WEEKDAY WONDERS

Content developed by the Tennessee Aquarium Education Department

TENNESSEE AQUARIUM

Wonders of Nature: Day 4

We live in a world filled with wonder! This week, young scientists invoke their innate sense of curiosity and wonder, as they explore our natural world by taking time to look up to the sky and down to the earth. They investigate natural phenomenon on a large scale, such as the phases of the moon, as well as on a more minute, less obvious scale, such as the resourceful way that plants can inhabit seemingly uninhabitable spaces and much more!

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

Have you ever wondered why insects' wings come in so many shapes?

Daily Nature Journal

Have your young scientist go outside and complete a nature journal entry. Use the Guide to Nature Journaling if you need help to know what your scientist should include.

Insect Wings

Have your young scientist go outside to look for insects. Ask your scientist to sketch quick pictures of each insect. Tell him or her to pay particular attention to the shape of the wings.

Your scientist may have trouble seeing the shape of the wings if the insect is flying. Feel free to help him or her find pictures of different insects to sketch after s/he has done some observation.

Ask your scientist why s/he thinks that different insects have different shapes of wings. Have him or her write ideas under the sketches.

Things That Fly

Ask your scientist to think about living things that fly. They should think of insects after the previous activity and will likely also think of birds. Have your scientist go outside and observe insects and birds. Ask him or her to practice moving like each of these living things.

Have your scientist pay careful attention to what is similar and what is different about the ways that birds and insects move. Have him or her tell you about the similarities and differences and how s/he moved to imitate each of them.

Model Flyers

One of the similarities between birds and insects is that they need *lift* to fly. While your young scientist may not have used that word, they may have said that they both went up in the air.

Tell your young scientist that s/he is going to model how birds achieve lift first. Help your young scientist to cut a piece of newspaper or light-weight notebook paper into a 3 inch by 11 inch strip. Have him/her hold the short end of the strip under his/her lower lip and blow straight ahead. The paper strip will flip up because the faster moving air above it pushes air away and reduces the air pressure above the paper. Share with your scientist that lift is what happens when air pressure below a thing is greater than the air pressure above it. This happens when air moves faster over the thing than underneath it. This is similar to the way a bird gets lift.

Now tell your scientist that insects use the motion of their wings to achieve lift in two ways. Instead of the rowing motion that birds use to move forward, insect move their wings down and forward and then up and backward in a flattened figure eight. To model this type of lift, your young scientist will need to flat objects with handles, such as rubber spatulas, ping pong paddles, or dinner knives to represent wings.

Have your young scientist hold his or her arms straight out with the objects in his or her hands. They should be parallel to the floor. Tell your scientist that the edges pointing forward are called the "leading edge" of the "wings." Ask your young scientist to tilt the leading edge down slightly and use it to make an upright, but thin (or flattened) figure eight. To do this, s/he should move the "wings" down and forward, then loop back to curve up and forward and complete the curve up and back. Once your young scientist gets the hang of this, he/she can roll the handle of the "wings" to keep the leading edge moving ahead of the rest of the "wing".

The changing angles of the leading edges of the wings provide lift. Also, because the tips of the wings are traveling faster than the bases of the wings, tiny vortexes like tornadoes form and move from base to tip, sucking air from the upper surface of the wing and providing even more lift.

Adults who would like a more complete explanation may enjoy reading the following article from *Discover Magazine*, https://www.discovermagazine.com/planet-earth/the-physics-of-insect-flight.

Wings at Home

Now that your young scientist has more understanding about how insects fly, have him or her go outside and watch for insects again. He or she should pay attention to whether the insects outside have wings, what shape the wings are, and how the wings move.

Also have your scientist observe if the wings might be doing other jobs for the insect. Remind your young scientist that just because an insect is not flying, does not mean that it doesn't have wings. Many insects prefer to walk or jump instead and only fly occasionally. Ask your scientist to write down other jobs s/he thinks wings might do for an insect.

Make Your Own Wings

In the last activity, your scientist had a chance to consider some of the different jobs that wings might have for insects. Tell your scientist that wings can range from thin, paper-like flaps, such as those that butterflies have, to tough, armor-like coverings on beetles. This means that they can do a range of jobs.

Write the following functions on small pieces of paper.

- Flying
- Body covering or armor
- Making sound or "music"
- Keeping heat in
- Communicating
- Orientation/Position in an area

Put all of the slips of paper in a small container. Tell your scientist that he is going to have a race to see how fast he can make an insect wing to do the different jobs. Have him or her draw one of the slips and read the function listed on it.

He or she should go as fast as possible and find something to use as a "wing" that serves that function. For example, if the slip reads "keeping heat in," your scientist might race to find a blanket and put it around his or her back. Have your scientist keep a list or tell you why s/he chose each item for each role.

Your scientist should choose another slip and race to find an item to make a "wing" that carries out that function. Again, have him or her explain why s/he chose the item.

As an extra challenge, you can make more than one slip of paper with each function to see if your scientist can find more than one item for each. You can have older scientists research what real insect wings that carry out each of the functions look like.

Team Wing

This activity takes two people on the team and an adult to help learn the moves. The adult on the team may need to kneel or sit in front of or behind the young scientist to achieve best results.

Explain to your young scientist that insects have two sets of wings—forewings and hindwings. The two teammates will work together to imitate the wing movement patterns of five common insects. The teammate in front is the forewings of the insect. The teammate in back is the hind wings of the insect.

Read each of the descriptions as you both get into position and make the movements as described.

BEETLE:

Forewings: Hold your arms out to the sides with hands slightly above your head. Don't move. Your arms are the beetle's hard forewings called elytra that protect its body when folded over the back.

Hindwings: Pretend to unfold your arms like a Transformer. Hold them out at your sides and as hard and fast as you can, use the figure eight movement described in Model Flyers above. You do all the work to fly this big, heavy body!

FLY:

Forewings: Hold your arms out to your sides and use the figure eight movement described in Model Flyers above. See if you can get up to the fly's 200 beats per second!

Hindwings: You're not really wings at all but vestigial wings called halteres. They are shaped like drum mallets so put the heels of your hands on your hips, hold your pointer fingers straight out, and point them in different directions at the same time. You act like a gyroscope to enable the fly to do aerial acrobatics like landing upside down on the ceiling.

BUTTERFLY:

Forewings: Hold your arms out to your sides and slowly and gracefully make the figure eight movement described in Model Flyers above.

Hindwings: Hold your arms out to your side and make exactly the same movements as the forewings, just a fraction of a second behind.

MOTH:

Forewings and Hindwings: Repeat the butterfly movement, but link your hands together by both holding on to opposite ends of something flexible like bandanas, socks, or yarn. Moth wings are connected by a locking mechanism.

DRAGONFLY (hovering):

Forewings: Hold your arms out to your sides and use the figure eight movement described in Model Flyers above.

Hindwings: You will make the same motion that forewings makes, but while he/she is describing the top loop of the figure eight, you'll be describing the bottom loop and vice versa. This is the hardest one of the

Team Wing activities, but take some time and you'll get the hang of it. If forewings and hindwings stand very close together and do this properly it is spectacular!