Natural Philosophy

Cycle 4: Life Science

	WE ARE FEARFULLY & WONDERFULLY MADE	supplemental materials
Week 7	**Retinal Blood Vessels**	"Retinal Blood Vessels—Hiding in Plain Sight"
Week 8	**Stereoscopic Vision**	"Stereoscopic Vision—Seeing Double"
Week 9	**Make a Rubber Chicken Leg**	"Make a Rubber Chicken Leg"
Week 10	**Hand It To You**	"Hand It To You"
Week 11	**Your Legs Are on Backwards (& check rubber bones)**	"Your Legs Are On Backwards"
Week 12	**The Human Brain**	"Your Nimble Noggin"

	LIFE SCIENCE	supplemental materials
Week 19	**Grow An Herb Garden (& check sponge fossil)**	"Grow an Herb Garden"
Week 20	**Fossil Formation & Solid Sponge**	"Fast-Formed Fossils" & "Solid Sponge"
Week 21	**Blubber**	"Blubber Gloves"
Week 22	**Tree Bark Rubbings**	"Make a Tree Bark Rubbing"
Week 23	**God's Wonderful Design for Trees**	"Why Not A Square Tree?" & "Space-Age Leaves"
Week 24	**God's Wonderful Design for Eggshells**	"God's Spaceships" & "Walking on Eggshells"

Experiment

RETINAL BLOOD VESSELS— HIDING IN PLAIN SIGHT

by David Menton

The retinas of your eyes are made of living cells, which must be nourished by blood vessels. But with all this blood covering your eyes, how can you see?

We might think of the eye as God's camera. If we compare the eyeball to a camera, the retina of the eye would correspond to the photographic film (or the light-sensitive CCD in a digital camera). But unlike film or a CCD, the retina is a living sheet of brain cells and fibers, about the thickness of a sheet of paper.

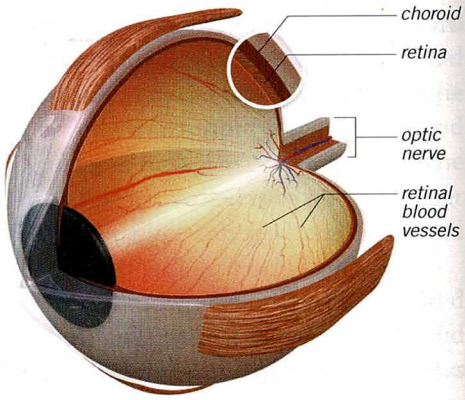
Since living cells need constant nourishment, the retina is supplied by a "sandwich" of blood vessels covering both its front and back surfaces (*Figure 1*). About 90–95% of the blood supply flows through choroid vessels behind the retina, outside of view, but about 5–10% of the blood supply flows through the retinal vessels in front of the retina (toward the lens and incoming light).

I'M NOT LOOKING AT YOU! Everywhere we look, we must look through this network of blood vessels on the front of our retinas. Why then do we not notice these vessels in our field of view?

A photo of a healthy retina (left) showing the distribution of retinal veins and arteries.

FIGURE 1

Blood vessels cover both the front and back surfaces of the retina.



Research studies show that we perceive images only if they move on the surface of our retinas. A fixed image on the retina slowly disappears from the brain's perception. As a result, we do not notice our retinal vessels because they are fixed to the surface of the retina and our brain simply ignores them.

SO HOW DO WE SEE ALL THE NONMOVING THINGS AROUND US? If our brain is designed to ignore images that aren't moving on our retinas, why can we see motionless objects in front of us, like a building? The reason is that the muscles of our eyes make small, rapid, involuntary movements so that everything in our visual field is in constant motion. These slight movements are unnoticeable but help the brain retain the image of any nonmoving objects. The retinal blood vessels, of course, move with the eyeball and retina, so their image or shadow remains fixed and thus not noticed. ■

Dr. David Menton *holds his PhD in cell biology from Brown University and is a well-respected author and teacher. He is professor emeritus at the Washington University School of Medicine in St. Louis. Dr. Menton has many published works and is one of the most popular speakers for Answers in Genesis–USA.*

See for yourself . . .

It is actually possible to see our own retinal blood vessels if we can make their shadow move on our retinas. You can do this in your own home, using basic materials.

MATERIALS

Stiff business card
Paper punch
Brightly illuminated white surface

PROCEDURE

Use a paper punch to punch a small hole near the end of a business card.

Hold the card close to one eye and look through the hole (close the other eye).

Now rapidly move the card left and right about an inch while looking through the moving hole at a brightly illuminated white surface, such as a plain white computer screen or even a brightly illuminated white wall.

If all is done correctly, you should notice silver/grey shadowy lines on the white surface. This is the pattern of your own retinal blood vessels!

This simple activity works because the light shining through the hole in the card acts as a rapidly shifting light source. The moving light casts a moving shadow on the retinal vessels, just enough to make them visible.

Alternative Way to See Your Blood Vessels

There is another easy way to see the tiny blood vessels that cover your retina.

MATERIALS

Flashlight

PROCEDURE

Sit in a dark room.

Cover one eye with your hand.

Shine the flashlight in the outside corner of the open eye while you look at a blank wall.

Jiggle the light rapidly (about twenty seconds) until you see a pattern of lines on the wall.

You are seeing the same blood vessels that your eye doctor examines when he peers into your eyes with a special flashlight (called an ophthalmoscope). He is looking for signs of eye diseases and conditions affecting blood vessels.

Natural Philosophy

Retinal Blood Vessels

Cycle 4, Week 7

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

   - "Retinal Blood Vessels—Hiding in Plain Sight", from *Answers Magazine*, Vol. 10, No. 2, Apr–June, 2015 (38–39)
   - White paper
   - Paper punch
   - TV set to white screen (I used laptop connection, searched online for "white screen", displayed that on TV)

2. Prep:

   - *Must have a big TV screen, displaying a white screen (clear, no fuzz or image at all) for first procedure (and ideally the room should be darkened, too). This works really well.*
   - *Or for 2nd procedure, must have a* ***very*** *dark room, a blank white wall, and a flashlight. (I've never tried this method.)*
   - Note: Instead of a business card, a white sheet of paper with a hole punched in the middle is what Dr. Menton suggests in a talk that he gives, so we've always done it that way.
   - Be sure and test this out for yourself before class!!!! At first, you're going to say, "I don't see anything;" just keep looking. You *don't* want to be trying to figure it out while all of the students are watching you. ☺

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

Natural Philosophy

1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics, or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Article/Demonstration

1. Read "Retinal Blood Vessels—Hiding in Plain Sight", by David Menton; perform demonstration as described.

Experiment

STEREOSCOPIC VISION—SEEING DOUBLE

by John UpChurch

Two eyes are better than one. There's more truth to that saying than you might realize.

One-eyed, humanlike creatures have been the subject of fantasy for centuries—from epic tales of the hulking Cyclops to the comic exploits of Mike Wazowski in *Monsters, Inc.* But life with only one peeper wouldn't be nearly as fun or menacing as these tall tales make out. In fact, you could say living that way would be quite flat.

You see, Solomon had it right when he said, "Truly the light is sweet, and it is pleasant for the eyes [both of them] to behold the sun" (Ecclesiastes 11:7). God spaced two near-spheres "just so" on your face to do more than squinch up when you smile or refuse to stay closed the night before a big trip. Open them both wide, and you've got one ocular sensation in a stunning, stereoscopic 3D that puts Hollywood's biggest efforts to shame.

Unlike most animals, we humans have our eyes placed up front and near the center of our flat faces. That's not just so we can see our noses when we cross them up. Rather, each of your eyes captures a different image of the scene in front of you. The images then zap to the back of your brain at exactly the same time. Before you can blink, your brain processes the two images by lining up the similarities and taking into account what's different. And what a difference those differences make.

Instead of mashing the information from our left eye and right eye into a flat panorama, our brains use the slightly differing views to give us depth perception. In other words, we know—in a general way—how close or far something is from us. To see this in action, put your hand way out in front of your face and then move it closer.

Your brain takes that two-eyed view and does some geometry for you in what's known as triangulation (try-an-gyu-LAY-shun), or measuring distances by using angles. (Bet you didn't know you do geometry every day.)

In addition to computing those angles, your brain measures shadows (what gets shaded by other objects), clarity (how clear the object is), and size differences (how big you know something is vs. how big it seems). It also relies on other visual cues to construct a view of the world that's pretty eye popping.

Humans have an embarrassment of riches when it comes to this stereoscopic vision. (*Stereo* means that two things are working in tandem.) We can take in around 120° of 3D splendor, which is one-third of an entire circle. (Our field of view is actually about 190° total, but we see 3D only in the overlapping regions.). Such a broad swath of two-eyed vision is perfect for catching baseballs, threading needles, and dodging a low-lying tree limb. Some animals with eyes on the sides of their heads, such as buffaloes, have a wider field of vision, but you also wouldn't want them driving a car. For that, you

See for yourself . . .

TRY IT RIGHT NOW. Look at the photos on the opposite page. To see a stereo image, you need to cross your eyes (that's the opposite of how it works normally, but it's easier to do). Stare at the photos and cross your eyes until one photo overlaps the other. Three images will appear. When you see them, focus on the middle one, and it will appear to have depth.

OTHER ACTIVITIES AT HOME. Testing out your stereoscopic vision doesn't require an elaborate setup. All you need are your peepers and a few things around the house. But you will need to make sure you and your parents see eye to eye before getting started.

MATERIALS

Your eyes

An eye patch (if you have trouble keeping one eye closed—plus, it's just fun)

A sewing needle (or two if you have a small one and a big one)

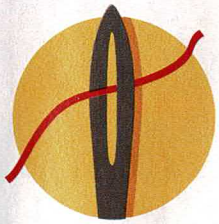
Some thread

A pitcher of water

A glass or cylinder that can hold water and stand up (the narrower, the better)

A towel (in case of spills)

A key that fits the lock on a door in your house



PROCEDURE

One-Eyed Needles

First, take your thread and prepare it for pushing through the sewing needle (or needles).

Close one of your eyes and then try to thread the needle.

If you have a larger needle, repeat the process with that one.

Now, try threading the needle with both eyes open.

Did you notice any differences?

Dangerous Waters

Take out your pitcher of water and place it by the sink.

Place your cup or cylinder in the kitchen sink.

Close one of your eyes.

Pick up your pitcher and try pouring the water into the glass.

Open both your eyes and try it again.

Locked on Target

Take the key to the door where it fits the lock.

Close one eye.

Unlock the door . . . if you can.

Open both eyes and try again.

need a human point of view.

However, not every person has full stereoscopic vision, even if they have two otherwise healthy eyes. Some people (like the author) have a condition known as amblyopia (am-blee-OH-pee-uh) or "lazy eye." In about 3% of children, the brain doesn't process images properly for one eye, which keeps the person from developing their full visual ability. Over time, one eye becomes dominant, and the other gets blurry. If it's not treated, this imbalance can hinder depth perception. (That's one reason you should get your eyes checked regularly.)

For most of us, though, because our brains are so good at 3D, we can even trick ourselves. Visual illusions that use colorful dots can create the impression of depth when you gaze intently at them. Stare at them long enough, and your brain combines the dots from the left eye with the splotches from the right eye to form the illusion of depth.

Filmmakers take advantage of the eye-brain partnership when they produce 3D movies. First they film each scene from two different angles (or use a computer to generate another version in post-production). Then, special projectors show both versions of the scene at the same time. When we wear those special 3D glasses, our brains combine the two versions into a single image.

Any way you look at it, God's gift of two eyes working in unison is truly an optic masterpiece. Sorry, Cyclops and Mike Wazowski, but we need stereoscopic vision if we're to truly experience the world in all its depth. ■

John UpChurch *serves as the editor for Jesus.org and is a contributor to the Answers in Genesis website. He graduated summa cum laude from the University of Tennessee with a BA in English.*

SUBSCRIBER EXCLUSIVE** . . . View a slideshow of stereo images taken at the Creation Museum at **www.answersmagazine.com/go/9-3-exclusives

Natural Philosophy

Stereoscopic Vision

Cycle 4, Week 8

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

    - "Stereoscopic Vision—Seeing Double", from *Answers Magazine*, July–Sept., 2014 (52–53)
    - Print a copy of p. 52, high-res, for each student
    - Small sewing needle
    - Large sewing needle
    - Thread
    - Pitcher of water
    - Narrow, tall glass for water (or a water bottle!)
    - 9x13" pyrex (to function as the "sink" for spillage!)
    - Key to the classroom that you are in

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

    1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics,

or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

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2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Article/Demonstration

1. Read "Stereoscopic Vision—Seeing Double", by John UpChurch.

2. Demonstrate having students hold a finger in front of them.

    a. Look at your finger, then close one eye. Did your finger "jump"?

    b. Look at it again, and try closing the other eye. Did you see it "jump" this time?

    c. Now look at it with one eye; then, switch eyes (close the eye that was open, and open the other one). Switch eyes again. Do you see your finger "jump", as you switch eyes??

