate to each camper.

You can pre-fill cups with household liquids (lemon juice, apple cider vinegar, olive oil, water) or have campers fill them. There should be enough liquid to submerge/cover the apple slice completely.

Appropriate Ages:
Program Duration:
Small scale 30 mins
Keep some specimens oxidizing all week.
Category: Food Science

Materials:

- **1 apple per camper**
- **Apple slicer/corer**
- **Small plastic cups**
- Lemon Juice
- Apple cider vinegar
- Olive Oil
- Water

Vocabulary Words to Learn:

- **Enzyme-**Proteins that accelerate chemical reactions
- **Enzymatic Browning**- browning occurring due to enzyme processes.
- **Oxidation-** reacting with oxygen

Safety:

Camp staff/adult should use apple slicer.

Bibliography:

https://www.ifst.org/lovefoodlovescience/resources/fruit-and-vegetables-enzymic-browning

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Apple Browning

Presentation/Procedure

Students will compare how different household liquids react with the enzymes in apples, and aid or prevent the oxidation, or browning, of the apples.

Each student should have a plate or tray labeled with their name. Each cup should be labeled with the type of liquid inside (4 cups total).

Invite the students to make guesses about how the different liquids are going to react with the apples. Do they think a certain liquid will make them brown faster? Will one prevent it completely?

In addition to the 4 cups with different liquids, keep one slice of apple on the plate so students can see the natural process of oxidation.

Find a spot in the room for campers to set their tray and revisit the apples throughout the week to check on the browning process. Were their predictions correct?

The enzymes need specific conditions to work, acids prevent the browning so any liquid that is acidic should prevent the apple from browning.

Questions to ask:

What are some foods that you've seen turn brown?

Why do you think the foods are turning brown?

Which liquid do you think will be the best in preventing the apple from browning? Why? Were you correct?

Which liquid was the most effective?

Why do you think it was the most effective?

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Jello and Pineapple

DO NOT CONSUME SPECIMENS FOR LONG TERM OBSERVATION

Objectives/Key Concepts

- Proteins are large, complex molecules. The protein collagen is what causes gelatin to set.
- Enzymes are naturally occurring molecules that snip other long molecules into shorter molecules in living things. For example, protease enzymes cut protein molecules into shorter amino acids.

Set Up:

1. Boil water
2. Place gelatin and plant-based gel in 4 separate cups.
3. Label each cup:
    - Protein gelatin with pineapple
    - Protein gelatin without pineapple
    - Polysaccharide gel with pineapple
    - Polysaccharide gel without pineapple

Presentation/Procedures:

- Begin by asking campers if they've ever eaten Jell-O
- Explain how gelatin works: "Gelatin is made of collagen which is a protein. To set gelatin the collagen protein must be heated up, then cooled back down."
- Pour boiling water over powder and mix
- Talk about enzymes, and how they can disrupt gelatin: "Enzymes are molecules that exist in living things that cut long molecules into shorter pieces. Protease enzymes cut protein into amino acids. Pineapple core has a protease enzyme called bromelain. Adding uncooked pineapple to gelatin causes the collagen proteins to be cut, not allowing them to set."
- Place pineapple with core in 2 labeled cups
- Place apple in other 2 labeled cups – Apple does not contain protease enzymes.
- "The plant-based gel does not use proteins to set, it uses polysaccharides, which are long molecules similar to sugars and starches."
- Have campers predict whether each of the gelatins/gels will set and record their predictions in their journals
- Place in fridge and observe throughout week, recording observations in their journals.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

Gelatin
Pineapple
Apple
Cup 4/Kid
Plant based gel
Water

Vocabulary Words to Learn:

Safety:

- Boiling water is very hot.
- Do not eat the experiment

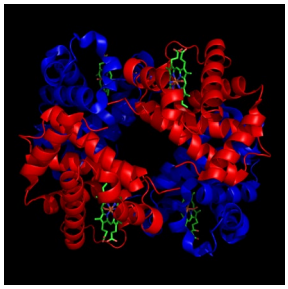
Bibliography:

Program Created: November 2021
Program Last Edited/Editor's Name: Brian Pollock – June 2022

Cincinnati Museum Center

Jello and Pineapple

Jello is a combination of long collagen fibers. These proteins fibers are first very active as the boiling water is poured over. As the temperature drops, the energy level drops within the fibers. This is normally when the Jello would set, and you would be able to enjoy it. Instead with the addition of pineapple rind it is prevents from setting. The proteins of collagen are prevented from setting due to the enzyme in pineapple core called bromelain. This enzyme cuts the fibers before they can harden and prevent the Jello from becoming solid.



