Wonders Track

Deserts and Strange Wood !

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Before you begin, ask for your piece of wood for this Mod.

This is a fun piece of wood! CWS has taught science to over 10,000 kids. NO ONE has ever guessed what this is. You try.

This is part of a cholla cactus. We call it a cholla skeleton. The cactus is often referred to as "jumping cholla,"...and boy, is it a pain. Visitors to Cali deserts are often unaware of its devious ways. The slightest brush with the cactus and a piece is off the cactus and onto you...and the needles' hooks get the needles further into your skin. Yeeoowch!

Cholla has a very amazing skeleton. If you walk through the desert and see a whole bush of it, it's quite a sight to see!

Cholla skeletons illustrate A VERY Important principle of science which we will cover in some detail here. But first, let's look for a minute at deserts.

Desert Stuff–Leaves

I met some people from another state which has bigger deserts than California. They told me how much they dislike the desert. I was surprised; there are a whole lot of great things there if you know where to look!





Desert leaves

We talked about leaves on plants in the desert. **U Think:** What are some characteristics of desert plants' leaves?

Because of the great heat that is constant in summers in many

deserts-and a general lack of water-the leaves of most desert plants are usually small, light-colored – even white sometimes – and some are hairy. All these features help the bushes and trees retain water and survive.

U-Think: Why does a small leaf help a plant to hold onto its water better than a larger leaf? When you someday go to visit a jungle, you will often see leaves that are very big and darker green. Why would a desert plant have smaller, lighter leaves, and a jungle have larger, greener leaves? (BTW: Have you ever looked closely at the plants at the grocery store or a

nursery? The ones with large greener leaves are almost always from places where there are jungles, and it rains a lot.)

Again, why are small and light leaves in the desert and greener and bigger ones in the jungle?



Large, flatter leaves are in the jungles to spread wide to catch any sunlight they can coming through the dense canopy of leaves overhead. These leaves have lots of green chlorophyll to catch any sun rays they can. This gives the plants have the energy to make food for themselves.

If plants in the desert, on the other hand, had big leaves like the umbrella-like leaves in trees of the

Costa Rican jungles, the wind would slowly move air over the leaf, and the leaf would act like a big frying pan heating the air hotter and hotter as it crossed the leaf. The scorching hot air would suck the water right out of the leaf!

Huge Palm Leaves

There are some large leaves in the desert, notably huge corrugated palm leaves. They come out of the center of the tree and unfold like a fan, and can reach 6 feet across.





Jungle leaves

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The palm leaf corrugations fold like the letter V. They help minimize the frying pan effect. When wind hits the palm leaf, it flows down the bumpy correlations so it doesn't get hotter and hotter as much as Costa Rican umbrella leaves do. Palm leaves are also super-tough and are coated with wax that helps hold the water in. AND, typically, if you see a palm tree in the desert, you have to go to an oasis where there is water. Oases are quite a gift from God! They are so fun with the beauty of the palms, the pools and waterfalls, and all kinds of amazing hiking trails. You just have to be careful of rattlesnakes.



Corrugations are for strength and air flow. (See corrugations in cardboard.)

Enormous Widening Saguaros

One interesting place to visit is Saguaro National Park in Arizona. It has some of the largest cacti in the world. You can see pictures of some here.

The saguaros don't have leaves. Their trunks are green; they are photosynthetic. That means they have chlorophyll in the cells in the "bark "of the saguaro. The saguaro uses the green chlorophyll in its trunk to make the sugars it needs by photosynthesis.