3. Perform demonstrations in article, as described.

MAKE A RUBBER CHICKEN LEG

Bones are some of your best friends. They hold you up and help you climb and run and jump. But why are they so strong? Well, the simple answer is minerals.

You know how your parents always tell you to drink your milk? Well, they know milk is a good source of calcium, a mineral that adds strength to bones.

If your bones were only made of minerals, like calcium, they would be hard but also brittle, which means they might easily break when you fall off your bike or trip over a toy. So God included another ingredient—collagen—to make your bones give a little. Collagen is made of flexible fibers to help your bones bend without shattering.

We can thank God for designing our bones with both hard minerals and flexible collagen so we can explore his world without easily falling apart.

Materials

- chicken drumstick with no meat
- small jar with lid
- vinegar

Hello there! I'm Buddy Davis, the host of *Out and About* on Answers.tv. Let's get our hands a little dirty as we investigate God's amazing creation.

Experiment

Imagine if we didn't have any minerals in our bones. We couldn't clap our hands or hit a baseball. We would be all wobbly. But, hey, we don't have to imagine it. Let's experiment to see what bones would be like without one of those important minerals—calcium.

1. The next time you eat fried chicken, clean all the meat off the drumstick and save the bone.
2. Next, place the bone in a small jar and ask an adult to pour in enough vinegar to completely cover the bone.
3. Twist the lid on the jar, and let it sit for two weeks. Be patient. It'll be worth it.
4. In two weeks, when you pull it out, the bone will be flexible enough to tie into a knot.

What was the trick? Well, you know how your mouth puckers and your eyes water when you taste or smell vinegar? That's because vinegar is an acid, and it's powerful enough to dissolve the calcium in the chicken bone, leaving the flexible collagen.

MAKE A RUBBER CHICKEN LEG

Cycle 4, Week 9

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

   - "Make a Rubber Chicken Leg", from *Answers Magazine*, Oct.–Dec., 2020 (*Kids Answers* 5)
   - Small jar with lid (large enough jar for all of the students' leg bones to fit in, or more than one jar)
   - Optional: "Flood Model Solves Antarctica Rainforest Mystery" article (from Geography, Week 17).

2. Supplies Captain will bring:

   - Chicken drumstick with no meat (ideally, one for each student!)
   - Vinegar

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

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Article/Demonstration

1. Read "Make a Rubber Chicken Leg", by Buddy Davis; perform demonstration as described.

    a. Ask students: Can you find any bones on your body?

        i. Arm bones—fun to learn how ulna and radius work, and also fun to see how our very special shoulder joint works!
        ii. Leg bones
        iii. Collar bone is really fun because they can pretty much put their fingers all the way around it
        iv. Finger bones—three in each finger, plus the fourth inside the hand!
        v. Toe bones
        vi. Leg bones
        vii. Etc.

    b. What would you be like without bones? (A puddle!)

    c. What makes your bones strong? (Earlier in the year, we learned about how holes in our bones, in arch shapes, give our bones great strength; and now we'll learn about minerals, which give our bones strength.)

2. This is a really short demonstration; I used the extra time to read and discuss the ICR Antarctica article to the students, "Flood Model Solves Antarctica Rainforest Mystery".

HAND IT TO YOU

August 24, 2015, answersingenesis.org/kids/science/science-experiments/hand-it-to-you/

Supplies

- Piece of paper, 1 per child
- Writing utensil, 1 per child
- Craft sticks, 5 per child
- Tape
- Small items to pick up (e.g., paper clips, rice, beads, beans, pencils)
- Paper bag with items of various textures inside, 1 for every 5 children
- Design Card—Hand

Class Time Directions

Our hands are absolutely amazing creations of God! Did you know that our thumbs, which are opposable—able to move freely—work with our fingers so we can do more complicated things than animals can? Try to guess how many bones work together in your hand. **Take responses.** You have 27 bones in your hands, all working together so you can bend your fingers to do things!

Give the children a piece of paper and a pencil. Ask them to lightly hold the pencil in one hand. Have them write their name (or draw a picture) on the top of the paper. Remind them how intricate the design of the hand is to perform this task—the muscles need to get signals from the brain about what to write and then need to move the bones in the hand to do the writing in small and large ways, moving different directions.

Then have the children hold their other hand flat against the sheet of paper and trace the outline of that hand. Tell them that apes cannot hold their hands flat, only humans can! Ape hands are hooked for gripping branches. But a flat hand has many uses—for sign language, for rubbing a back, for smoothing things out, etc.

Also, only human hands have the ability for the pinky and ring fingers to grasp with the thumb. To demonstrate, have each child hold up their piece of paper. Then ask them to grasp it between their thumb and index finger. Note that both humans and apes can do the same. Then ask each child to grasp the paper between the thumb and little finger. Only a human can do that. An ape cannot.

Our fingers are amazingly able to bend and move. **Let kids wiggle their fingers and hands.** Let's see what happens if we don't have fingers that bend.

Give each child five craft sticks and tape. Have them tape one stick on each finger so that each finger can't bend. Try to pick up various small items with the unbending hands. Discuss their findings.

Most animals' hands don't bend. What kind of things could we not do if our fingers and thumbs didn't bend?

Take responses: we couldn't pick things up, write, text, play baseball, tie our shoes, eat with our hands—we couldn't do anything that requires our fingers to bend.

Our hands also feel in amazing ways. There are about 5,000 touch receptors on each finger, making our fingers very sensitive. Touch receptors send information to our brain that allows us to feel many different textures, such as the softness of a blanket, the smoothness of a baby's skin, or the roughness of tree bark. There are also receptors that help us sense vibration, pressure, temperature, and pain. These receptors are important for telling us about our world and keeping us safe in a fallen/cursed world. For example, this helps us know when something is very hot so we can pull our hand away from it and not be injured.

Have trekkers remove craft sticks and then reach into the bags without looking and guess what the items are.

We use our hands to work, and God gave us amazing hands; different hands than the hands animals have. **Read *Proverbs 13:6*.** We need to make sure that whatever our hands are doing, they are working for the Lord. How can our hands do that? **Take responses and give examples. In everything we do (e.g., homework, chores, playing with friends), we need to have wise hands that honor the Lord. Pass out the Design Card—Hand, one for each child.**

Natural Philosophy

Your Amazing Hands

Cycle 4, Week 10

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

    - "Hand It to You", from answersingenesis.org/kids/science-experiments/hand-it-to-you (August 24, 2015).
    - Paper
    - Pencils
    - Tape
    - Craft sticks (in the cabinet)
    - Paper bag with items of various textures inside

2. Supplies Captain will bring:

    - Small items to pick up—paper clips, rice, beads, beans, pencils
    - (Note: the "Design Card—Hand" in the article is a VBS handout; we don't have it; we don't need it ☺)

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

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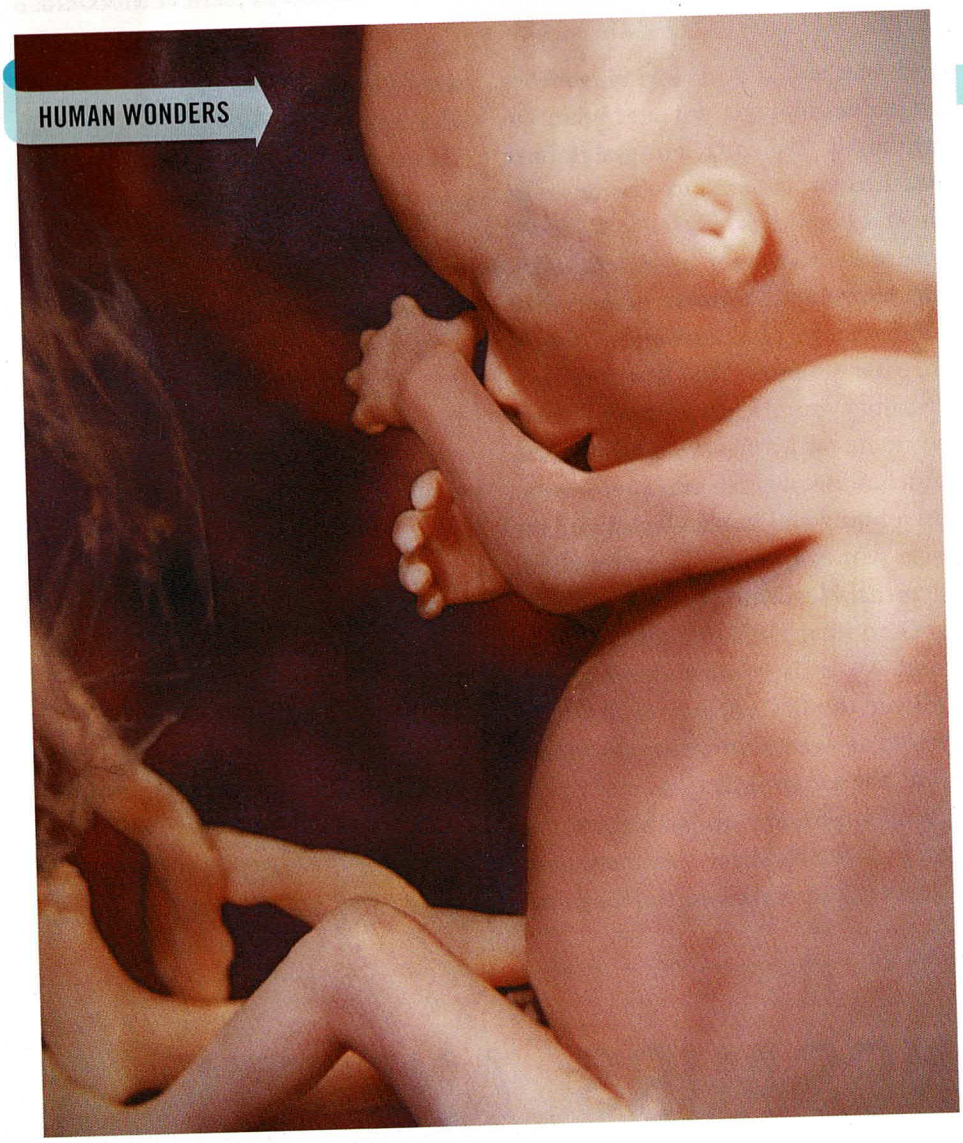
Article/Demonstration

1. Read "Hand It to You; perform demonstrations as described.



Your Legs Are on Backwards

by David N. Menton

No, you didn't read that wrong! When your legs and arms first appeared in the womb, they bent in the same direction. But as you developed, your legs and arms rotated in opposite directions. Is that crazy, or what?

YOU MIGHT BE surprised to discover that your legs are on backwards compared to your arms. (A simple experiment on the next page will show you this.) If you stand up straight with your palms facing forward, your forearms will bend forward at the elbow, but your lower legs will bend backward at the knee.

We can thank our Creator, however, for His wisdom in making us this way. If our arms flexed backward like our legs, it would be difficult to see our hands working behind our backs. On the other hand, if our legs flexed in the opposite direction, it would be difficult to walk forward.

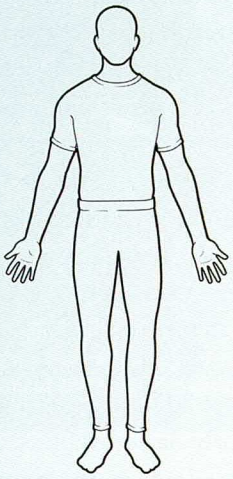
God gave His creatures a variety of designs to suit His purposes. Bats' legs, for example, are not completely rotated. As a result, the bat can't walk on the ground, but its legs are perfectly designed for flying and hanging upside down in caves.

The crucial rotation in our legs and arms occurs while we are developing in our mother's womb. At first our arms and legs are bent in the same direction, but as we develop, our arms rotate 90 degrees in one direction, while our legs rotate 90 degrees in the opposite direction. This results in our arms and legs facing in opposite directions.

So the next time you want to use your hands or feet, remember that God designed them for a purpose and He wants you to use them for His honor and glory. For example, you can bend your knees, fold your hands in prayer, and thank Him for Jesus who saved you from sin and death. ■

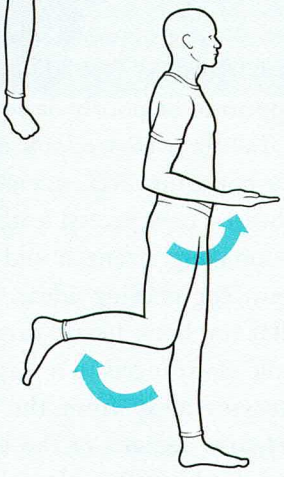
Dr. David Menton *holds his PhD in cell biology from Brown University and is a well-respected author and teacher. He is Professor Emeritus at the Washington University School of Medicine in St. Louis. Dr. Menton has many published works and is one of the most popular speakers for Answers in Genesis and the Creation Museum.*

see for yourself . . .



STEP ONE

To do this experiment you need to grab some adhesive tape. It is also best to wear a tight-fitting jogging suit, leotards, or underwear with long legs. Then you must stand in the "anatomical position." Stand up straight with your feet together and with your arms at your sides and the palms of your hands facing the front. In this position, your arms and legs have a front surface and a back surface.