Clean Up:

The Jello will be used throughout the week for observations. STORE IN FRIDGE AND TAKE OUT TO OBSERVE

Once the camp is complete throw it away.

Everything used in making the jello should be cleaned on day it's prepared, and the remains should

[Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]

Program Created: November 2021
Program Last Edited/Editor's Name: Brian Pollock – June 2022

Cincinnati Museum Center

StrawberryDNA

Objectives/Key Concepts

- DNA is present in all living things and contains the recipe for making organisms.
- Scientists carefully follow lab procedures to ensure successful experiments.

Set Up:

- Isopropyl Alcohol should be kept in a freezer ahead of time. When it is time to do the activity, take alcohol out of freezer and keep on ice until it is used.
- Set out containers, bag, strainer and tweezers for campers and set up a station to gather materials
- Measure our small amount of isopropyl alcohol for each camper

Presentation/Procedures:

- Begin by explaining background etc.
- Write procedure on board:
  1. Measure about 90mL of water into a small container (Extraction Mixture)
     a. Measure and add 10mL of soap to the water
     b. Measure and add ¼ tsp of salt to the mixture
  2. Place one strawberry in a Ziploc bag.
  3. Add the extraction mixture to the Ziploc.
  4. Press spare air out of the bag.
  5. Once the extraction mixture had been added and the air pressed out, begin mashing the strawberry gently until there are no large pieces.
  6. Once the strawberry has been totally mashed pour the mixture onto a strainer and press till all the liquid is through and pour into a test tube.
  7. Measure and gently add 5mL of ice-cold isopropyl alcohol onto the top of the extraction mixture.
  8. Using a dropper, tweezers, or toothpick, pull white film from the top of the test tube. This is the strawberry DNA.
  9. Put DNA and a small amount of alcohol into the centrifuge tube and seal shut.

Clean Up:

- Combine all liquids with lots of water and pour down drain.
- Clean all tools (Containers/Strainer) and work areas
- Wash hands

Appropriate Ages: 10+
Program Duration: 45 min
Category: *Food Science*

Materials:

Material station

- Isopropyl Alcohol (5 mL each)
- Dawn dish soap (10 mL each)
- Water (90 mL each)
- Salt (1/4 tsp each)
- Strawberry – (1 each)
- Centrifuge tubes (1 each)
- Pipettes

Camper stations

- Beaker for water and mixing solution
- Graduate cylinder for measuring soap and alcohol
- Beakers to strain into
- Ziploc Bag
- Strainer
- Tweezers
- Test tubes and holder
- Toothpicks
- Disposable spoons

Vocabulary Words to Learn:

- **DNA –** the molecular instructions for living things.
- **Procedure**
- **Variable**

Safety:

- Campers should wear safety goggles while working with chemicals.
- Alcohol is flammable. Keep away from flame.
- Measure a small amount alcohol into a beaker for campers to pour from to avoid large spills.
- Do not eat or drink anything during labs.
- Clean area thoroughly and wash hands when finished.

Program Created: November 2021
Program Last Edited/Editor's Name: 6/16/2022 Brian Pollock

Cincinnati Museum Center

StrawberryDNA

Background Information

DNA is the hereditary blueprint of our cells. It is replicated in every cell in our body. Humans have 23 pairs of tightly packed DNA structures known as Chromosomes. DNA controls all the traits that are displayed by living things. Strawberries are octoploid meaning they have 8 copies of each chromosome making it easier to extract large amounts of DNA. Strawberries are also easy to mash.

To extract the DNA, we need to break open the cells and the nucleus of the cells where the DNA is stored. The salt is added to create osmotic pressure, which bursts the plant cell wall of the strawberry. The soap is added to break up the cell membrane present in all living cells. Once those are broken open, with the help of our hands mashing the strawberry, the DNA will be available in solution. In order to extract it from everything else, we add the ice-cold alcohol. DNA is insoluble in alcohol, so it clumps together, making it visible.

In order to extract the DNA we will have to very carefully follow the lab procedure. Lab procedures are written out ahead of time to make sure all steps are followed. In a science lab, everything is recorded. This way scientists can figure out why certain results were seen. Scientists also make small changes, one-at-a-time to the procedure to test how those changes will affect the results.

