WEEKDAY WONDERS

Content developed by the Tennessee Aquarium Education Department

TENNESSEE AQUARIUM

STEM Around Us: Day 3

We are surrounded by science, technology, engineering, and mathematics (STEM) every day. We do not always realize the extent that they play a role in our lives, but no matter your career or hobbies, STEM is involved. The more young scientists understand about STEM, the better their critical thinking, their passion, and their interest. This week, your young scientist will have opportunities to explore the connections between STEM and the world, beginning with bird wings and flight.

These curated activities are listed in a suggested sequence but may be done in the order that works best for you and your young scientists. Learn more about this series in the Introduction to Weekday Wonders.

Question of the Day

How do man-made buildings mimic nature?

Daily Nature Journal

Have your young scientist go out and complete a daily nature journal entry. Doing daily nature journaling helps people to connect with the world around them more easily. If you need additional guidance about what your young scientist should put into a daily entry, see the Guide to Nature Journaling.

Penny Bridge

Remind your scientist of the building activities in yesterday's Weekday Wonders. The goal in those activities was to make a strong structure. Tell your scientist that today's activities will let them explore another kind of structure in building and in nature.

Give your young scientist 30-50 pennies and ask him or her to build a bridge using only the pennies. Allow him or her as much time as the activity holds interest. Your scientist may struggle with this activity, but that is okay. He or she will have an opportunity to return to it at the end of the day's activities.

Ice Arch

Prepare 9 to 11 rectangular or square ice cubes for your scientist to use in this activity. If you do not have an ice cube tray, you can also make ice in an egg carton. If you have a plastic or Styrofoam egg carton, the carton is already waterproof. If you have a paper or cardboard egg carton, line it with aluminum foil before adding the water.

Once the ice cubes are solid, offer them to your scientist with the instruction to build an arch from the ice. Allow your scientist to try for as long as he or she wishes—or until the ice melts! If your scientist is getting frustrated, help him or her to build the arch on a flat, moveable surface, such as a cookie sheet, piece of cardboard, or cutting board. Then, you can carefully stand the arch up, move the surface, and have an upright arch.

Ask your scientist what s/he notices about the arch. Have your scientist consider how many pieces of ice it took as well as what would happen if s/he added more ice. Finally, challenge your scientist to see if s/he can make a toy or other object sit on top of the arch without it collapsing.

Arches in the World

Ask your scientist to brainstorm where s/he has seen arches in the world. Encourage him or her to think of both natural and human-made structures. Ask your scientist to draw or write a list.

If your scientist has difficulty, see if you can spark ideas by having your scientist think of large, old buildings, sports arenas, and certain cars. You might also ask your scientist to think of domes, which are three-dimensional arches. Once your scientist has thought of some arches or domes, see if s/he can think of any animals or insects that have a domed shape.

Strong Arches

Ask your young scientist to think about an egg's shell, making the connection that they are a domed shape. Share with your scientist that eggs seem like very fragile things. We cradle them in cartons in the grocery store and can easily break one against the side of a bowl when cooking. However, an egg can be incredibly strong, too. Remind your young scientist that before an egg hatches, the parents must actually sit on the egg to keep it warm. Ask, if an egg is so fragile, why doesn't the parent bird break it?

In this activity, your young scientist will pit his or her own strength against an egg shell! Just in case this experiment gets messy, it is a good idea to perform this activity outside, or at least over the sink!

Have your scientist hold out his or her hand, palm up. Place a raw egg in your scientist's hand, and ask him or her to close their hand around it, keeping the thumb next to the fingers. (Do not wrap the thumb around the egg.) Ask your scientist to squeeze the egg and see if s/he can break it. This works best if the scientist is putting equal pressure around the egg. If your young scientist has small hands that will not wrap around the egg, try this variation. Have your scientist interlock their fingers to form a basket. Place

the egg in between the palms and ask your scientist to squeeze as hard as s/he can. If pressure is placed evenly around the egg, the eggshell will NOT break!

This is how the parent birds can sit on an egg without crushing it – the pressure of the bird's body is evenly distributed around the egg. If your scientist presses the egg in just one spot instead, the egg will break. This also explains how the baby bird is able to escape from the egg – the baby bird's beak places pressure in only one spot on the shell, which allows it to crack.

Ask your scientist to consider another animal that has a dome shape—a Box Turtle. Box Turtles are a type of turtle that can pull its legs and head into its shell and close it like a box when the turtle feels threatened. Besides simply protecting the head and legs because they are no longer exposed, can your scientist think of any other ways the shell might help to protect the turtle?

Arch Walk

Go for a walk in the area and have your scientist look for arches. These might be part of the architecture of buildings, or they might be in nature. For each arch your scientist finds, discuss why the object it is part of might need a strong structure. For example, if there is an arched doorway in a large building, talk about how there is a lot of weight on top of the arch but it needs to not collapse when people walk through.

Extension:

Have your scientist research some of the ways arches have been used in history. The Roman aqueducts are a great example of how arches can be used to support a lot of weight from water moving through an area.

Egg Drop Challenge

Now that your scientist knows a little more about how eggshells, arches, and domes work, s/he is ready for an egg challenge! Tell your scientist that the challenge is to create an invention that will keep an egg from breaking when dropped from a tall height.

Have your scientist gather materials that might be useful for the experiment. These can include repurposed materials such as bubble wrap, fabric scraps, straws, plastic bags, craft sticks, tape, etc. Almost any material could be used for this experiment! Ask your scientist to think about what might help protect their egg during the drop. Some things to think about might include: how to slow the contraption down before it hits the ground, what materials might help evenly distribute the pressure of the hit (refer back to the egg crushing activity), and how to keep the egg inside the contraption. You might encourage your scientist to test several ideas in different contraptions.

When your scientist has completed his or her invention(s), place an egg inside and start dropping! If the egg breaks, encourage your scientist to think about why it didn't work and make adjustments to try again.

If your scientist is younger (or you want a little less mess), try a variation of the egg drop challenge using resealable plastic bags. Place an egg inside an empty plastic bag and have your scientist drop it from a height. What happened to the egg? What could your scientist put inside the bag to help protect the egg? Some suggestions for material include: fabric or cotton balls, beans, rice, cereal, water, ice, etc. Have your

scientist make several different bags and predict whether the egg will break with each new material. Place an egg into each bag and drop it from the same height. Were the predictions correct?

Penny Bridge, Revisited

Your young scientist has had a chance to explore arches and domes in many different ways today. Offer him or her the pennies from the Penny Bridge activity and see how quickly your scientist can build a bridge now. He or she should be able to make an arch from the pennies, making a stable bridge!

Extension:

Have your scientist do research about the advantages and disadvantages of using arch bridges to cross roads or waterways. Does the research make your scientist want to redesign the wildlife crossing s/he developed in yesterday's Weekday Wonders?