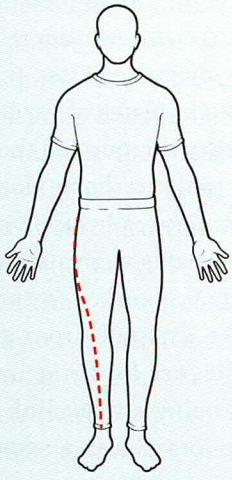


STEP TWO

Now stand on one leg and flex (bend) your arm and knee on the other side of your body. Notice that when you flex your arm at the elbow your hand comes forward, but when you flex your leg at the knee, your foot goes backward.

STEP THREE

If you are limber, you should have no trouble assuming the same position you were in when you were in your mother's womb. To do this, sit on the floor and flex your legs with your knees spread out and the soles of your feet pressed together. Now flex your arms so your elbows spread out, and press your palms together. To observe how your legs rotate, apply a long strip of adhesive tape to the outermost border of your leg (or legs), going all the way from hip to foot.



STEP FOUR

Now stand up in the anatomical position, and you will observe that the tape spirals down your leg, revealing a 90-degree rotation. (While standing, you can demonstrate how your arms rotated 90 degrees in a direction opposite your legs. Place the palms of your hands together with elbows out, just as in the fetal position. Now slowly bring your arms down to the anatomical position. Note that the hands have rotated 90 degrees in a direction opposite the rotation of the legs.)

Natural Philosophy

Your Legs Are on Backwards

Cycle 4, Week 11

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

   - "Your Legs Are on Backwards", from *Answers Magazine*, Apr–June, 2010 (34–35)
   - Rubber chicken legs from 2 weeks ago? (Ours needed to wait more weeks.)

2. Supplies Captain will bring:

   - Painter's tape

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

   1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics, or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

Natural Philosophy

The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

First

1. Check rubber chicken bones from two weeks ago!

Article/Demonstration

1. Read "Your Legs Are on Backwards", by David Menton; perform demonstration as described.

EXPERIMENT

Bacteria in Your Home

FROM *UNLOCKING SCIENCE* WITH ROGER PATTERSON

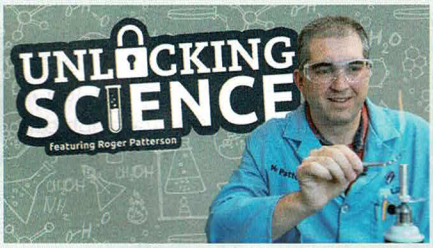
Bacteria are everywhere—in air, water, soil, plants, animals, and even inside you! Bacteria are a type of microbe. In 1676 Anton van Leeuwenhoek, a Dutch businessman and scientist, first observed and described bacteria using a microscope. He called the organisms he saw *animalcules*, meaning "little animals."

Though the Bible doesn't mention bacteria, we know God created them most likely on days three, five, and six because they are living organisms. When land was created on day three, free-living bacteria in the soil were likely created along with bacteria for symbiotic (mutually helpful) relationships with plants. Bacteria for symbiotic relationships with swimming and flying creatures were probably created on day five, and bacteria for symbiotic relationships with land animals and humans most likely were brought into existence on day six. It's also possible that free-living bacteria associated with air and water were created on day two. However, bacteria usually serve as connections between the physical and biological world, so their creation on day two is unlikely since no living things were yet created.

You can't see bacteria without a microscope—but you can see a colony of bacteria. When hundreds of thousands or millions of individual bacteria grow together, they form colonies, that look like little dots and might be different colors.

Though most are beneficial or harmless, some bacteria can cause disease. That's why companies have developed antibacterial cleaners claiming to kill bacteria. But what if you put those claims to the test on bacteria around your house?

If you don't have petri dishes or fancy lab gear, don't worry. You can perform this experiment in your kitchen. Just be sure not to take a nibble along the way! ■

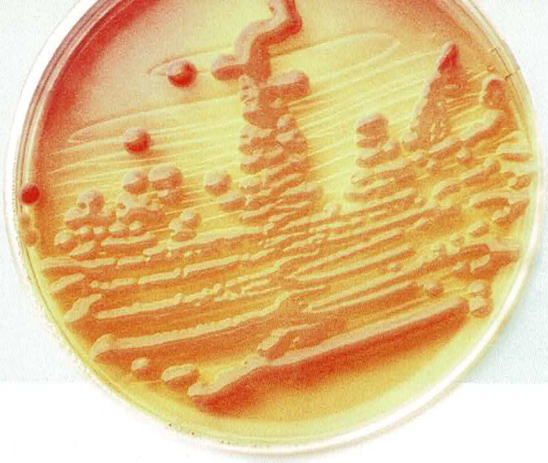


Roger Patterson helps kids understand science from a biblical perspective through experiments and hands-on activities in his Answers.tv show *Unlocking Science*.

MATERIALS NEEDED

- Plain or unflavored gelatin powder
- Sugar
- Beef bouillon cubes or granules
- Muffin pan and foil muffin cup liners
- Toothpicks
- Permanent marker
- Cotton swabs
- Zipper bags (sandwich size)

Answers.tv | Watch *Unlocking Science* "Hands On: Culturing Bacteria at Home" on Answers.tv for a demonstration of this experiment.



STEP ONE—

PREPARE TO GROW THE BACTERIA

1. In a saucepan, mix 4 envelopes of gelatin with 4 cups of cold water, 8 teaspoons of sugar, and 4 bouillon cubes (or 4 teaspoons of bouillon granules).
2. Bring slowly to a boil, stirring constantly.
3. Cool slightly and fill muffin cup liners (in muffin pans) about ⅓–½ full with the hot gelatin.
4. Cool until gelatin is solid. Do not touch the surface of the gelatin and do not eat it.
5. Place the filled liners in zipper bags and store them in the refrigerator until you're ready to use them. Be sure to use them within 2 to 3 days.

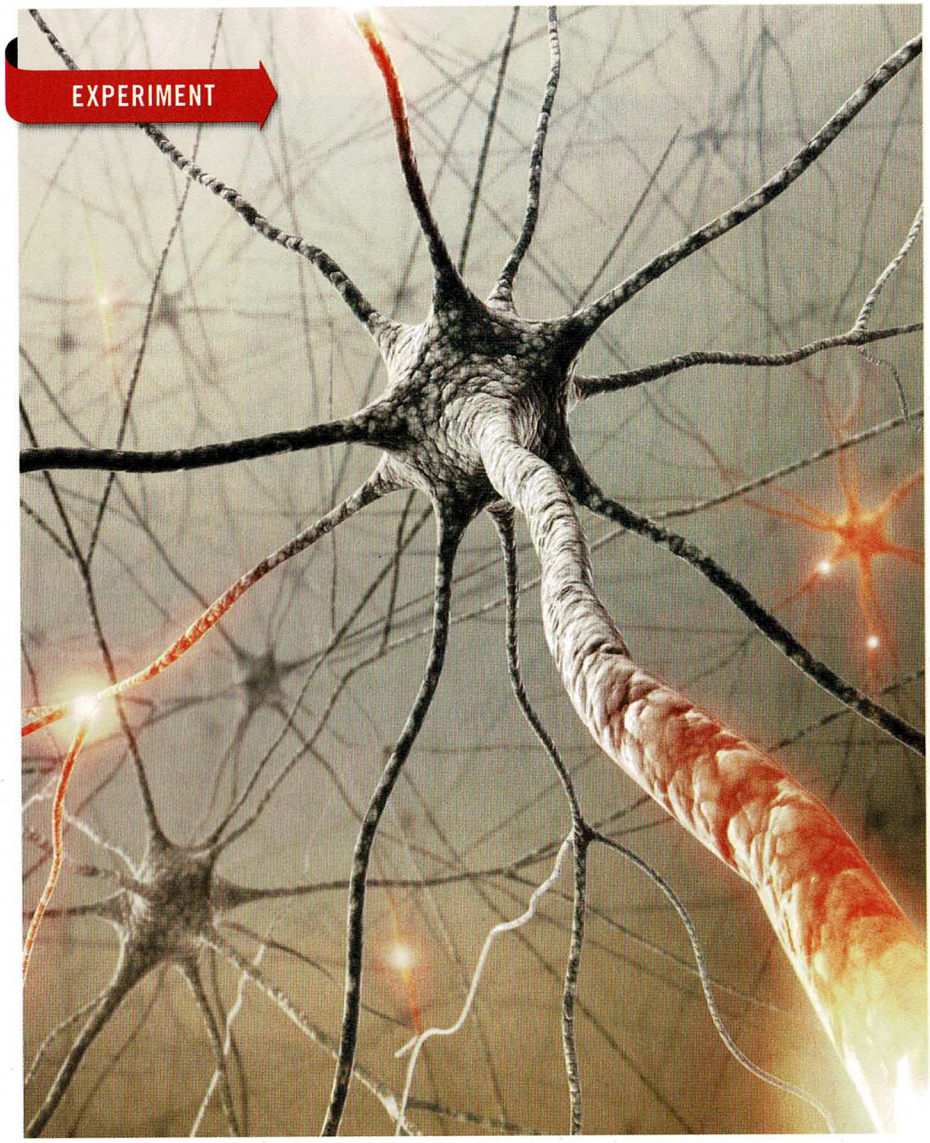
STEP TWO—

SAMPLE THE SURFACES

1. Wash your hands thoroughly.
2. Without touching the gelatin with your hand, use a toothpick to draw four lines, dividing each gelatin cup into 4 sections. Each section will represent one of the household locations you sample for bacteria.
3. On the bottom side of the muffin liners, label each of the 4 sections with a sampling location, such as "kitchen doorknob" and "bathroom sink." (You'll need to create duplicates of each gelatin cup because you'll sample each area again after cleaning the area. Note whether the sections represent the sampling location before or after you've cleaned.) Be sure to leave one section of a gelatin cup clean to use as a control to compare with the contaminated gelatin cups.
4. For each sampling location, swab a surface in your home that might be frequently handled (for example, stair rails, counters, or the refrigerator door). Then swab gently across the surface of one gelatin section that you've marked to correspond with the location.
5. Place each muffin liner with gelatin in its own plastic zipper bag but leave a small section unzipped to let in air.
6. Clean each sampling location with an antibacterial household cleaner. Wait 15 minutes. Re-swab sampling location (as done in Step 4) onto the second batch of gelatin cups corresponding to the locations. Place all the specimens in a warm location (such as the top of the fridge).
7. Count and record the bacteria colonies at 24, 48, and 72 hours. Compare the samplings from before and after the location was cleaned. Do not remove muffin liner from bag and do not touch the gelatin.
8. Dispose of the bags and gelatin in muffin liners when the experiment is complete.

What did you see?

Did you find fewer bacteria colonies after cleaning the surfaces? We can be thankful that God gave us the ingenuity to create products that help protect us against harmful bacteria.



EXPERIMENT

Your Nimble Noggin

by John UpChurch

Would you rather have a computer or a brain in an emergency? Knock a robot off its legs, and you decide! Our brains are designed to process millions of bits of complex information, day in and day out, including split-second decisions to avoid an accident.

LET'S HIT THE SLOW motion button on a memorable moment in your life. Imagine the last time you almost fell on a slick floor. While your body movements may not have won an Oscar for special effects (no impossible backflips in cyberspace), something more amazing did happen. Your brain kept operating the seemingly impossible way our wise Creator designed it to perform every day.

Take a closer look at that near-fall—just before you sighed in relief from a crisis averted. In a millisecond, your body sent an SOS to your brain that it had lost balance, your feet shouted that they were sliding, your eyes scoured the room for something to grab, and then your hand responded to the signal zipping down from the brain. In fact, it probably took you longer to read that sentence than it did for your brain to avoid that tailbone-biter.

In other words, that wrinkly gray tissue in your head is fast. Super fast.

Unlike computer technology, which people often tout for speed, the quickness of the brain leaves silicon in the dust. Computers accept a string of human commands and spit out results, but your brain deals deftly with millions of signals from all five senses every second, making innumerable conscious and unconscious decisions at the same time.

The brain processes the morning light coming into your eyes, family members' excited voices hitting your eardrums, the sticky sensations on your fingers, the sweet flavor on your taste buds, and the pleasant cinnamon smell filling your nose. And that's just in a single moment at the table, eating breakfast rolls.

But there's more to your noggin than noshing on breakfast. Your brain knows how to respond quickly. When your senses say something needs to happen fast, your brain responds. You could say it zaps into action.

YOUR NIMBLE NOODLE NETWORK. Of everything God made in the universe, the human brain is easily one of the most impressive. Inside your head are around

see for yourself...

You'll need to think fast for this experiment, and you'll need a friend to help.

MATERIALS

A ruler, a pencil, and a piece of paper to keep track of your results

PROCEDURE

Have your friend hold the ruler vertically so that the zero end points down toward the floor.

Put your hand in a C shape around the bottom of the ruler. Get as close to it as you can without touching. This will allow you to catch the ruler when it falls.

Ask your friend to count from one to ten. At some point during the counting, he or she will drop the ruler.