Here's a fun thing saguaros do. When it rains in the desert, and it is not often, sometimes it rains very hard. I can imagine that if a Grandpa Saguaro could talk when it rained, he'd yell out, "DRINK UP, KIDS. No water for six months! "

> Saguaros do exactly this. They take in the water really fast after it rains through special roots God gave them! When they do, they do the strangest thing. See the pleats around

the cactus? (Enlarge the picture.) The trunk of the saguaro grows wider as the cactus drinks in more water. The pleats get smaller and smaller because the huge cactus is getting fatter! God gave this huge cactus the ability to get fat with water! That's a bit weird. But it works! It takes baby saguaros 10 years to reach a towering one-inch high, but they grow to be 50-80 feet high, and some live to be over 200 years old! THAT IS A LOT OF REALLY HOT, DRY SUMMERS TO MAKE IT THROUGH! Water fatness must do the trick!

Jackrabbits and You

Desert leave

One more quick fact about life in the desert. Animals can often turn their ears to hear sounds better. You can do this too, by using your hands. YOU MUST TRY THIS AND USE IT FOR THE REST OF YOUR LIFE. We call it "deer ears."

When you are out hiking by a stream and you can barely hear it because it is still far away, cup one hand behind each ear, like in the picture below. Aim your hands toward where you hear the stream coming from. You will hear the stream much better, Lift your hands on and off the back of your ears, and you'll hear the sound of the stream go loud and quiet, loud and quiet. Your hands will act like amplifiers to the sound just like big ears do.



ears!

Jackrabbits are desert rabbits which can't cup their ears, but God has equipped them with some really big ears. They hear amazingly, and they also cool themselves with their

When they get hot, their ears become thermoregulation coolers. Their brain expands the capillaries in their ears, and the blood going through them is cooled by the wind. Then the cooler blood goes inside their bodies! Good grief! We learned that God made a moose's antler a sound amplifier. Now we're learning that God uses ears as air conditioners!





A saquaro cactus can grow over 50 feet tall!





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Watch this video now. It's about the Toucan and how God cools him! Toucans live in the forest where it is often hot. but there is also a lot of moisture in the air, so wet evaporating doesn't cool a whole lot of animals there. So God does the next best thing. You won't believe how a toucan cools himself! **BILL COOLED TOUCANS**



Why does the cholla wood have holes in it?

Think about the following. Weight is critical in animals. When I was 20 years old, I found

a book that I loved called "Bone Engineering." It told about amazing ways bones are built to be able to handle stresses that are put on them. Later I learned that bones can detect electricity and can build themselves stronger in ways that they need. Scientists examined a professional tennis player's serving arm and found that the arm bone was made stronger in a circular pattern like a barbershop pole!



Struts in hollow bird bones make them lighter and strong.

Beach-walking Discoveries

This helps the bone with stresses that affect it when tennis players serve. Only God could design bones to figure out how to handle things like that!

We've learned a lot through the years that these bones that strengthen themselves in the right places are also ingeniously designed for weight. God has designed our bones and the bones of His animals perfectly so they are not too heavy.



If you make a rocket too heavy, it won't get into outer space. If a critter is too heavy, it won't walk, run, or fly right.

I was walking along a local beach a couple of years ago when I made the greatest little discovery for our science camps. I found a 2-foot-long skinny bone about as thick as 3 pencils. It is amazingly light. I had no idea what it was then I noticed a long row of bone bumps on it about 1/4" high and spaced one inch apart. Ah! I knew what it was in a moment. It was a pelican wing bone! Wow! I love this bone! It's great to show, and it's great to bonk the kids when I need to get their attention! (Just kidding!) U-Think. What are the bumps for?

They are reinforced bumps so the pelican's feathers can grow into bone! I guess God knew His pelicans needed some extra bone glue so a storm doesn't blow all His bird's feathers off! A featherless pelican wouldn't do anyone much good!

Bird-Light Bones

On Day 4 of Creation Week, God created all the birds of the world. There is a whopping amount of beauty in birds and a whopping amount of engineering. Birds fly in a thousand different ways, and every bird that flies has to be light enough to get lift off, or that bird will go



nowhere.