Bibliography:

- https://www.stevespanglerscience.com/lab/experiments/strawberry-dna/
- https://www.scientificamerican.com/article/squishy-science-extract-dna-from-smashed-strawberries/#:~:text=When%20you%20added%20the%20salt,for%20you%20to%20see%20them.

Program Created: November 2021
Program Last Edited/Editor's Name: 6/16/2022 Brian Pollock

Cincinnati Museum Center

Rubber Egg

Objectives/Key Concepts

- Calcium compounds will dissolve in acid.
- Eggshells and teeth have calcium compounds that make them rigid. Long exposure to acid will weaken them.

Set Up:

Collect materials

Optional: Draw image on egg

Presentation/Procedures:

1. Put the egg into the vinegar – you should see bubbles start to form on the egg.
2. Leave the egg undisturbed for at least a day (In the fridge). You should see some wonderful scum form.
3. Take the egg out of the vinegar and rinse it with water. The shell will rub off.
4. Give the egg a poke with your finger and squeeze it gently.

Clean Up:

- Keep egg under liquid when not being observed.
- Do not move around when holding egg.
- When week completes throw egg away and take out trash immediately

Background Information

Vinegar, or dilute acetic acid, dissolves the calcium carbonate in the eggshell, just leaving the inner membrane, or skin, of the egg behind. As the calcium carbonate is responsible for making the shell hard, the vinegar-soaked egg feels soft and rubbery.

When calcium carbonate (the eggshell) and acetic acid (the vinegar) combine, a chemical reaction takes place and carbon dioxide gas is released. That's why you see the bubbles.

The chemical reaction keeps happening for about a day until all the calcium carbonate in the egg is used up. Calcium carbonate is in eggshells, seashells, and limestone. Teeth have calcium phosphate, which undergoes a similar reaction with acid. Acidic foods and plaque will soften tooth enamel over time. Limiting acidic foods and brushing teeth regularly will keep teeth healthy. Over the week we will be coming back to this egg and see what damage could occur without proper teeth care.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

- **Clear glass or plastic cup or beaker**
- **Vinegar**
- **Egg**

Vocabulary Words to Learn:

Acid – A solution with low pH. Acids are corrosive. Acidic foods taste sour.

Safety:

Do not eat the egg. Keep the egg in the refrigerator when not observing to prevent bacterial growth

Bibliography:

https://www.ucsf.edu/news/2010/08/101193/tooth-enamel-natures-crowning-achievement#:~:text=Enamel%20is%20comprised%20of%20the,crystal%20structure%20known%20as%20hydroxyapatite.

https://www.portdiscovery.org/news-room/stem-home-bouncy-egg-experiment

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Density Towers

Objectives/Key Concepts

Working in pairs campers will learn about density, build density towers, and test the densities of various objects.

Set Up:

Add food coloring to the corn syrup, water, and alcohol. Do not add too much to the alcohol or it can increase its density too much. The corn syrup will take a long time to mix the food coloring so do this ahead of time.

Provide cylinders for each group of campers. Pour all the liquids into smaller containers for campers to use. There should be more than needed for each group as they will be measuring the liquids before pouring them into the cylinders.

Presentation/Procedures:

We will be making density towers. The towers are made by layering liquids of different densities carefully on top of each other, so they stay separated. The basic idea behind density towers is that two fluids of different densities, and which do not mix, will stay separated with the less dense fluid floating on top of the denser fluid.

This will illustrate the concept of density and allow us to test the density of different materials as well.

To make the density tower, we start by pouring a small amount of the densest liquid carefully into the cylinder. In this case we start with corn syrup. Next, we pour in honey, then Dawn dish soap, then water, then vegetable oil, then baby oil, then rubbing alcohol.

Each pour must be done very slowly and carefully to avoid mixing or inverting the mixtures. Campers may need some help pouring the liquids to avoid spilling.

Once the mixtures are layered, you can test different materials for their density. Test a variety of materials by carefully dropping them into the density tower and observing where they settle. The density of the material tested is between the densities of the two liquids between which it settles. Test materials like an eraser, a nail, a piece of wood, a piece of cork, a LEGO brick, a ping-pong ball, a popcorn kernel a bit of carrot, etc.