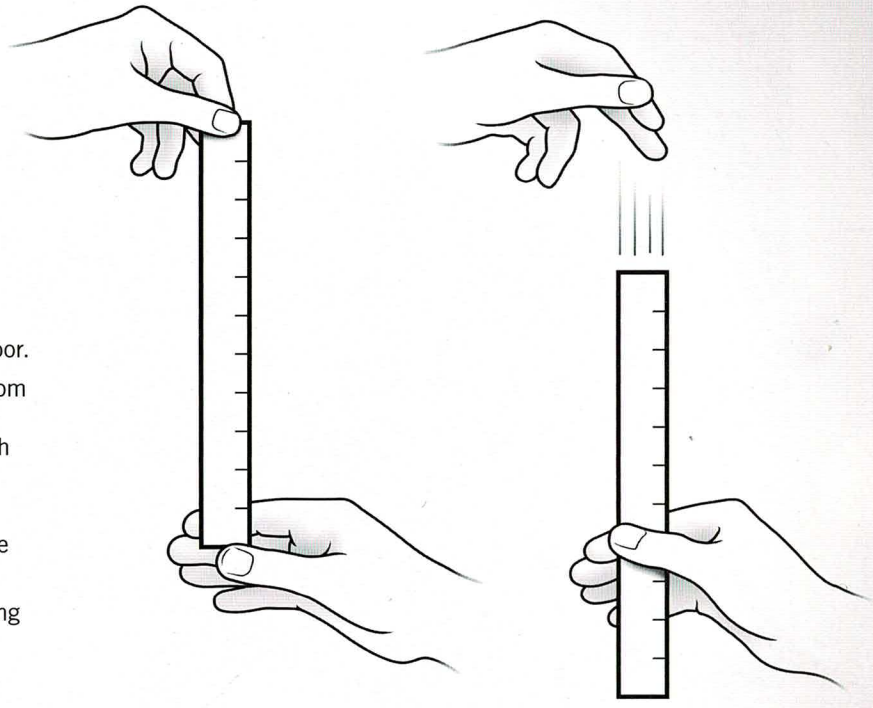
Catch the ruler as fast as you can by pinching your fingers shut.

Write down the point where your fingers pinched the ruler.

Repeat the process several times.

CALCULATE THE RESULTS

Every 2 inches on the ruler comes out to around 100 milliseconds (0.1 seconds). So, if you caught the ruler after 6 inches (15 cm), your reaction time would be about 300 milliseconds (0.3 seconds).



TRY THIS: *Try catching the ruler with the hand you don't write with. In other words, if you're left-handed, use your right hand to catch. Are your times different with that hand?*

Turn on a TV or radio in the same room that you're trying the experiment. How did it impact your reaction time?

Get a group of friends or family members to do the experiment. Plot the times on a graph. Does age make any difference? Do women do better than men?

Ask your friend to tell you ahead of time when the ruler will drop. Were you able to snatch the ruler faster?

100 billion microscopic cells called neurons. These neurons constantly "talk" to each other using chemical and electrical sparks that travel down a chain from one cell to the next, similar to children whispering down a line in a telephone game. Unlike children talking, however, your neural communication never stops. Your brain is always on and working, whether you are conscious of the chatter or not.

The signals make a great car race impersonation. When the message zooms from your foot up the spinal cord to your noggin, the information travels around 150 miles per hour (241 km/h). Not to be outdone, the message leaving your hand speeds along at more than 200 miles per hour (322 km/h).

All that racing around over short distances adds up quickly. It means you react fast. In most cases, a healthy brain can process what the five senses tell it and respond in 100–300 milliseconds. And if you encounter something really dangerous, like a hot stove, the signal doesn't even have to go all the way to the brain—its extensions into the spinal cord can make some decisions automatically.

Think about it: you can react to danger in less than half a second. (While there's no danger involved, you can test this brain speed in the experiment above.)

So, the next time your neurons sizzle to keep you from danger, push the stop button (on your body, that is) and think about your amazing three-pound cerebrum. We humans are pretty clever designers, but nothing we make compares to the ingenuity God wired into our brains. To see His marvelous work, we just have to use our heads. ■

John UpChurch *serves as the editor for Jesus.org and is a contributor to the Answers in Genesis website. He graduated summa cum laude from the University of Tennessee with a BA in English.*

Natural Philosophy

The Human Brain

Cycle 4, Week 12

Key Verses:

The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

I will praise thee, for I am fearfully and wondrously made: marvelous are thy works, and my soul knoweth it well.
Psalm 139:14

Getting Ready

1. Bring:

    - "Your Nimble Noggin", from *Answers Magazine*, July–Sept., 2013 (30–31)
    - Pencil
    - Piece of paper
    - Rulers (ideally, one for every 2 students; we have a few in supplies cabinet)
    - "Bacteria in Your Home", from *Answers Magazine*, October–December, 2020 (One for each family.)

To Start

1. Recite Key Verses.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

    1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics, or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

    The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

Natural Philosophy

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Article/Demonstration

1. Read "Your Nimble Noggin", by John UpChurch; perform demonstration as described.

Extra

1. Give out copies of "Bacteria In Your Home" for them to do at home, just for fun. ☺

GROW AN HERB GARDEN

There's nothing like a sweet vanilla ice cream cone in the summer or a peppermint candy cane at Christmas. We enjoy tasty flavors like vanilla and peppermint because of herbs (plants that can be used for flavoring, food, and even medicine). Your mom might cook with herbs like sage and rosemary, or you might drink some herbal tea like chamomile. Other herbs can be used as medicine, such as aloe vera which helps soothe scrapes and burns.

In Genesis 1:29, we read that God gave Adam and Eve "every plant yielding seed that is on the face of all the earth . . . You shall have them for food." Not only did God give us some plants as food, but he also gave us some plants to flavor our food and to help keep us healthy.

Hello there! I'm Buddy Davis, the host of *Out and About* on Answers TV. Let's get our hands a little dirty as we investigate God's amazing creation.

Herbs are easy to grow inside or outside. Plant your own herb garden and enjoy eating what you grow.

Materials

- Seeds or seedlings (young plants) of your choice
- An empty egg carton if you're starting with seeds
- Outdoor pots or containers
- Potting soil
- Scissors
- A watering can

Planting

1. Ask an adult to help you choose which herbs to grow. You can buy seeds or seedlings at your local nursery (a place where plants are grown and sold), online, or sometimes at the grocery store. If you're starting with seedlings, skip to step 3.

2. If you're starting with seeds, cut the lid off the top of your egg carton and add some potting soil to each section. Place a seed in each section, cover the seeds with a little more soil, and water them. Cover the carton with plastic wrap and set it in a sunny spot. When the growing seedlings have a few leaves, they're ready to plant.

3. When you have seedlings, add potting soil to pots or containers and dig little holes about two inches below the container rim. (You could also plant them in the ground if you prefer.) Handle the seedlings gently, lifting them with their roots and soil and placing them into the holes. Gently press them in. Sprinkle more soil around them and water them right away.

4. Your herbs need 5–6 hours of sunlight every day. Water them often but check the soil first. Herbs grow best in moist soil that's not super wet. You may need to pull out weeds around your plants. Some herbs, like basil, may need to be trimmed.

5. Eat what you grow. Your plants will continue to grow even when you snip off leaves to use in recipes. Enjoy experimenting with your homegrown herbs and the unique flavors they add to different foods!

Natural Philosophy

Grow an Herb Garden

Cycle 4, Week 19

Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

    - "Grow an Herb Garden", from *Answers Magazine*, Aug–Sept, 2021 (Kids Answers, 5)
    - Watering can
    - Bible
    - "Bacteria in Your Home", from *Answers Magazine*, October–December, 2020 (One for each family.)

2. Christina & Robyn will bring:

    - Empty egg cartons
    - Potting soil
    - Seeds for herbs (recommend: Italian sweet leaf basil, rosemary, Greek oregano, thyme, Roman chamomile, parsley)

To Start

1. Recite Key Verse.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

    1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics, or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

Natural Philosophy

The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Intro

1. The way God causes plants to grow is simply marvelous. Look at this seed. The Bible says this seed is dead.

    a. John 12:24
    b. 1 Corinthians 15:36–37

2. And what does the dead seed bring forth?

    a. Genesis 1:11–12

3. For a seed to grow, it needs:

    a. To be planted in the earth
    b. Water
    c. Sunlight
    d. Air

4. And with those things, all by itself, the seed suddenly comes to "life", and grows, and produces a fully-developed plant, after its own kind, which bears seeds, to make more of the same plant!!

5. And on top of how wonderful God's works are in all of this, the plants are a blessing from God to us!!!

    a. They take the air that we breathe out, and clean it, to make more fresh air for us to breathe!
    b. They make beautiful fragrances.
    c. They are beautiful to look at.
    d. They provide homes for the birds and small animals.
    e. They provide all kinds of tasty and nutritious food for us! What can you think of?

i. Fruit—candy, just growing out of dirt!!
ii. Sugar (sugar cane)

Article/Demonstration

1. Read "Grow an Herb Garden", by Buddy Davis.

2. Have every child start seeds in his egg carton. (Lord willing, this will be a blessing to every family!)

EXPERIMENT

© Tobkatrina | Dreamstime.com

Fast-Formed Fossils

by Heather Brinson Bruce

Do fossils require millions of years to form? Hardly! Even secular geologists now recognize that rocks form very quickly. The key is the right chemical conditions, not time. See for yourself with a simple experiment.

EVERYONE KNOWS that the fossils we find all over the world took millions of years to form—scientists proved that years ago, right?

Actually, even secular geologists recognize that fossils form rapidly. If they didn't, the organism would decay so quickly there would be almost nothing left to fossilize!

Scientists constantly test ways to understand and replicate the process of forming fossils. Taphonomists (those who study how to make fossils) have demonstrated the astonishing speed of fossilization. Some fossils can be generated in days, or even hours![1]

Fossils can form in a wide variety of ways. Some common methods include:

1. The body can leave an **impression or cast** showing its outer shape in the surrounding sand or mud. This can include footprints and the inside and outside of shells. With the right ingredients and conditions, the cast can harden quickly, like cement.
2. **Petrification** takes place when minerals replace the original material of the plant or animal. These petrified fossils must form quickly, before the body parts have time to decay. Petrified wood is a classic example.
3. **Permineralization,** or encased fossilization, occurs when dissolved minerals fill the pores and empty spaces in the plant or animal but don't replace any of the original material. The chemicals then turn into crystals, keeping the organism safe and preserved. While it is possible for many different chemicals to do this, quartz is the most common. Most dinosaur bones are permineralized.

Fossils can form under all kinds of conditions all over the world. While water and dissolved minerals are

see for yourself . . .

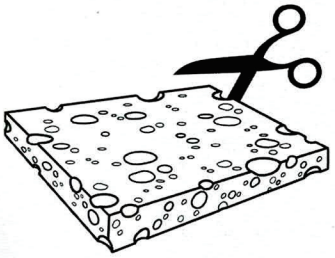
Fossils are rare today, but you can make them in your own home! Try the following experiment and watch a kitchen sponge "fossilize"!

MATERIALS

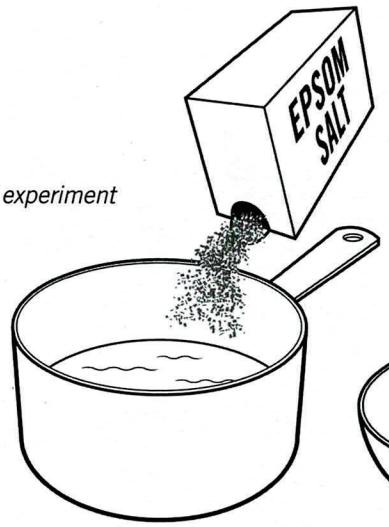
2 kitchen sponges
1 shallow dish
1 small pot
1 cup of water
Epsom salt
Food coloring

PROCEDURE

(Adults should supervise the experiment and perform all cutting.)



1. Cut both sponges into bone shapes and set one aside. Place the other sponge into a shallow dish.



2. Heat water close to boiling and stir in as much Epsom salt as will dissolve. *Add food coloring to water (if desired).*

3. Pour the salt water over the sponge.

4. Place the bowl where it will not be disturbed for a few days. Leave uncovered so the water can evaporate.

FINAL RESULT Once dry, compare the two sponges. Break the fossil in half. What happened to the sponge material? Was it encased (permineralized) or replaced (petrified)?

usually needed to form the three types of fossils above, many processes—coalification, compression, freezing, desiccation (drying out), to name a few—do not require either.

Though there are numerous ways to make fossils, fossilization is somewhat rare today. Why is that?

God created the world to efficiently recycle organic matter. When something dies, scavengers, fungi (like mushrooms), and/or bacteria normally consume it. This process of decomposition leaves nothing behind to fossilize.

