

Montshire at Home: Teacher Guide

WEEKLY THEME: EGGS – Use easy-to-find eggs as a unifying theme as your students engage in both classic engineering challenges and simple biology explorations.

MONTSHIRE AT HOME is a series of learning activities, resources and short videos, developed, hosted and curated by the Montshire's Education team. It's designed to support children, families, and teachers with easily accessible concepts, content, and materials while learning at home.

Teachers can use these materials to support remote science learning opportunities for their students at home. Below is a suggested learning progression using this week's theme, activities, and resources found on the Montshire's Online Resource web page.

SUGGESTED LEARNING PROGRESSION

Day 1: Inside an Egg

EXPLORE

- ▶ Dissolve the eggshell from a raw egg to observe and dissect the anatomy of an egg.
- ▶ How long does it take to chemically dissolve an eggshell?
- ▶ How many parts does an egg have?

DISCOVER

- ▶ The calcium carbonate shell of an egg dissolves in an acid like vinegar – bubbles on the egg's surface is evidence of a chemical reaction.
- ▶ An egg has multiple membranes that act as containment boundaries.
- ▶ Inside an egg the spring-like chalazae provides structural support.

Day 2: Separating the Parts of an Egg

EXPLORE

- ▶ Use kitchen science to separate the white from the yolk and follow two recipes.
- ▶ What parts of an egg are recognizable from the first experiment?
- ▶ How does the texture of egg white change as it is whipped?
- ▶ What does whipping do to the yolk? How does adding oil change that?

DISCOVER

- ▶ The membrane around the yolk allows the white to be separated without mixing.
- ▶ Whipping egg whites incorporates small bubbles of air into the protein rich whites, creating egg foam.
- ▶ Whipping oil into yolks creates small bubbles of oil into the fat rich yolk, creating a creamy sauce.

Day 3: How Strong is an Egg?

EXPLORE

- ▶ Measure how much weight an egg can support before it cracks.
- ▶ How many books do you predict your eggs will be able to hold?
- ▶ How does the number of books you added to your eggs compare to the weight of the books? What are some variables in this experiment?

DISCOVER

- ▶ Eggs are surprisingly strong – stronger than the weight of an incubating chicken sitting on them.
- ▶ The domed or arched shape of an egg is what gives it strength.
- ▶ Sudden force or concentrated force can still break an eggshell.

EXTENSION

- ▶ Challenge students to break an egg by squeezing it in their bare hands.

Day 4: Egg Drop

EXPLORE

- ▶ Build a container that can prevent your egg from breaking when dropped.
- ▶ Can you make a "test-egg-dummy" to try out different ideas first?
- ▶ What variable is most dangerous to your egg: impact, bounce, speed?

DISCOVER

- ▶ Eggs continue to have momentum when they hit the ground, moving through any open space in the container.
- ▶ Containers' aerodynamics influence how and the speed in which they move through the air.
- ▶ Weight and balance determine which part of the container makes contact with the ground first.

EXTENSIONS

- ▶ Based on your grade level, add more engineering restrictions, i.e., must fall X feet, container no larger than X, must do X number of trials.

Day 5: Hollow Egg Surprises

EXPLORE

- ▶ Practice blowing out an egg to create a hollow container.
- ▶ Can you empty an egg with only one hole?
- ▶ How big do the hole(s) need to be? How much pressure is needed to drain the egg?
- ▶ How can you hide something in your egg that is larger than the exit hole? (Like a ship in a bottle.)