Background Information

Density is a measure of the mass of an object per unit of volume. Gas being the least dense form of matter has a very small amount of mass spread across a large amount of volume. Liquids have a bit more mass spread across the volume of a given container. Solids however have a large amount of mass spread across a relatively small volume.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

- Corn Syrup – 25mL each group
- Honey – 25mL each group
- Dawn dish Soap – 25mL each group
- Water – 50mL each group
- Vegetable Oil – 25mL each group
- Baby Oil – 25mL each group
- Rubbing Alcohol – 25mL each group
- Food Coloring
- Tall cylinders, like graduated cylinders or vases.
- Small bits of food, like carrot, grape, dried pasta, whatever is around

Vocabulary Words to Learn:

Safety:

- Clean any spill thoroughly to avoid any slip hazards.
- Campers should not drink the liquids.
- Care should be taken to avoid getting the liquids in eyes.

Bibliography:

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Salting Out

Objectives/Key Concepts

- The density of an object is its how much it weighs compared to its volume. Density causes substances and objects to separate and layer. More dense substances will fall below less dense substances.

Set Up:

- Make sure you have everything needed in the poly-density kit.

Presentation/Procedures:

- Give the campers the definition of density and ask them to describe a few real-world examples.
- Introduce the demonstration by describing how salt and alcohol are miscible.
- Remove the cap from the bottle containing extremely pure salt (NaCl), and both the white and blue beads.
- Add 400 ml of clean water, and recap. The water level will be about 11 cm (4.25 in.) from the bottom of the bottle. Shake for several minutes until the salt dissolves.
- Add 450 ml of 91% rubbing alcohol (isopropyl), and tightly recap. The liquid level will now be about 19 cm (7.3 in.) from the bottom of the bottle
- Shake the bottle and wait. Can shake to repeat the process multiple times.
- Be sure to point out the emulsion in the bottle.

Clean Up:

- Wipe up any spills.

Background Information:

Water and isopropyl are miscible: they form a solution no matter what ratio they are combined in. Adding salt to water pushes the isopropyl alcohol out of the solution. In the demonstration, the salt water, beads, and alcohol are separated to begin with. When shaken, the salt water and alcohol form an emulsion. The blue beads are denser than the emulsion, so they sink to the bottom. The white beads are less dense, so they float to the top. This emulsion is unstable, since the salt water and alcohol do not want to mix, so it begins to separate into the salt water and alcohol. While this happens, the beads begin to move towards the middle, because the salt water denser than both beads, and the alcohol is less dense than both beads.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

- Poly-density kit with bottle, white and blue beads, and salt
- 91% isopropyl alcohol
- Water
- Beaker to measure water and isopropyl alcohol

Vocabulary Words to Learn:

Density: mass compared to volume
Miscible (mi-suh-bl): can form a solution
Immiscible: cannot form a solution, liquids that will want to separate when mixed
Emulsion: mixture of immiscible liquids

Safety:

No safety concerns

Bibliography:

https://pubs.acs.org/doi/pdf/10.1021/ed500830w

Program Created: November 2021
Program Last Edited/Editor's Name: Brian Pollock – June 2022

Cincinnati Museum Center

Electric Dough

Objectives/Key Concepts:

To introduce visitors to the nature of electricity, and allow them to create their own circuit, and experiment with circuits using playdough.

Background Information:

An **electrical circuit** is a complete path around which electricity can flow. Electricity can only flow through a circuit when all components are working. A closed circuit is when all parts are working and connected, and an open circuit is when a part of the circuit is missing or broken. In an open circuit, energy can no longer flow because the path is not complete.

Conductivity is the ability to move electricity or heat from one place to another. We use circuits to conduct, or move, electricity.

A **short circuit** happens when the flowing electricity finds an easier path to take around the circle. Electricity will always take the path of least resistance.

A **series circuit** is multiple parts on one circuit that are all connected along the same path. Some Christmas lights are a series circuit, when one light goes out, all of the lights go out.

A **parallel circuit** is multiple parts that have different branches with different currents. These work independently, so when one goes out, the others can stay on. Most modern Christmas lights are parallel circuits now.