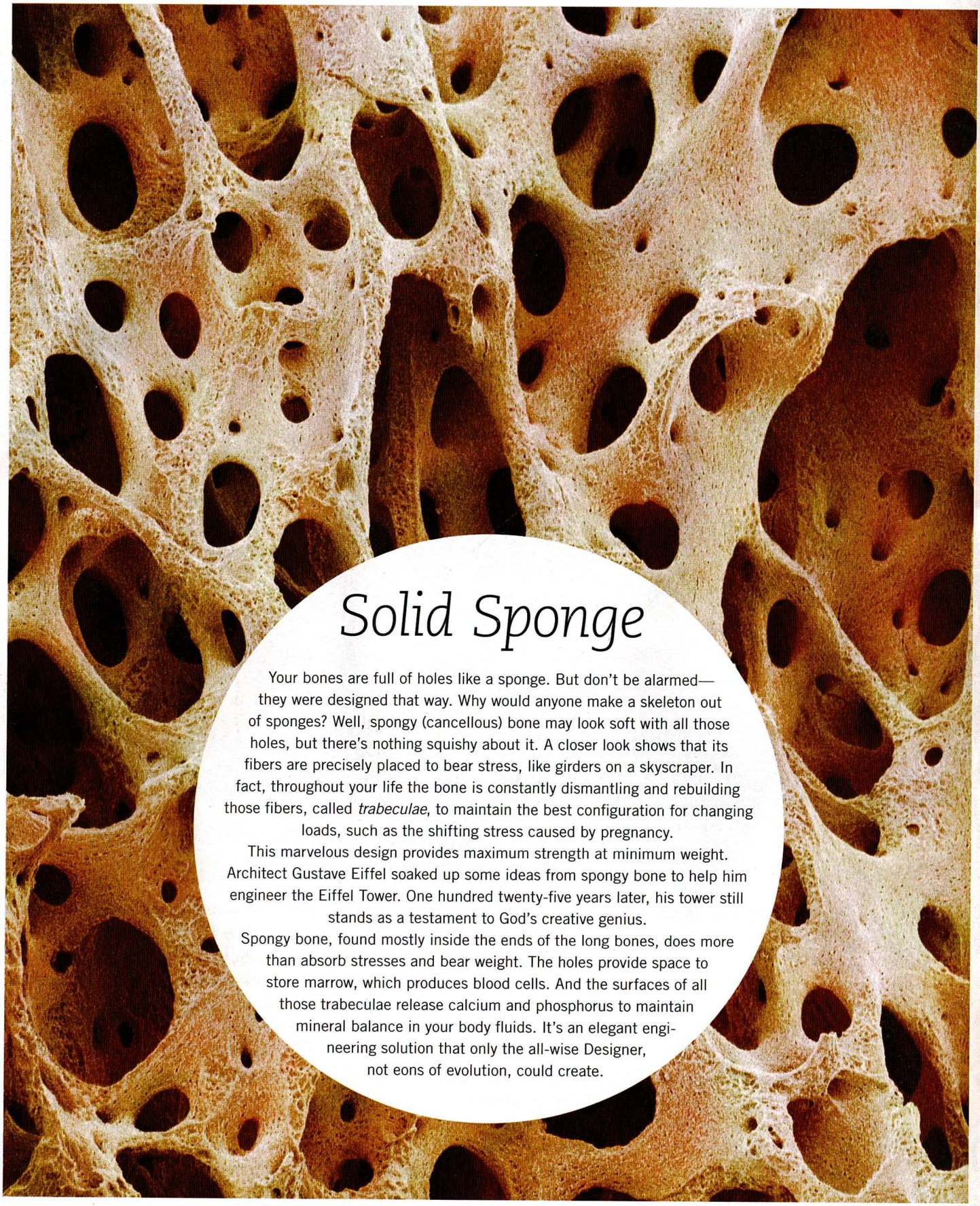
However, massive catastrophes like Noah's Flood would produce the conditions necessary to quickly bury and protect creatures so that they can fossilize. It appears that God wanted to leave abundant evidence of His past judgment of mankind's sin.

While scientists are still trying to sort out the complex details about fossilization, one fact is undisputed—it can be amazingly fast. ■

NOTES

[1] Vera Everett, "Soft Tissue Fossilization," www.answersingenesis.org/articles/aid/v4/n1/soft-tissue-fossilization.

Heather Brinson Bruce *earned dual degrees in English and chemistry from Clemson University. Married and blessed with two beautiful nieces, she writes and edits for* Answers *magazine as part of the full-time staff.*



Solid Sponge

Your bones are full of holes like a sponge. But don't be alarmed—they were designed that way. Why would anyone make a skeleton out of sponges? Well, spongy (cancellous) bone may look soft with all those holes, but there's nothing squishy about it. A closer look shows that its fibers are precisely placed to bear stress, like girders on a skyscraper. In fact, throughout your life the bone is constantly dismantling and rebuilding those fibers, called *trabeculae*, to maintain the best configuration for changing loads, such as the shifting stress caused by pregnancy.

This marvelous design provides maximum strength at minimum weight. Architect Gustave Eiffel soaked up some ideas from spongy bone to help him engineer the Eiffel Tower. One hundred twenty-five years later, his tower still stands as a testament to God's creative genius.

Spongy bone, found mostly inside the ends of the long bones, does more than absorb stresses and bear weight. The holes provide space to store marrow, which produces blood cells. And the surfaces of all those trabeculae release calcium and phosphorus to maintain mineral balance in your body fluids. It's an elegant engineering solution that only the all-wise Designer, not eons of evolution, could create.

Susumu Nishinaga | Science Source

Natural Philosophy

Fossil Formation

Cycle 4, Week 20

Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

    - "Creation on Display: Solid Sponge", from *Answers Magazine*, July–Sept, 2014 (27)
    - "Fast-Formed Fossils", from *Answers Magazine*, Oct–Dec, 2011 (24–25)
    - Electric tea kettle or other method for boiling water
    - Pyrex pie plate or similar dish (that can be left at WW for a week)
    - Scissors
    - Quart-sized measuring cup (4 cups)
    - Kitchen spoon for stirring
    - Optional: pictures of different kinds of dinosaur or other fossils
    - Optional: actual fossils

2. Supplies Captain will bring:

    - 2 kitchen sponges (no scrubber side or anything, just plain sponges)
    - Bag of Epsom salt

To Start

1. Recite Key Verse.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

    1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics,

or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Intro Quick Extra Article

1. Read "Creation on Display: Solid Sponge".

Article/Demonstration

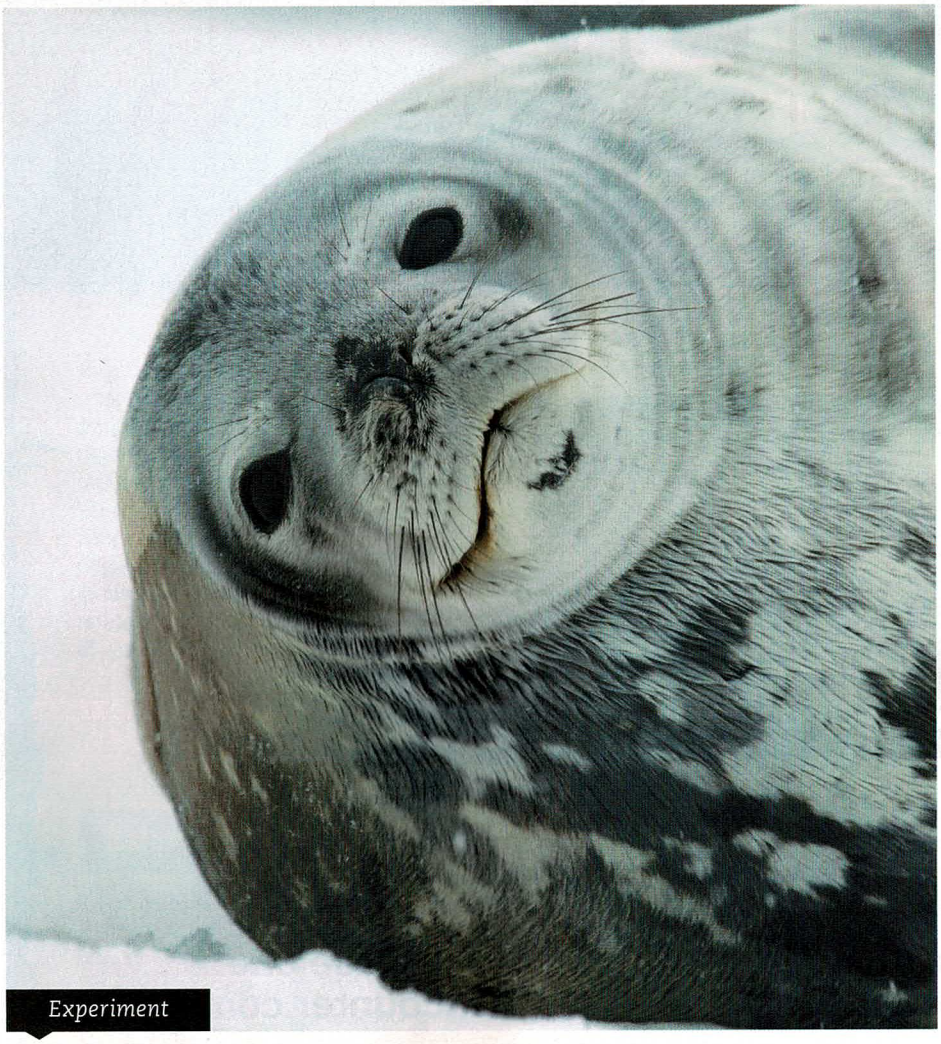
1. Read "Fast-Formed Fossils", by Heather Brinson Bruce.

    a. Note about permineralization: How would most dinosaur fossils be formed in this way?
    b. (Hint: Dinosaur fossils are usually fossils of the dinosaurs' *bones*!)
    c. (Answer: Because, as we read in "Solid Sponge", bones are *porous*; that is, they are filled with holes! All of those holes in the bones are the "pores and empty spaces" that get filled up with chemicals in permineralization, resulting in fossilization.)

2. Perform demonstration, with these modifications:

    a. Use a quart-sized measuring cup.
    b. Pour 1 cup of boiling water from the electric kettle into the quart measuring cup. *Do not use more water!!!!!! If you do, it'll take weeks or even months to evaporate!!*
    c. Add the Epsom salt to the water in the quart measuring cup, stirring to dissolve. Add as much Epsom salt as will dissolve (just like the directions say).
    d. Continue as directed in the article.

3. We'll check the results of our experiment next week! (Hint: Do you think it will take millions of years to fossilize this sponge?!)



Experiment

BLUBBER GLOVES

by Don B. DeYoung

Living in ice water sounds like an oxymoron for warm-blooded animals. But God designed a clever coat of insulation that makes life a breeze for animals that call the arctic their home.

Have you ever jumped into a pool of water so cold it took your breath away, instantly covering your body in goose bumps? Such derring-do might make for a refreshing, short plunge, but it can quickly become life-threatening. Heat rapidly leaves your body in near-freezing water, lowering your core temperature to a dangerous condition called hypothermia. In the polar regions, where salt can drop water temperatures to 28.8°F (-1.8°C) your heart can cease in minutes.

So how do so many creatures feel right at home in such cold conditions? Most fish are cold-blooded (ectothermic), which means God designed their internal temperature to depend on the temperature of their surrounding environment, slowing their activity and metabolism as water temperature drops. But warm-blooded (endothermic) mammals are designed differently. They can generate body heat internally; but if they can't maintain a constant internal temperature (homeothermy), they are in danger of dying from the icy cold. This is where God's care for creatures in extreme cold is clearly seen.

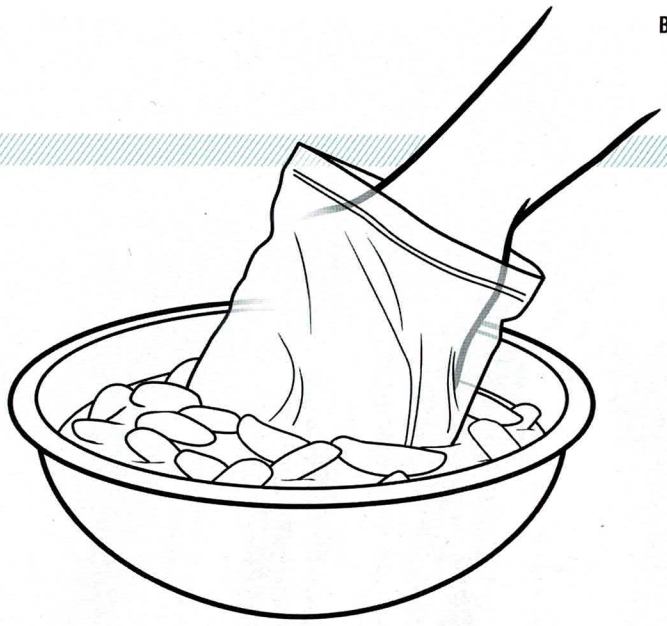
Warm-blooded mammals that enjoy life in cold waters include whales, seals, sea lions, and walruses. Despite the cold surroundings, they maintain a body temperature similar to that of people, about 99°F. A key to maintaining their internal heat is a thick layer of insulating blubber. This fatty tissue, which may gross us out if we see it on our dinner plate, is a marvel of design.