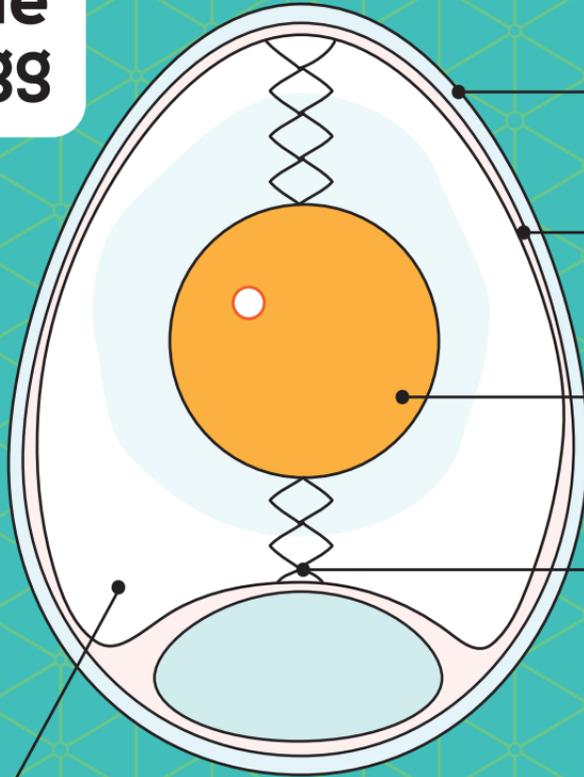
DISCOVER

- ▶ Two holes are needed to break the vacuum of an egg.
- ▶ The membrane stays around the inside of the eggshell, but the yolk membrane needs to be punctured to blow out the egg.

EXTENSIONS

- ▶ Cultures around the world decorate and carve eggs into art.
- ▶ What could you invent with an empty eggshell?

Inside an Egg



Shell: Keeps the egg safe with tiny pores to let air and water out.

Membrane: A skin-like layer that holds it all together.

Yolk: Contains all the fat and energy to grow a new chick, and its own membrane, too!

Chalazae: White bungee-like cords that hold the yolk in place.

White: Provides all the protein and water for a growing chick.



Recipe: Meringue Cookies

Fluffy Egg White Cookies

Make a light and fluffy cookie by beating tiny bubbles into the protein rich white of an egg – turning egg slime into foam.

Don't forget to wash your hands before and after cooking and handling raw eggs.

Materials

- ▶ Small bowl
- ▶ Whisk
- ▶ Large bowl
- ▶ Cookie sheet

Ingredients

- ▶ 2 eggs
- ▶ 4 tablespoons sugar
- ▶ Flavor of your choice:
 - ▶ 1 teaspoon vanilla
 - or 1/4 cup chopped nuts
 - or 1 teaspoon cocoa powder

1. Separate the whites from the yolks of two eggs.
 - ▶ To do this, crack the egg in half, slowly lifting the top half off and letting the egg white ooze out the bottom of the egg into a small bowl.
 - ▶ The yolk will stay in the bottom. Without popping the yolk, slowly slide it into the top of the egg shell allowing extra egg white to slide off the yolk into the bowl. Set the yolks aside for another recipe!
 - ▶ If any of the yellow yolk ends up in the small bowl—stop! Make some scrambled eggs and start again. The fat in the yolk will prevent you from making bubbles in the egg white.
2. Put the egg whites in a large bowl and beat it with a whisk. (You can also use an egg beater or electric beater if you have one... but that takes much less work!) Whisk the egg whites FOREVER until they change from clear and slimy to white and fluffy.
3. Beat in one tablespoon of sugar. Then three more tablespoons of sugar one at a time. The sugar will dissolve in the egg white and turn the foam shiny.
4. Beat until the egg whites are stiff, which means they can stand up on their own after you pull the whisk out.
5. Gently mix in your flavor. (Some vanilla, or maybe finely chopped nuts?)
6. Drop spoonfuls of your sweet fluffy egg white onto a cookie sheet. Use parchment paper if you have some!
7. Bake at 200 degrees for two hours. Keep an eye on them! Little cookies cook fast and big cookies cook slow.



Recipe: Mayonnaise

A Secret Sauce from Eggs

Yolks are rich and fatty. If you mix oil in with egg yolks, you get a fatty oily mess that doesn't mix well. But if you slowly and carefully whisk them together so that they each make the tiniest bits of oil and fat, you can create the amazing, creamy (and emulsified!) deliciousness of mayonnaise.