Appropriate Ages: 5+
Program Duration:
Category: *Science*

Key Concepts:

- A **closed circuit** allows the energy to flow through a closed loop
- In an **open circuit,** a part of the loop is missing or broken and the energy cannot flow
- Electricity will always choose the **path of least resistance**
- **Conductivity** is the ability to move heat or electricity from one place to another

Materials:

- playdough
- LED lights
- Battery holders
- AA Batteries
- Cookie cutters (optional)

Program Created: Anna Butcher
Program Last Edited/Editor's Name: 9.14.2017 Katie Bell – updated format

Cincinnati Museum Center

Electric Dough

Set Up:

Give each table circuit information sheets, LED lights, battery holders, batteries, and small portions of each type of playdough on the table. Ask campers to wash hands before using playdough.

Presentation/Procedures:

1. Have campers create two balls of playdough, connecting to each of the two wires on the battery packs. Explain to visitors that a circuit must be a closed loop in order to conduct electricity. Add the LED light between the two balls of dough. (If the LED light doesn't light up, turn it around, they only allow energy to flow in one direction!)

2. After creating the first closed circuit, push the two balls of dough together so that they are touching. The LED light will go out, and you have created a short circuit! Explain that electricity will follow the path of least resistance, and it's easier to bounce around in the dough than to travel up the wire and through the LED.

3. Use the cookie cutters or make your own sculpture, create a circuit and watch it light up!

Clean Up:

If Playdough is still soft an pliable, it may be used again.

Safety:

Small parts and electricity are involved. Supervise younger visitors.

Questions to Ask Visitors:

- *What components are needed to create a complete circuit?*
- *What happens when two pieces of conductive dough are pushed together?*
- *How does the formation of the dough change the brightness of the light?*
- *How do you use electricity in your life?*
- *Where are the circuits in your home?*

For Younger Visitors:

Younger visitors will enjoy creating different formation with the playdough, and LEDs and battery packs should be handled by an adult or staff member. Younger visitors can observe how their dough formations conduct electricity.

Bibliography (optional):

How Stuff Works, "How Circuits Work". http://science.howstuffworks.com/environmental/energy/circuit.htm

Program Created: Anna Butcher
Program Last Edited/Editor's Name: 9.14.2017 Katie Bell – updated format

Cincinnati Museum Center

Blindfolded Miracle

Objectives/Key Concepts

- Taste perception manipulation
- Importance of eyes in perception

Set Up:

- Make sure you have the same amount of miracle berries as campers
- Make sure you have limes, lemons, onions
- Make sure you have blindfolds

Presentation/Procedures:

1. Begin by allowing campers to taste their food normally and have them record thoughts in journal.
2. Then apply a blindfold (ONLY CAMPERS WHO WANT TO)
3. Mix up the order of foods and allow the camper to taste them. Ask them to describe.
4. After this remove the blindfold and give them a miracle berry. [NOTE: DO NOT CHEW MIRACLE BERRY LET DISOLVE ON TONGUE]
5. Retry the same foods again and ask them how they taste and how that differs from their original sense of taste.
6. Remind them that one day their taste buds will change, and vegetables will taste good.

Clean Up:

- Throw away all unused food

Background Information

Taste perception in many cases revolves around the proteins on your tongue. These proteins are there to keep us safe from harmful temperatures and make sure we don't eat anything dangerous. You can feel the effect of these anytime you eat hot mac and cheese or a very sweet candy. Today we will be changing our perception of acidic foods. Then will mess with our ability to see the food we are eating.

Miracle Berries contain a glycoprotein which binds to the taste sensing proteins on your tongue. This glycoprotein changes the perception of acidic/ sour tasting foods. It will cause a sour tasting acid (Citrus) to taste sweet. If you think of taste perception as a lock and key model Miracle berries change the lock and make the previously sour key taste sweet. Taste perception is incredibly manipulatable. We will begin by chemically changing your perception with the Miracle berries. After this part of the activity, we will blindfold campers (only if they want to).

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:
Miracle berries
Blindfold
Lemon
Limes
Onion's
Cherry tomatoes

Vocabulary Words to Learn:

Safety:
Ensure campers are seated and away from sharp edges and stuff.