We sometimes humorously call the fat around our waist blubber, but this is not its technical meaning. The word refers to a special type of thick fat and connective tissue located between the skin and body muscles of marine mammals. Heat moves very slowly through this fat. In technical terms, blubber has a "low thermal conductivity," similar to Styrofoam insulation.

A whale's fat layer may be more than a foot thick, but thickness is not the main factor in blubber's effectiveness. The insulating ability depends strongly on its internal water content, concentration of lipids, and blood flow. Blubber is so effective that walruses can lie directly on Arctic ice in complete comfort, even with temperatures reaching -40°F (-40°C). Penguins experience even colder temperatures in the Antarctic, yet they are likewise protected, even in the dead of winter.

Retaining too much body heat can cause its own problems, especially for sea creatures like whales that swim from the Arctic to warm seas. However, God designed their bodies so they can adjust the quantities of water, lipids, and blood flow, thus regulating how effectively the blubber insulates heat.

Blubber serves several purposes beyond protection from the cold. For one thing, fat has a high energy content. So animals can readily draw on this internal energy supply for survival. Whales may eat little or nothing at all for days or sometimes months when they are



See for yourself . . .

Let's explore how a whale feels in cold water. With adult help you can make a "blubber glove."

MATERIALS

Bowl of water
Several ice cubes
Four sandwich bags
Wide duct tape or package tape
Shortening, such as Crisco, from the kitchen
Tablespoon
Paper towels for cleanup

PROCEDURE

Make Two Gloves. Shortening is used in cooking to produce soft cookies and moist cakes. This solid form of vegetable oil behaves similar to animal fat and provides a substitute for whale blubber. Scoop 3–4 tablespoons of shortening into a sandwich bag. Now insert a second sandwich bag into the first, kneading or pushing the shortening between the walls of the bags. To prevent leaks, seal the two sandwich bags together around the upper edges with wide tape, leaving the center bag open.

This will make a pocket or glove that you can put your hand into without touching the shortening itself. Try out the glove, spreading out the shortening so that it surrounds your fingers. With two other sandwich bags, make another glove, one inside the other, but this time without any shortening. Tape is optional for this second glove.

Test Each Glove. Place several ice cubes in the bowl of water. When the water is cold, put on your "blubber glove" and dip it into the water. Does the shortening protect you from the chilly temperature?

Now try the non-shortening glove as a comparison. Squeeze out extra air from between the bags, put on this glove, and reach into the water. Does the water feel cold with no insulation?

To experiment further, return to the blubber glove and measure how many seconds or minutes pass before you feel the cold. After you finish, you can keep the glove indefinitely to show friends, or return the shortening to the kitchen container, or dispose of it.

To explore other benefits of blubber, moisten your fingers and make a marble-sized ball of shortening. If you place this ball into the water, will it sink or swim? Try it! This shows how whales can rest at the surface of the ocean.

breeding or traveling long distances.

Furthermore, the distribution of blubber helps streamline the animals' bodies into rounded shapes. Blubber typically covers all of a sea mammal's body except for its fins, flippers, and tail flukes—converting it into a torpedo. As a result, the creature glides through water with little effort or wasted energy.

A third important property of blubber is its buoyancy. Without blubber, sea mammals would need to work constantly to avoid sinking. The density of blubber is similar to that of ice, allowing marine mammals to rest effortlessly at the ocean surface.

Many animals, including sea otters, are equipped with fur for insulation instead of blubber, but this is not nearly as effective. Fur retains heat in air pockets, but during deep dives this air gets expelled. Evolution proposes that whales and other sea mammals gradually developed blubber over millions of years, sometime after land animals returned to the sea. In contrast, Genesis 1:21 clearly states that God supernaturally created every kind of sea animal on Day Five of Creation Week.

Each marine mammal is a majestic part of creation. Blue whales, for instance, can grow one hundred feet long and weigh up to 200 tons (181 m. tons), more than twice the size of the largest known dinosaurs. Whales "sing" to each other with complex tones that pass through miles of water. Some whales can plunge more than a mile deep in the ocean and stay submerged for over 90 minutes. If the Creator had not equipped them with a layer of blubber, this would be impossible.

"Let heaven and earth praise Him, the seas and everything that moves in them" (Psalm 69:34). ■

Dr. Don DeYoung *is chairman of science and math at Grace College, Winona Lake, Indiana. He is an active speaker for AiG and has written 20 books on Bible-science topics. Dr. DeYoung is currently president of the Creation Research Society with hundreds of members worldwide. His website is DiscoveryofDesign.com.*

Natural Philosophy

Blubber

Cycle 4, Week 21

Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

   - "Blubber Gloves", from *Answers Magazine*, Vol. 10, No. 1, Jan–Mar, 2015 (40–41)
   - Large mixing bowl
   - Globe
   - Optional: blubbery animal pictures

2. Supplies Captain will bring:

   - Ice cubes
   - Sandwich bags
   - Duct tape
   - Shortening
   - (Plastic spoons & paper towels are already at WW)

To Start

1. Recite Key Verse.

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Natural Philosophy

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Blubbery Animals

1. The blubbery animals are all mammals—their bodies work very much like men's bodies do.
    a. Their bodies keep the same consistent temperature all of the time, and that is necessary for them to stay alive.
    b. We call that *warm-blooded*.
    c. Birds and the other animals like dogs and cats and bears and elephants are all warm-blooded.
    d. Fish and reptiles (aligators, snakes, lizards, etc.) are not warm-blooded.
2. Show them the globe; show them the parts of the earth where the blubbery animals live—the North and South Poles.
3. North Pole examples:
    a. Walruses
    b. Narwhals
4. South Pole examples:
    a. Penguins (penguins only live south of the equator!)
5. Blubbery animals at both poles:
    a. Seals
    b. Sea Lions
    c. Whales

Article/Demonstration

1. Read "Blubber Gloves", by Don B. DeYoung, perform demonstration as described.

Make a Tree Bark Rubbing

What's your favorite thing about fall? There's a lot to like about this season, from pumpkin pies to cozy fires to colorful leaves. Every year, I enjoy watching the tree leaves turn from green to gold.

When God made plants, including trees, on day three of creation week, he created them with everything they'd need to live. He designed special cells in the leaves to use energy from sunlight to make food for the tree in the spring and summer. These cells contain chlorophyll (KLAW-ruh-fil), which gives the leaves their green color.

In the fall, days get shorter and colder. The leaves stop making food, and the chlorophyll in the cells breaks down. The green color fades to yellow, orange, red, brown, and even purple, depending on the tree.

Different types of trees—maples, oaks, and elms, for example—have their own unique shapes and colors of leaves. They also have their own bark patterns. Tree bark is like a protective skin that defends the tree against disease, insects, and the weather. It also stores water to keep the tree hydrated.

Hello there! I'm Buddy Davis, the host of *Out and About* on Answers TV. Let's get our hands a little dirty as we investigate God's amazing creation.

Let's go outside and get an up-close look at the unique leaves and bark patterns of different trees.

Materials

- Blank sheets of paper
- Tape
- Glue stick
- Pen or pencil
- Crayons

Activity

1. Remove the wrappers from the crayons before you go outside.
2. Find a tree and tape a piece of paper to the trunk.
3. Rub the side of a crayon all over the paper.
4. Collect a leaf from the tree, either from the ground or a branch, and use the glue stick to attach the leaf onto the paper with the bark rubbing.
5. Label each piece of paper with the name of the tree. (If you don't know what kind of tree it is, ask a parent or guardian to help you find it in a book or on a website.)
6. When you're done collecting your bark rubbings and leaves, look through all the different patterns and colors. As you admire God's creativity, be sure to thank him for the beauty of trees!

Natural Philosophy

Tree Bark Rubbings

Cycle 4, Week 22

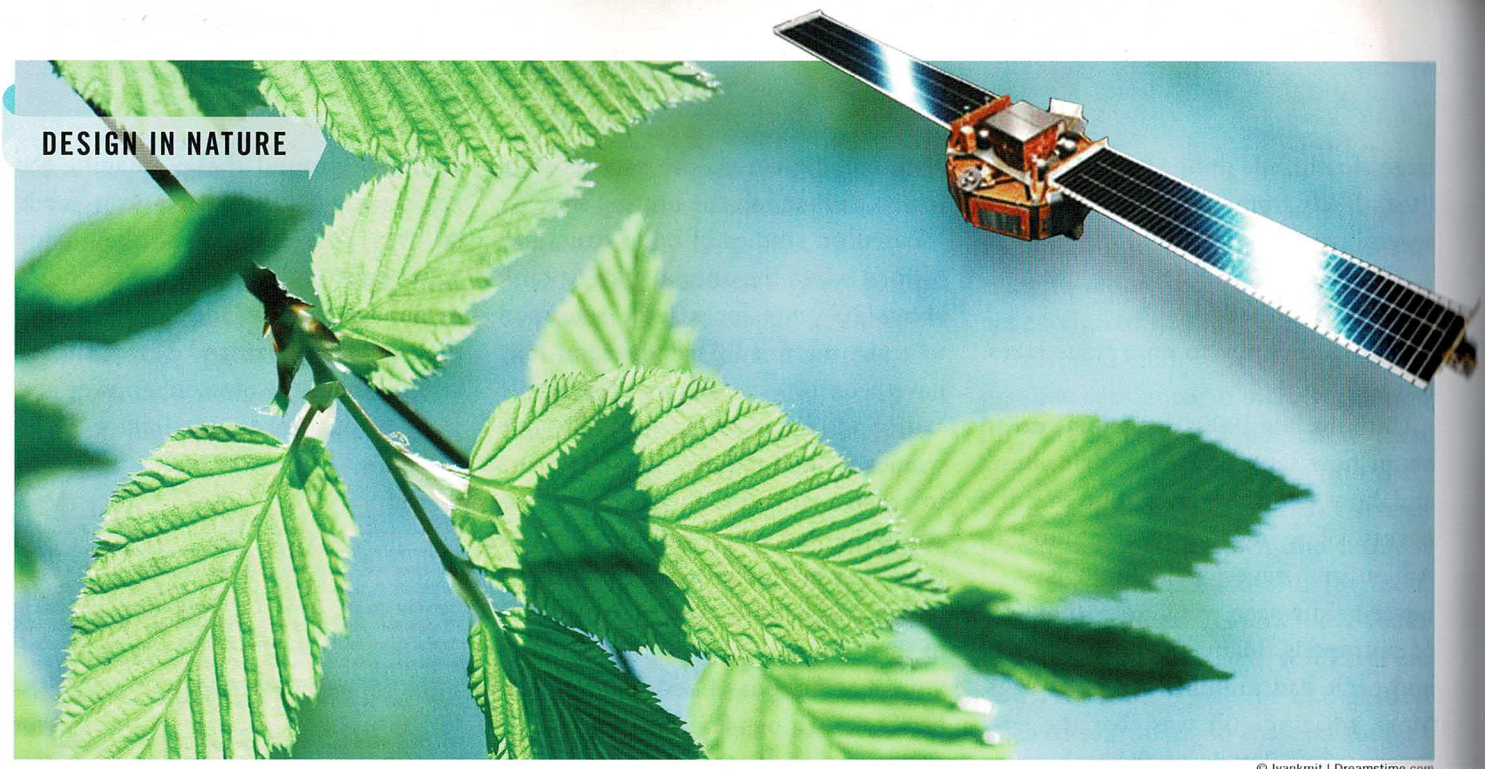
Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

    - "Make a Tree Bark Rubbing", from *Answers Magazine*, Kids Answers, Oct–Dec, 2021 (5)
    - A few blank sheets of paper for each student
    - Crayons, with papers stripped off
    - Glue stick or tape
    - Pencil

GO STRAIGHT OUTSIDE & DO THE ACTIVITY (TIME IS SHORT, MAKE THE MOST OF IT)!!



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Space-Age Leaves

by Don DeYoung

HOW DO YOU DESIGN A HUGE SOLAR PANEL THAT CAN BE FOLDED UP AND STORED IN A TINY ROCKET? TO FIND THE ANSWER, SCIENTISTS LOOKED INSIDE THE BUDS OF THE COMMON BEECH TREE.

Imagine the benefits of building large solar panels on earth and then launching them into space to collect energy from the sun. But there is a big problem. To be effective, solar panels require maximum surface area and lots of metal bracing for strength, yet somehow the panels must be folded compactly and stuffed into a rocket for the initial journey into space.

The design must be both lightweight and strong so that the panels will unfold without the need for a lot of motors or fear of damage. How can these design challenges be overcome?

The Japanese found a solution in God's creation—in the buds of the common beech tree. The tree begins each growing season by constructing new leaves compactly folded within small buds. When it's time for the plant to begin absorbing energy from the sun, the buds open, and the new leaves unfold like accordions.

The intricate folding of the beech leaf is an ingenious design. You can see it for yourself by doing a simple origami exercise (sidebar).