The ruby-throated hummingbird goes on a 500-mile migration path across the Gulf of Mexico. Can you believe that? A tiny hummingbird flies 500 miles nonstop! Before it leaves on its momentous journey, it



A 500-mile migration across water. Wow!

hunts and hunts trying to find enough nectar to build up its fat reserves by 2 ounces. Without this fat increase, the little hummer won't be able to complete the journey, and it will fall into the ocean and die.

Making it across the Gulf is such a big deal that the night before, God has him fall into a deep sleep called torpor. It's like hibernation where his breathing almost stops and his heart, too. He is so "out" that as he sits on a branch, he won't wake up even when touched! God knew His little bird would need every bit of energy it could get to make the trip!

Do you think God overlooked the hummer's bones? Do you think hummers have strong, lightweight bones, too? You bet! The hummingbird's bones are hollow with struts, just like the pelican's bones are. If his bones were too heavy, down he'd go!

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So light bones for birds are critical, and God accomplished this as my snazzy pelican wing bone proves. Are airplane wings like bird bones?

Light Wings Are Critical!

U-Think: Are airplane wings solid, like a piece of wood is solid? If they are not solid, what do you think they look like inside?

Airplane wings are not solid. They have braces called struts in them, just like bird



bones do. These are special braces that make the wing light but strong. If you had a little plane with solid metal wings on the runway in our little town, you'd run it down the runway and never get it off the ground but instead run willy-nilly in



the field at the end of the runway! YOU NEED LIGHT WINGS ON PLANES!

Bird bones and plane wings are hollow inside. Both have struts, with bird struts being in the bones. This makes them both strong and light. God thought of it first, and His struts grow into place. Impressive!

One Weird Skull!

Here is a shocker. **U Think: What kind of a skull is this?** There is a BIG hint in the middle of the head. Think hard about this one. If you get it right, I think you oughta be able to stay up later tonight!

Believe it or not, this is an elephant skull.

Holes, Holes Everywhere!

This is a very odd skull. Someone decided to scrape away the outer bone of the skull to expose what you see here. **U-Think:** What in the world are all those holes? Every elephant skull has them. What are they for?



They are called sinuses. The bones around them make the skull stronger. If the skull was hollow and something hit the elephant hard like a charging elephant, the elephant's skull would cave in. These bones around the sinuses keep the skull strong.

Is there another reason to have these sinuses? We have some in our heads. God uses sinuses in us for various things, including helping your voice to sound like you. But elephants don't have voices like people do. What else could the sinuses be for?



U Think: If you get this, tell your mom and dad we highly recommend a milkshake! This takes a bit of cross-wiring. Why did God put all these sinuses in the elephant's skull? Think!

To reduce weight! Can you imagine holding up a HUGE elephant head all day long? If the skull were solid bone like the bones in a hippo's leg, elephants would walk around all day long with their head down! The regal majestic elephant would be no more; they'd all be head-hangers!



And..another question. If you get this one right, send us a note! No one has ever got this one right.

U-Think: What is that weird bone for in the middle of the elephant skull–two reasons? This is comical. An elephant's nose weighs almost 250 pounds. Would you want to hold a 250pound nose in front of you all day long? God knew that would be hard on His elephants, so He made them a nose hanger. (You should have laughed!) But it's true. The nose-hanger protrudes out just enough so big Elle's BIG nose will hang out from her body. Can you imagine all the elephants of the world dragging their noses on the ground? We'd have to put them all in slings! U-Think: What else is this long bone used for? To hold the elephant's tusks! The bone has a double purpose! **Before we look at why God put holes in the cholla cactus skeleton, let's look at a verse.**

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A Wood Surprise!

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Romans 1:20

God gave His elephants all they needed to be quite fun and magnificent. He also did this with His other animals. Whether it be the big nose of an elephant, the gigantic beak of a toucan, the big feet of a kangaroo, or the big tails of His squirrels, everything helps His animals and makes them a delight to us. Romans 1:20 says that God's creation shouts about God's reality. Here's how.