Bibliography:

Program Created: June 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Banana Makey

Objectives/Key Concepts

- Understanding conductivity

Set Up:

Load games up from scratch.MIT.edu or mysteinbach.ca
(Careful not all are appropriate)

- Get the makey makey kit from camp supplies.
- Make sure you have enough bananas
- Attach one alligator clip to the very bottom silver holes. (This must be held while touching other inputs)
- Depending on game you play attach alligator clips to all directionals, space, and click inputs. Then attach them those leads to bananas.
  (For any input to work you must be holding the banana that is attached to the bottom holes then touch the input.)
  (If there is an issue unplug the makey makey and replug)

Presentation/Procedures:

- Connect makey makey to a laptop
- Open scratch.MIT.edu or mysteinbach.ca
- Select game
- Challenge campers to create a functional controller out of the available fruit and vegs
- List conductive fruits and vegs on board

Clean Up:

- Disconnect all alligator clips from makey makey and tested foods.
- Return all alligator clips to the Makey Makey kit.
- Throw all fruits and vegetables away

Background Information

Electricity is a massively important utility to the modern world. One of these all two important applications is VIDEO GAMES!! Makey makey's are simple devices that mimic a control minus the very important part of buttons. In order to do this, we will need something that is conductive to electricity. Meaning it is a substance that allows for the free flow electrons with little resistance. In this activity we will make buttons out of FOOD! Bananas are one route, but we can also use anything that can transfer current. So, water, Marshmallows, Banana's, and tomatoes are all conductive.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:
One Laptop to one makey

- Makey Makey
- Alligator Clips
- Assorted fruits and vegs

Safety:

Makey Makey does not channel enough current to do any damage.

Bibliography:

(Game catalogue)
https://scratch.mit.edu/

https://www.mysteinbach.ca/game-zone/
(Avoid anything other than games section)

Upon completion

- Disconnect bananas from alligator clips.
- Due to a similar process as Apple browning you can draw on bananas!
- Allow guests to stick and poke on the outside. (Make holes as close)
- As the week goes on the images drawn on the bananas will appear darker and darker.

Program Created: November 2021
Program Last Edited/Editor's Name: Jacob Cason

Cincinnati Museum Center

Popcorn & Thermoception

P

Objectives/Key Concepts

- You know if something is hot or cold because of nerve signals.
- Some chemicals can confuse your nerves and cause them to make you feel hot or cold, even when the temperature hasn't changed.
- These chemicals naturally occur in certain foods, like chili peppers and mint.

Set Up:

- Get popcorn from SSA (Jacob)
- Mix half the popcorn with dried mint.
- Mix the other half with cayenne pepper. Go easy with the pepper. Kids are usually very sensitive to spicy food.
- Pour each type of popcorn into small bowls.

Presentation/Procedures:

- Tell the campers they are going to be tricking their own brain.
- Hand out the popcorn and tell them to pay special attention to how their mouth feels as they eat it. It's ok to stop eating it at any time.

Clean Up:

- Throw away all uneaten popcorn.

Background Information

Menthol (in mint) and Capsaicin (in chili pepper) both confuse our sense of thermoception to make us think that drastic and dangerous temperature changes have occurred, even though no actual temperature change has occurred. Proteins present on our tongue are the first line of defense from a dangerous temperature. They detect menthol and capsaicin and translate that into cold and hot temperatures. This sensation is likely a defense mechanism to prevent mint and pepper plants from being eaten. Humans and tree shrews are the only mammals that eat these molecules for fun!

Capsaicin content is measured in Scoville units. Jalapenos are about 5,000 Scoville units, Habaneros are about 150,000.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:
Pre popped popcorn
Dried Mint
Cayenne
Water for campers to drink
2 small bowls for each camper

Vocabulary Words to Learn:
Nerve: Part of the body that carries signals to and from the brain.
Menthol: The chemical in mint that produces a cold feeling in the mouth.
Capsaicin: The chemical in chili peppers that produces a hot feeling in the mouth.
Thermoception: The sense of temperature. Part of our sense of touch.

Safety:
Do not get spice in eyes

Program Created: November 2021 Jacob Cason
Program Last Edited/Editor's Name: Brian Pollock - June 2022

Cincinnati Museum Center

pH Potions

Objectives/Key Concepts

- pH measures how acidic or basic a liquid is.
- An acidic solution has a lot of particles called hydrogen ions. A basic solution does not have a lot of hydrogen ions.
- Certain chemicals and our taste receptors are sensitive to changes in pH.
- Basic and acidic solutions cause reactions in different ways.

Set Up:

- Prepare the pea flower batch with 1 tsp of pea flower powder and 32oz of water.
- Make a large batch of watery baking soda by adding
- Make a large batch of watery toothpaste.
- Give each camper three cups.