Japanese scientist Koryo Miura extended the origami concept of the beech leaf to a pattern called the miura-fold. In 1995 this design was put to the test. The Japanese built a massive solar array—80 feet (24 m) long with a surface area of 620 square feet (58 m^2)—that they folded up and stored in a Japanese satellite called the Space Flyer Unit.

Engineers are looking at other amazing folding patterns in nature, too, such as the leaves of other trees and the wings of beetles and butterflies.

Folding examples from nature have a great range of potential applications. Consider highway maps that we struggle to refold after use. A folding design somewhat similar to the beech leaf has been used in a Tokyo subway map. A single pull extends the map to full size, and a downward push collapses the map once again.

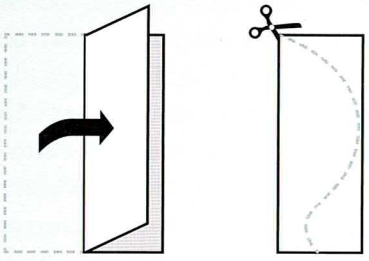
The miura-fold, when made into a cylinder shape, is also useful as a design for heart stents that clear blocked arteries. There appears to be no end to origami applications, inspired by created designs like the leaf of the beech tree. Such practical folding patterns are clearly a gift from the Creator. ■

P. Forbes, *Gecko's Foot* (New York: W.W. Norton & Company, 2005), pp. 181–183.

Dr. Don DeYoung *is chairman of physical science at Grace College, Winona Lake, Indiana. He has written 16 books on Bible-science topics. DeYoung is currently president of the Creation Research Society with hundreds of members worldwide. His website is DiscoveryofDesign.com.*

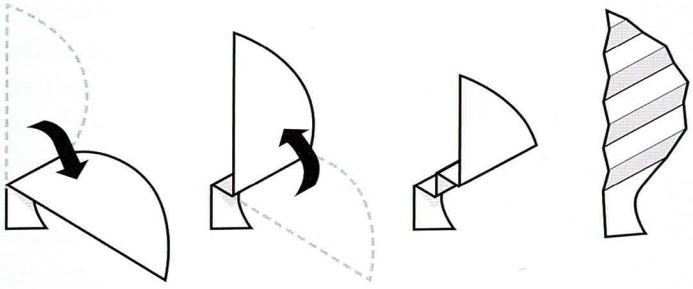
see for yourself . . .

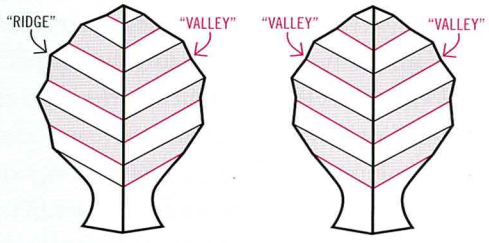
Folding and unfolding a street map can be a real hassle, especially since you have to follow so many steps in exact order. But engineers have discovered a different kind of fold in beech leaves, which allows a large folded object to open and shut with one motion. Although it takes several steps to create the initial fold, once you're done, you can open and close the object with ease.



1. Take a sheet of paper (any size and shape will do, but it works well if the paper is about twice as long as it is wide). Then fold it in half along its long axis. This fold will be the leaf stem. Cut the paper into the shape of a leaf.

2. With the paper still folded, start at one end and make accordion folds all along the stem fold. These folds will be the leaf's veins. They should be parallel to each other and at an acute angle to the stem (a 60-degree angle works well).



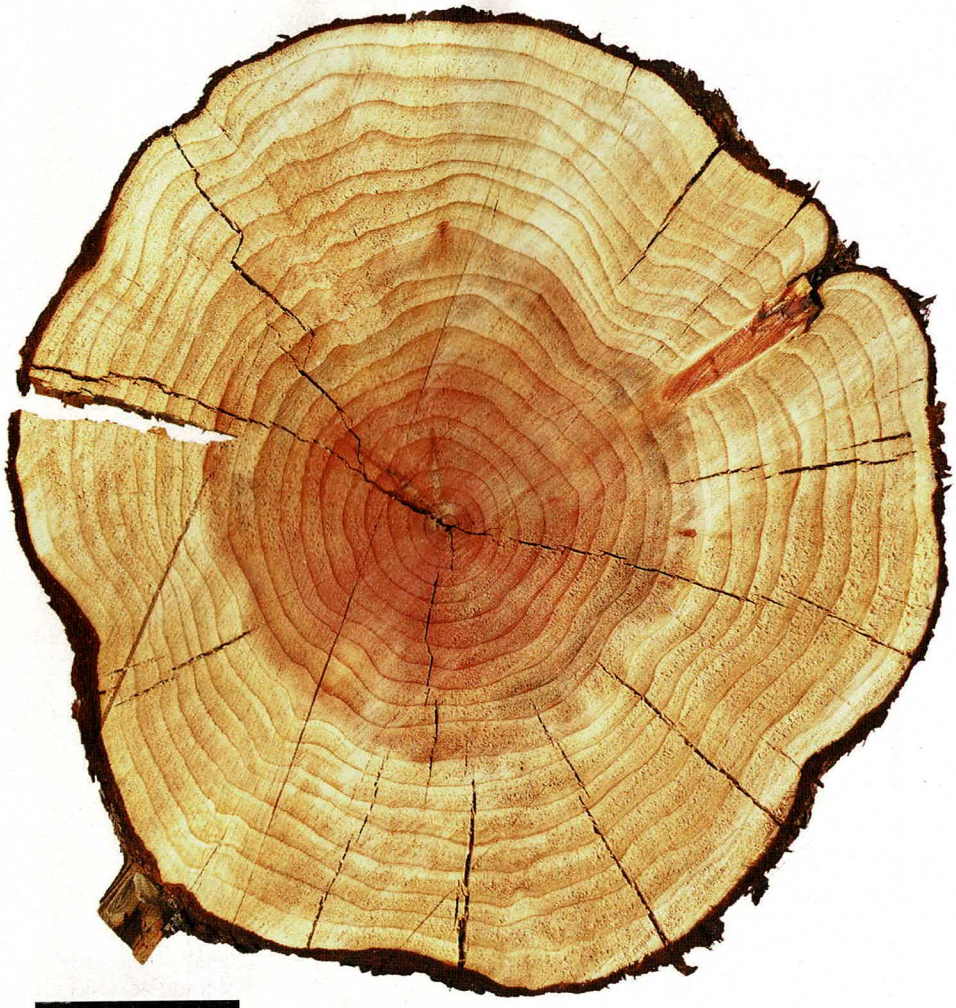


3. Now unfold the whole leaf. You will notice two problems. First, the veins on one side are folded in the wrong direction, so reverse those folds. At the same time, the whole stem is a "valley," but every other fold needs to become a "ridge" to match the ridges on the veins.

4. Now you can open and shut your new leaf along the folds, with one quick motion!

Sound complicated? Just view the video at www.pienetwork.org/a2z/p/paperfolding to see this fold in action.

subscriberexclusive Visit **www.answersmagazine.com/go/5-1-exclusives** to try another folding project that shows how the same fold is used for maps.



Experiment

WHY NOT A SQUARE TREE?

by Don DeYoung

Some realities of nature are so common that we don't even stop to ask why. Like round trees.

Why don't we find square tree trunks or triangular shapes in nature? Many obvious details, such as round trunks, are often overlooked. If we'd just pause a moment to consider the scientific reason for their existence, we might discover new reasons to praise our Creator.

Trees are round primarily because the wood layers grow outward from the center in all directions. Growing in the shape of a cylinder has a big benefit. It seems to be optimum for tree strength against stress on the top of the tree from wind and heavy branches.

A rounded tree bends more easily than a flat-sided tree. A cylinder bends equally in all directions, depending on the wind. In contrast, a square tree trunk would be vulnerable at its corners. The corners would not bend but simply break in heavy winds. Telephone poles and light posts are round for a reason (see experiment)!

ROOM FOR IMPROVEMENT? The rounded tree shape has other benefits, too. For instance, it minimizes the outside surface exposure to injury or infestation. Round trees have one disadvantage, however—not for the trees but for modern loggers. The problem is waste.

When circular trees are harvested and cut into boards, the outer, rounded portion—nearly half of the log—ends up as scrap, whether discarded, burned, or ground into pulp for paper production. A lot of good wood is lost in the process. It has been suggested that if trees were square instead of round, there would be much less waste.

This isn't a problem with the original tree design, however. Throughout history, logs have been a primary source of fuel, and fuel is not a waste. Only when modern industry developed other energy sources did it become "waste" to burn wood byproducts. Advanced industrial nations try to maximize their profits when harvesting trees.

Still, is there any hope of solving the waste problem? In the 1980s a botanist in Canada's heavily forested province of British Columbia thought he might have found a way to get trees to grow square trunks. Cutting away the bark at four "corners" (every 90°) he was able to get the wood to grow extra at these corners. Carrying the idea even further, he suggested workers might be able to cut open such trees and remove flat boards from the inside. If loggers left intact the trees' outer growth layer (called the cambium), the trees would grow new wood.

The researcher was granted a patent for his square-tree technique; however, the novel idea failed to generate commercial interest. He only succeeded in making square trees less than a centimeter across before dropping the research.

Square trees do grow in places other

See for yourself . . .

Let's explore the design of trees by comparing two paper shapes, round and square.

MATERIALS

- An 8½ x 11 inch sheet of paper
- Tape
- Several lightweight books (Paperbacks work well)

PROCEDURE

To begin, fold and carefully tear in half the sheet of paper to make two equal half sheets, each 5½ x 8½ inches. Roll one sheet into a cylinder with a bit of overlap and tape the length of the seam so that the tube stands 5½ inches high. It may take a helping hand to cover the seam with tape. On the second sheet of paper, make four equal folds to form the sides of a box. Tape the seam as before, which this time will be on a corner. The result is an open rectangle the same height as the cylinder. Crease the corners of the square so they are as sharp as possible.

Now the comparison begins. Which shape, round or square, will support the most weight before collapsing? First, with the square shape standing on end, carefully place a small book on top, and then add others. The limit is typically 2-3 books before the tower collapses. The flat sides and corners appear to be the weak parts of the box shape. Next, repeat the process by stacking the same books on the round tube. You may need additional books this time. Did you find that the round shape supports more weight than the box? With no weak corners or flat sides, the cylinder has added strength.

Which paper shape, square or round, most resembles the trunk and limbs of a tree? Can you think of other rounded shapes in nature? Consider flower stems, seashells, and even our bones. Round shapes are also found around the house, including water pipes, soup cans, and light bulbs. All are designed for strength, just as God designed trees for their beauty and strength during Creation Week.

than research labs and storybooks. Panama is home to a grove of more-or-less square trees in the cottonwood family (*Quararibea asterolepis*) that has become a tourist attraction. Even the inside tree rings show the square growth pattern. But it's just an oddity that puzzles scientists. To figure out whether the square design is caused by the environment or genetics, botanists planted some of the seedlings in Florida, where they grew normally. So it appears that the rich volcanic soil at this location in Panama may be a factor.

Trees are arguably the largest and the oldest living things on earth. One giant redwood in the western United States has grown to a height of 379 feet (115.5 m), equal to a 30-story building. Meanwhile, bristlecone pine trees live for several thousand years. Trees stand tall with outstretched arms, through storms and drought, wind and hail, summer and winter. Their round trunks clearly hold them up quite well. ■

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Natural Philosophy

God's Wonderful Design for Trees

Cycle 4, Week 23

Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

    - "Why Not a Square Tree?", from *Answers Magazine*, Vol. 11, No. 1, Jan–Mar, 2016 (38–39)
    - "Space-Age Leaves", from *Answers Magazine*, Jan–Mar, 2010 (30–31)
    - Paper (printer paper is fine)
    - Scotch tape
    - Small books (like Blue Back Spellers, maybe 5 small books)
    - Fossil sponge from 3 weeks ago

2. Extra demonstration, if there's time:

    - Paper (printer paper is fine)
    - Scissors for students to use

To Start

1. Recite Key Verse.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

    1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics, or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

Natural Philosophy

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>
> True religion and true philosophy must ultimately arrive at the same principle.
>
> 2. Hypothesis or system on which natural effects are explained.
>
> 3. Reasoning; argumentation.
>
> 4. Course of sciences read in the schools. (Noah Webster's 1828)

First

1. Check on your fast-formed fossils from three weeks ago!

Article/Demonstration

1. Read "Why Not a Square Tree?", by Don B. DeYoung, perform demonstration as described.

Bonus Article/Demonstration

1. Read "Space-Age Leaves", by Don B. DeYoung.
2. If there's time, also perform demonstration as described.

God's Spaceships

THE TRANSLUCENT BLOB clings desperately to the yolk as I separate the egg white for breakfast.

Thank you, Lord, for daily reminders of your provision. You cared so much for the life of helpless chicks that you designed little space capsules for them. Oxygen passes safely through the shell to the life inside, while the egg white keeps enemies (like bacteria) at bay.

Thank you for providing life to sustain my life (1 Timothy 6:13). This day let me take every opportunity to share the life found in your Son, Jesus Christ, who is life, who made life, and who gave His life to sustain ours. Amen.