Note: Homemade mayonnaise contains raw eggs which means it may increase the risk of foodborne illness. Check with your grown-ups.

Materials

- ▶ 2 small bowls
- ▶ Whisk
- ▶ Small spoon

Ingredients

- ▶ 1 egg
- ▶ Pinch of salt
- ▶ 1/2 tablespoon of lemon juice
- ▶ 1/2 cup of oil

1. Separate the yolk from the white of an egg.
 - ▶ To do this, crack the egg in half, slowly lifting the top half off and letting the egg white ooze out the bottom of the egg into a small bowl.
 - ▶ The yolk will stay in the bottom. Without popping the yolk, slowly slide it into the top of the egg shell allowing extra egg white to slide off the yolk into the bowl. Put the yolk into its own bowl. Set the white aside for another recipe!
 - ▶ If the yolk pops—no worries! Make some scrambled eggs and try again!
2. Add ½ tablespoon of lemon juice and a pinch of salt to the egg yolk. Mix like mad with the whisk until it changes from gooey to a bright smooth shade of yellow.
3. Here's the tricky part that takes lots of time and elbow grease. The oil needs to be very slowly mixed into the egg yolk. One small spoonful at a time. Add your first small spoonful and mix away until the oil has completely become incorporated into the yolk.
4. Repeat. And repeat. And repeat... until your egg yolk changes from looking slimy yellow to looking like beautiful whipped cream. Just remember, it goes on a sandwich and not on ice cream! Feel free to add other flavors (like mustard or pickles, not chocolate or strawberry).



Experiment: How Strong are Your Eggs?

Test how strong an eggshell is by carefully stacking books on raw eggs.

REQUIRED MATERIALS

- ▶ 4 Raw eggs
- ▶ 1 Egg carton
- ▶ Books
- ▶ Bathroom scale (optional)

How many books do you predict your eggs will hold before the shells crack? _____

1. Choose four equal sized eggs with no gray cracks.
2. Make four individual egg holders from an egg carton.
3. Place eggs pointy side up in each egg holder.
4. Carefully place a book on top of all four eggs. Did they crack?
5. Add one book at a time until the eggs break!

How many books were you able to stack? _____

Were all your books the same size and weight? _____

How many pounds of books were your eggs able to hold (use a bathroom scale)? _____

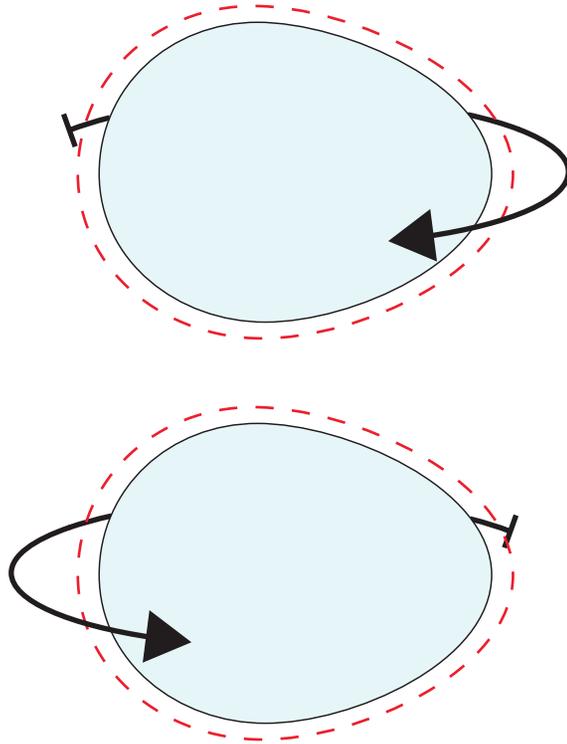
Wash your hands and any materials with soap and water if you got raw egg on them!