Presentation/Procedures:

- **Explain the connection between pH and hydrogen ions:** "pH measures hydrogen ion concentration. Hydrogen ions are charged atoms or molecules containing hydrogen. They act like magnets to other molecules and cause reactions, so it's important to know if a solution has a lot of them. A lot of hydrogen ions means a solution is acidic. If a solution does not have a lot of hydrogen ions, then it is basic. Our taste receptors are sensitive to pH, meaning that they react when we drink liquids with different pH."
- **Explain that pea flower reacts to that hydrogen concentration:** "Like our taste buds, chemicals in pea flowers called anthocyanins are also pH sensitive, so when you change the pH around them, they react in some way."
- **Talk about the pH of household liquids:** "Most sodas and juices are acidic. Soapy water and baking soda are basic. Distilled water is neutral. Today, we will be adding different solutions to pea flower tea to see how the anthocyanins in the tea will react when we change the pH."
- Tell the campers to label the cups with the liquid you will be adding (lemon juice, orange juice, baking soda, unsweetened tea, baking soda, apple cider vinegar, toothpaste & water, milk), let the camper chose which they want to test.
- Add some of the pea flower tea into each cup. This doesn't need to be a lot, just enough to observe a change in color.
- Have the campers write in their journals what they observe about the pea flower tea and how they think the tea will react to the liquids they chose.
- Using the pipettes, add a small amount of the substance each camper wants to test into the appropriately labeled cups.

Appropriate Ages: 7+
Program Duration: 10 minutes+
Category: *Food Science*

Materials:

- Pea flower
- Cups
- Pipettes

Ingredients

- Lemon juice
- Orange juice
- Soda (7 up/ Sprite)
- Unsweetened tea
- Baking soda & water
- Apple cider vinegar
- Toothpaste & water
- Milk

Vocabulary Words to Learn:
pH- Hydrogen Ion concentration
Basic- low pH
Acidic- high pH

Safety:

No serious safety concerns

Bibliography:

Program Created: November 2021
Program Last Edited/Editor's Name: Ben Freudenberg

- Allow the campers to observe and have them write the way the pea flower tea changed with each liquid they tested.
- Ask them what they think the pH of the liquid is (acidic or basic?) and how strong it was. Connect this idea to how much the color of the pea flower changed and what color it changed to. (i.e. "We know lemon juice is an acid, and it changed the tea into a vibrant pink. When we added the baking soda, what color did the pea flower tea turn? Is baking soda an acid or a base? How strong is it?)

Clean Up:

- All liquids can be disposed of in the drain.
- Throw away cups, wipe down any spills.

Background Information

Measures of the concentration of hydrogen ions is commonly known as pH. The pH concentration can be high (Basic) or low (Acidic). Many items in the kitchen can vary wildly from very acidic to very basic. Both tastes are very noticeable to our bodies' taste receptors.

Butterfly Pea flower, like our taste receptors, is pH sensitive. This is due to anthocyanins which occurs naturally in pea flower. This is the same antioxidant that gives eggplants, cherries, and blue berries their purple and blue colors. In this experiment, you will demonstrate pH of modern drinks.

Of the testable liquids, they have the following pH:
lemon juice (acidic, 2-3),
orange juice (acidic, 3.5)
soda (acidic, 2.5-3.5)
unsweetened tea (acidic, 4.9-5.5)
baking soda and water (basic, 8)
apple cider vinegar (acidic, 2-3)
toothpaste and water (basic, 7-10)
milk (acidic, 6.7-6.9)

The closer the pH gets to 1 or 14, the more acidic or basic the liquid is, and the greater the pea flower tea will change color when the liquid is added. Acidic solutions will change the pea flower tea magenta. Solutions closer to 7 will change the pea flower tea cobalt. Basic solutions will change the pea flower tea aqua.

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Cincinnati Museum Center

Baking soda color play

Objectives/Key Concepts:
Observe the chemical reaction of baking soda and vinegar and experiment with color mixing in a foamy fun way.

Background Information:

Baking soda and vinegar react chemically because one is a base (baking soda) and the other is an acid (vinegar). In this reaction, carbon dioxide bubbles are formed, just like the bubbles in a carbonated drink.