The Mistake of Accident Thinking

Some people make the mistake of believing in evolution's mistakes. They believe all of God's wonders were made entirely by mistakes happening in the DNA CODE, and all the mistakes got all the right things on the right animals by accident. Some think

that this is how the 40,000





muscles in the elephant trunk came about, enabling the elephant to pick up a penny with his trunk-or a 500-pound log so heavy that men cannot lift it.

This is a mistake, a big big one. It just isn't possible. THE CODE that is too small to see makes a cute baby elephant from plants the momma elephant eats. THE CODE grows cute baby elephants into powerful big elephants. THE CODE is a miracle of God's love and engineering. Could the nose-holder bone appear by accident and, by accident, be just the right size to hold out Elle's nose he right amount? Could all the sinuses in an elephant skull happen by accident?

The Importance of Romans 1:20

Read this verse that we just mentioned: "For since the creation of the world God's invisible qualities—His eternal power and divine nature—have been clearly seen, being understood from what has been made...."

This verse in Romans 1:20 says we know God's power by what He made. Great mountains like the Matterhorn in Switzerland show this. The stars do also, some of which are a million times the size of our sun. These mighty, amazing things show the glory of God–and His infinite power.

And Romans 1:20 also says that we know God's nature by what He made. What is His nature? It's what He is like.

U think: What is the most important of all the attributes of God? His wisdom, His diligence, His honesty...or something else? All these are important, as are all the other qualities of who God is. But the Bible tells us what is greatest. What is it? Love. The Bible even says, "God is love." (1 John 4:8)



1 Corinthians 13:13 reads, "But now these three things abide: faith, hope, love; but the greatest of these is love." We see God's love through what He made. God made fun animals like the elephants so all of us could enjoy them and be delighted. He also made them so we could understand that He loves us. The fun of God's animals like dogs and cats and dolphins and horses–all shout, "I, the One who made you, love you!"



We'll talk about animals like the lion in a later Mod. Even lions are a

gift of God's love...It's amazing why...

Holes and Cholla Skeletons

And our last thing. Back to where we started. Based on all we have said about bones and skulls, WHY ARE THERE HOLES IN CHOLLA SKELETONS?

And the answer is...ta ta ta (trumpet sound!) Probably not a lot of people in the whole world know for sure why the holes are there, but our best guess is that the holes are for two reasons. The first is weight. Cactus grows and there is not a lot of water to grow a lot. A cactus can save a lot of energy by not making so much wood inside. Our second guess is for the easy release of the cholla's cactus branches. Yeeooowch! But this helps the cactus survive when so many animals want to eat it for the water in it! **That's it! Now on to a few fun activities!**



CrossWired Science	EXPERIMENT JOURNAL NOTES	Student: Date:
Experiment:	Cactus Collection and M	lore! 30 min
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1.Saguaro National Park Video Watch for 11 minutes.(After this it dips a bit into evolution.)

2. Identify Desert and Jungle Leaves

Visit a nursery and a grocery store. Find 15 leaves from the jungle and the desert in each location.

3. Super-Botany Collection

It's nice to have a box to throw things in like the Cholla Cactus skeleton. You could have treasures in it like drift wood, rocks, pinecones, bark samples, wood types, shells, seed pods, pine needle types, pressed flowers, etc. Get a Botany Collection Box! Hobby Lobby is a great place to pick one up.

4. Cactus collection

Start a cactus collection!

Gather or buy 2 cactus plants begin your collection. If the weather is bad where you live, get smaller plants and put them inside in a window sill.

Note the beauty of the spines and the shape of the stalks. Some are quite amazing! We are always amazed at the geometric design God has placed in cacti and succulents.

Note, too, how photosynthetic the trunk of the cactus is and if it grows seasonal leaves or if your plant only relies on the chlorophyll in its stalks.

QUESTIONS

- 1. What does the saguaro do to save water for hot days?
- 2. What are the compartments in elephant skulls called?