Spin the Egg

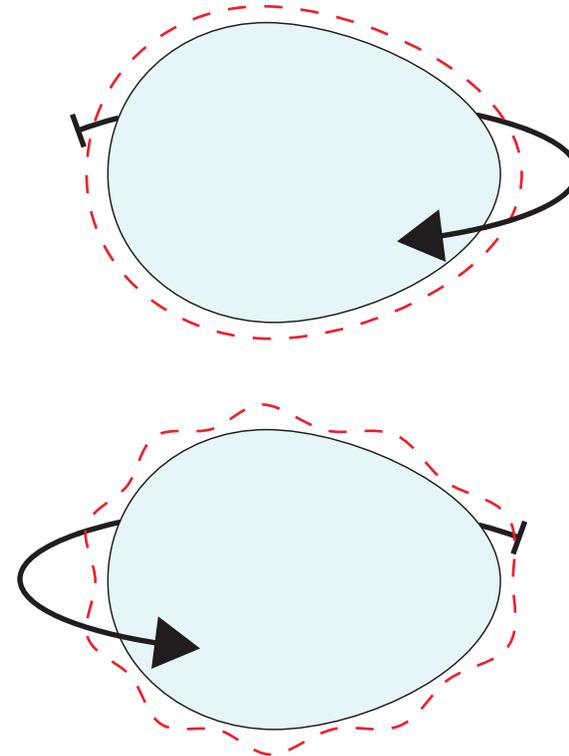
1. Spin the egg in one direction.
2. Quickly reverse the direction you're spinning the egg.
3. Observe the results.

Hard Boil Spin



A solid egg spins fast and smooth in all directions.

Raw Egg Wobble



A liquid egg sloshes and wobbles when the spin changes direction.



Experiment: Egg Drop

Your challenge is to drop a raw egg from a great height—and not have it crack! To do this you will need to build a container for your egg. Plan your egg experiment and record your results here.

REQUIRED MATERIALS:

- ▶ Raw eggs
- ▶ Small Ziploc bags
(always put your egg in here to make clean up easy!)

OPTIONAL MATERIALS

What material from home can you build with?

- ▶ Paper
- ▶ Cardboard
- ▶ Sticks
- ▶ Cotton
- ▶ Toilet Paper
- ▶ Rubber bands
- ▶ Get creative!

Draw your first idea here:

Draw your second idea here:

Test 1

Did your egg crack? If not—success! Why do you think your container protected your egg?

If yes, no worries! What could you change to improve your container?

Test 2

Did you get the same or different results the second time?

What did you or could you change to improve your container?



Activity: Hollow Egg Surprise

Empty out an egg shell to create a hollow egg you can hide surprises in.

Materials

- ▶ Egg
- ▶ Small bowl
- ▶ Pushpin or tack
- ▶ A surprise!
- ▶ Paperclip

Instructions

1. Wash your egg well before using.
2. Poke holes in the egg.
 - ▶ Using the push pin, very gently poke a hole in the pointy rounded top of your egg. You may have to rock the pin against the shell a few times to get the hole started. This will be the hole you blow into.
 - ▶ Repeat, gently making a hole with the pin on the bottom of the egg. This is the hole the raw egg will come out of. It will need to be larger than the top hole. It should be about 1/8 inch to 1/4 inch across – the size of a pencil eraser. Use the pin to break off one tiny bit of egg shell at a time to enlarge the hole.
3. Break up the yolk.
 - ▶ Unfold the paperclip and push it up and down into the hole in order to pop the membrane around the yolk.
 - ▶ Cover the holes with your fingers and shake the egg, making a scrambled egg inside!
4. Blow out the insides of the egg.
 - ▶ Place your egg over the small bowl.
 - ▶ Make a seal with your mouth around the tiny top hole, so no air can escape.
 - ▶ Blow as hard as possible! The raw egg will start to come out the bottom of the egg.
5. Wash the inside of your egg.
6. Fill the egg with surprises.
 - ▶ Tiny pebbles
 - ▶ Flower petals
 - ▶ A rolled up note
 - ▶ Confetti
7. Make scrambled eggs with the previous contents of your hollow egg!