Acids and bases are two kinds of chemicals, determined by the type of Ions in them. If there are a lot of hydrogen ions present, it is an acid, if there are not hydroxide ions, it is a base. Scientists use the pH scale to determine how acidic or basic a liquid is.
Vinegar is a weak acid; some other common acids are orange juice, colas and lemon juice. Baking soda is a mild base; other common bases include soaps, detergent, bleach and even blood!

Baking soda and vinegar is a neutralization reaction. When an acid and base come together and "neutralize" or share their + and – charged ions, a chemical reaction occurs resulting in lots of carbon dioxide bubbles.

Appropriate Ages:3+
Category: science

Key Concepts:

- Almost all liquids are either acids or bases.
- Vinegar is a weak acid, baking soda is a mild base.
- When combined, there is a chemical reaction causing the formation of carbon dioxide bubbles, like in a carbonated drink.

Materials:

- Baking soda
- Vinegar
- Liquid watercolors
- Pans or trays
- Tarps
- Pipettes
- Spoons
- Water cups to mix water color and vinegar

Program Created:
Program Last Edited/Editor's Name:

Cincinnati Museum Center

Baking soda color play

Set Up:
Place tarp on table(s) if desired

Fill cups (spill proof if you have them!) with a small squirt of liquid watercolor to about 4 parts vinegar. Note: liquid watercolors are very saturated and will stain clothes and skin when they are full strength.

Give each camper a tray, pipette and access to multiple colors of liquid watercolor mixed with vinegar.

Fill each tray with a thin layer of baking soda, lightly covering the surface.

Procedure:

Share the background information about the chemical reaction that happens when you combine baking soda and vinegar. Gently squeeze the bulb of a pipette, place it in the color then release it to fill with color. Squeeze the bulb again and drip the colored vinegar onto the baking soda.

See what happens? It bubbles, fizzes and pops! The acid and base combine to make a fun chemical reaction! Kids can also experiment with mixing colors; try mixing primary colors to make secondary colors, or just have fun experimenting.

Liquids in tray can be poured in the sink, but the used powder should go in the trash.

Hints:
Kids like to stir with the pipettes, which is fun, then they put them in the vinegar again, which will neutralize the vinegar. You may need to add more vinegar or color as they mix. Dump and remake any colors that turn brown as needed

Questions to Ask campers:

What new colors can you make with the color choices you have?

Does the reaction keep going forever?

What happens to the baking soda after the reaction? (Is there more of it less of it?)

Program Created:
Program Last Edited/Editor's Name:

Cincinnati Museum Center

Owl Pellet Dissection

Objectives/Key Concepts

- Understanding of different digestive styles.
- Light understanding of bone structure for prey animals.

Set Up:

1. Prior to the class make sure all bone identification sheets are present as every table in use.
2. Make sure every table has a pellet.
3. If supplies allow give multiple pellets to each group.

Presentation/Procedures:

1. Ask the camps do they eat bones? (Clearly no)
2. Ask the campers what they think birds do about bones?
3. Begin by explaining the digestive process of owls/birds. (Background information below)
4. Place the bone identification papers out and pass out owl pellets.
5. As students dissect the pellets help them identify the bones and skeletons compared to the bone identification sheets.
6. Give the groups a challenge to try to assemble as much of a skeleton as possible.

Clean Up:

1. Once the dissection is complete throw all the rubbish into a trashcan.
2. Throw that trash bag into a dumpster.
3. Using a Clorox wipe clean all trays and tables.

Background Information

Owls do not chew their food. Food passes from the mouth to the gizzard. The gizzard is a bag like organ that has rocks and sand to help digest tissue. Anything that is indigestible such as teeth, skulls and bones is left in the gizzard and is compacted. After a few hours the owl's esophagus begins to spasm and ejects the "pellet".
These pellets are used to identify the main food sources of a group of owls. It can be used to determine if they are properly fed, detect pathogens, and determine if they are healthy.

Appropriate Ages: 10+
Program Duration: 1 hr
Category: *Animal Digestion, Food Science*

Materials:

- Owl Pellets
- Dissection Trays
- Dissection tools
- Sanitary wipes
- Bone ID sheets

Vocabulary Words to Learn:

- Digestion- The process of turning food into nutrients

Safety:

- Be sure to clean all areas that the owl pellets are around.
- Dissection tools are sharp and can be dangerous.

Bibliography:

- https://www.owlpages.com/owls/articles.php?a=4
- https://www.carolina.com/knowledge/2020/02/19/all-about-owl-pellets

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