Make a Toilet Paper Bird Feeder

Winter can be a tough time for birds. The days are short, the nights are cold, and food is harder to find. The summer buffet of fruit and insects is gone. Even seeds are often blown away by winter winds or get soggy in the snow and aren't fit to eat. That's why God designed most birds to fly to warmer places (migrate) during the winter, where they can find more to eat.

But not all birds migrate. Some rely on backyard bird feeders to stay full, and even the birds on a migration journey will stop to refuel at feeders. You can lend a hand—or wing—to our feathered friends by providing food during the cold months. The best bird foods contain high fat and oil to give the birds energy. Offer the birds peanuts and peanut butter, sunflower seeds, and other seed mixes.

Birds aren't the only ones who have a hard time finding food in winter. Squirrels, mice, raccoons, and other critters do too. Help protect the birds from predators by placing food near brush or a hedge where birds can hide.

Hello there! I'm Buddy Davis, the host of *Out and About* on Answers TV. Let's get our hands a little dirty as we investigate God's amazing creation.

You can make your own bird feeder at home with just a few items that you probably already have.

Materials

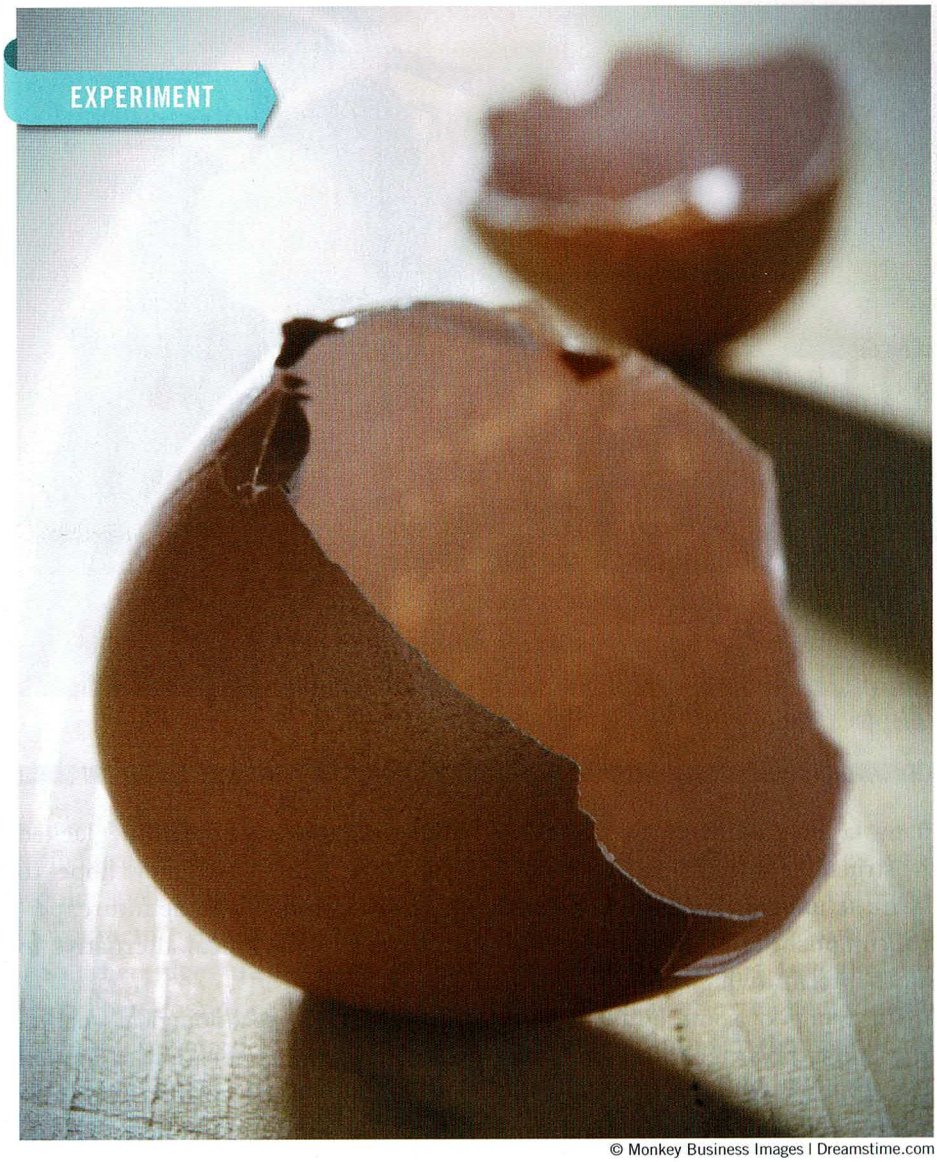
- toilet paper roll
- peanut butter
- birdseed

Experiment

1. Remove any extra toilet paper stuck to the roll.
2. With a spoon or butter knife, spread peanut butter all over the outside of the roll. You can hold the inside of the roll with your fingers to keep your hands clean—well, mostly.
3. Pour some birdseed onto a plate, and move the roll around until it's coated with seeds.
4. Hang your feeder outside by slipping the roll over a tree branch.

Now grab a warm blanket, a cup of hot chocolate, and enjoy watching your feathered friends find your feeder!

EXPERIMENT



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Walking on Eggshells

by John UpChurch

Eggs aren't exactly famed for strength. But have you ever considered what the thin egg wall was designed to hold up—the weight of full-grown mother chicken! A simple experiment will help you to see the secret behind the eggshell's amazing strength.

AN ARCHITECTURAL marvel is sitting innocuously in your refrigerator. Other manmade structures, such as the exotic Taj Mahal or modern high-tech football stadiums, have borrowed the same exceptional design. But while those buildings demanded enormous amounts of human labor and money to construct, you simply picked up your masterpieces at the marketplace—a dozen of them, to be exact.

Opening the egg carton, you may not recognize the contents' structural excellence. After all, eggs have a reputation for breaking easily. At the store we examine each carton to make sure nothing has oozed out, and at home one or two whacks are sufficient to open the shell.

But there's more to eggs than omelets and cakes. If you've ever been tasked with plucking eggs from startled hens, you've uncovered the first evidence that these oblong spheres aren't so fragile. After all, they absorb the weight of the chickens that laid them.

You can test this strength for yourself. Put on some gloves, grab an egg, and squeeze the rounded ends between your palms. Done correctly, the thin-shelled wonder won't break. If you squeeze the flat sides, however, your fingers will plunge into a squishy mess.

Companies pack eggs with the pointy ends up to capitalize on the strength of their curved ends. The ancient Romans employed this same egg-shape in their aqueducts, bridges, and enormous amphitheaters. But you might be more familiar with its common names: the arch or the dome (which is essentially an arch rotated around its axis).

Eggshells get some of their strength from their unique mix of hard crystals (calcium carbonate) that are held together by flexible organic material (called a protein matrix). But much of

the strength of the egg comes from the shape itself.

When a heavy weight presses down on an arch or dome, the force moves uniformly down the sides toward the base. The lack of angles or corners means that no one spot must handle the whole load. So hens can sit on their eggs with the arched end pointed up because the weight gets distributed evenly. The same is true when your hands push on the ends.

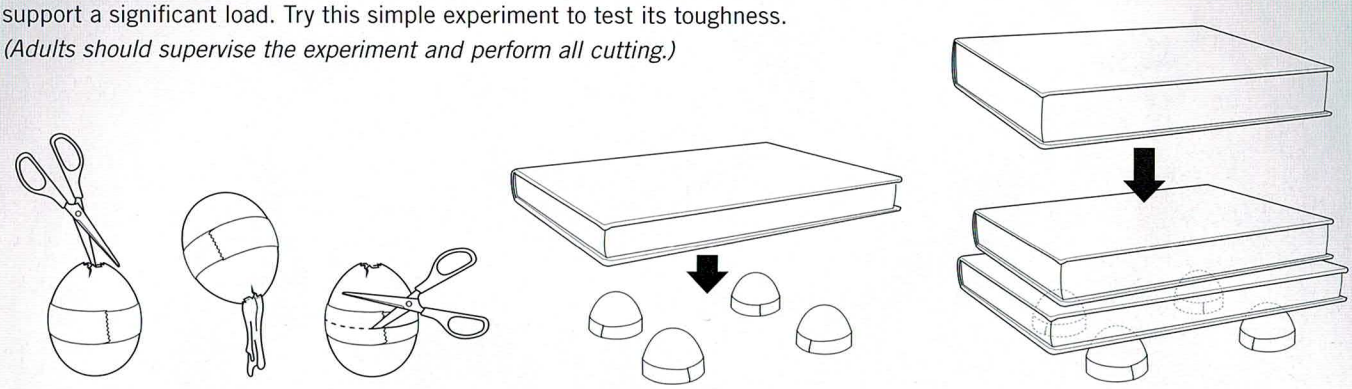
For this reason, arches and domes pack an architectural punch. They can enclose a great deal of space without needing internal supports, and they can span large distances without collapsing under the strain. (Try the experiment below.)

God built amazing strength into the eggshell's shape to resist pressure from above—and yet it's so delicate that a chick can peck its way out, and cooks can easily crack it open. Think about that the next time you pull a lowly egg carton from the refrigerator. There's more inside than you might think! ■

John UpChurch *serves as the editor for Jesus.org and is a contributor to the Answers in Genesis website. He graduated summa cum laude from the University of Tennessee with a BA in English.*

see for yourself . . .

Because weight is distributed evenly, the dome shape of the eggshell can support a significant load. Try this simple experiment to test its toughness. *(Adults should supervise the experiment and perform all cutting.)*



(A) (B) (C) (D) (E)

MATERIALS

4 eggs

Painter's tape or masking tape

Sharp scissors with a pointed end

Several large books (such as textbooks or dictionaries)

Towel

Bathroom scale

STEP 1—PREPARE THE EGGS

(A) Wrap tape around the middle of each egg. (The tape both prevents the eggshell from cracking while you cut it and helps to keep the edges smooth.) Poke a fairly large hole in the pointed (smaller) end of the eggs.

(B) Drain the contents of the eggs.

(C) Insert the scissors into the hole you made, and then carefully cut up toward the middle of the egg. Now make a horizontal cut around the middle of the eggshell. Discard the smaller end. Make sure that the edge of the remaining shell is as straight as possible and that it has no cracks. (Don't peel off the tape because that could rip the shell.) *Note: Make sure all the eggshell halves are as close in height as possible.*

STEP 2—STACK THE BOOKS

(D) Smooth the towel out on a flat surface. Place four eggshells on the towel, with the curved end up. Form a rectangular shape that's slightly smaller than your largest book.

(E) Starting with the largest book, stack one at a time on your eggshells until one collapses.

STEP 3—WEIGH THE BOOKS

Weigh the books to see how much weight your eggshells held. (A boy or girl weighing up to 40 pounds [18 kg] could actually stand on the shells without breaking them, if the eggs were cut perfectly and the child's weight were evenly distributed on the shells!)

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GOD'S WONDERFUL DESIGN FOR EGGSHELLS

Cycle 4, Week 24

Key Verse:
The earth *is* the Lord's, and all that therein is; the world and they that dwell therein.
Psalm 24:1

Getting Ready

1. Bring:

   - "God's Spaceships", from *Answers Magazine*
   - "Walking on Eggshells", from *Answers Magazine*, Jul–Sept, 2011 (48–49)
   - Several large books such as textbooks, encyclopedia volumes, dictionaries (Robyn has encyclopedias in her room you can use!)
   - Bathroom scale
   - Towel
   - Optional: pictures of different kinds of birds ☺
   - "Make a Toilet Paper Bird Feeder", from *Answers Magazine*, Jan.–March, 2021 (*Kids Answers* 5). (One for each family.)

2. Supplies Captain will bring:

   - Dozen eggs (extras in case things don't go right)
   - Sharp scissors with pointed tip (like small sewing scissors; they'll get messy)
   - Painter's tape

To Start

1. Recite Key Verse.

2. PHILOS'OPHY, noun [Latin philosophia; Gr. love, to love, and wisdom.]

   1. Literally, the love of wisdom. But in modern acceptation, philosophy is a general term denoting an explanation of the reasons of things; or an investigation of the causes of all phenomena both of mind and of matter. When applied to any particular department of knowledge, it denotes the collection of general laws or principles under which all the subordinate phenomena or facts relating to that subject, are comprehended. Thus, that branch of philosophy which treats of God, etc. is called theology; that which treats of nature, is called physics or natural philosophy; that which treats of man is called logic and ethics,

or moral philosophy; that which treats of the mind is called intellectual or mental philosophy or metaphysics.

The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works, and to render our knowledge of both practically useful and subservient to human happiness.

True religion and true philosophy must ultimately arrive at the same principle.

2. Hypothesis or system on which natural effects are explained.

3. Reasoning; argumentation.

4. Course of sciences read in the schools. (Noah Webster's 1828)

Intro Quick Extra Article

1. Read "God's Spaceships".

Article/Demonstration

1. Read "Walking on Eggshells", by John UpChurch; perform demonstration as described.

Extra

1. Give out copies of "Make a Toilet Paper Bird Feeder" for them to do at home, just for fun. ☺