

Lizards & Polarity & More!

pg.1

Sometimes you can see what God makes, and it creates a great sense of wonder in you that helps you realize that God loves to do new things, creative things, wonderful things, things that have never been done before. I had this happen one day in Costa Rica.



Costa Rica Surprise!

A group of us stayed in a small, quite beautiful town with a high school, pizza parlor, skating rink, ice cream store, and more. We'd taken some high school Costa Ricans out to pizza and ice cream. Afterward, we loaded a bunch in our car and headed out to the jungle for an exciting time, swinging on vines and jumping in the river. We were eager to share the Lord with them, and there's nothing we like more than taking teens into God's outdoors and having all kinds of fun with them, and sharing the Lord with them in the happiest of contexts.

In the early morning after our jungle adventure, I took a walking devotional time with the Lord through the outskirts of the village when I got a God-treat that took me completely by surprise.

Off a village road, I spotted a little stream and decided to investigate. As I approached, a long lizard popped his head out from under a bush. The little guy piqued my curiosity. I tried to sneak up on it when all at once it did something I'll never forget. It bolted toward the water, then went up on two legs and ran all over the stream! I was shocked! Then I laughed.

I realized I just came upon a basilica lizard—also called the Jesus lizard—that loves to run on water!



Why Did God Create What He Created?

Think about this. God made a lizard that runs on water! Isn't that a little bit nutty, a little bit over the top? Why in the world does God— who makes stars that are a million times bigger than ours—make a water-running lizard???

I absolutely know why. It's because He loves to fill us with delight. He loves little boys and little girls, and He loves moms and dads, and He loves older people. GOD LOVES TO DELIGHT PEOPLE AND PUT BIG SMILES ON THEIR FACES AND SWEET THINGS INTO THEIR HEARTS. Let's change topic for a minute to talk about a unique way reach students for Christ.

A Family Camping/Hotel-ing Ministry To Internationals

God loves to do NEW things, majestic things, exciting things, awesome things—very, very fun things, too. God opened a door for us 35 years ago to do something hugely creative for us through some very dramatic miracles. It involved launching a ministry bringing Japanese teens and collegians on a homestay to the US. Here they spend 3 weeks with our families, and part of each homestay is all about going into God's creation with 20 or so young people and 60 Americans from our families.



Lizards & Polarity & More!

pg.2



Bryce Canyon is spectacular !

Our 9-day trips to places like Yosemite, the Grand Canyon, the High Sierra mountains, Zion National park, and much more have been extraordinarily fun and beautiful. They have been adventures like none other and are greatly effective in showing the kids so much about the Lord. The program was a miraculous gift of God's new things to us that astonished us 35 years ago and does to this day. This year we're heading to a 600-mile trip through the wilds of Utah. We

get to show the kids incredible things that God created for us to enjoy! We haven't seen any basilisk lizards lately, but it seems like we've seen just about everything else!

How's That Lizard Do That Anyway?

Back to our lesson. There's a decent slice of Science in being able to understand what God how God made it possible for His speedy lizard to run on water. Here's the scoop, then we'll take you into some fascinating experiments.

Water is made of 2 gases, one that explodes and one that helps the other to explode even more. (And we drink it. Wow!) Two hydrogen atoms are brought together, and one oxygen. They combine, and water is made. The chemistry symbol for water is H_2O ; the 2 means there are two hydrogens, and the fact that O (Which is the atomic symbol for the gas oxygen) has no number means that you only have one atom of oxygen. When you put the three atoms together, they make water, AND they do something weird that is critical to life on earth.

Electrons That Do Something Strange That All Life Depends On!

Everything is made of atoms. Atoms are like legos in that they make things, But atoms don't just make a few things like Legos do; atoms make everything from a grain of sand to a star to a hippo to you. Even legos are 100% made of atoms!! So is your nose. Really. Everything everywhere is made of atoms!



Atoms have electrons circling around them insanely fast. Electrons are atom parts that are like little sparks. This is what is important for understanding the basilisk lizard: electrons have a **NEGATIVE** charge. Protons—other atom parts – are in the middle of the atom, the nucleus. Protons have a positive charge The important thing here, however, is that electrons have a negative charge. Got it?

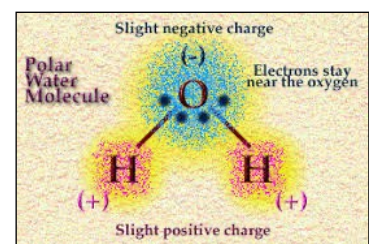
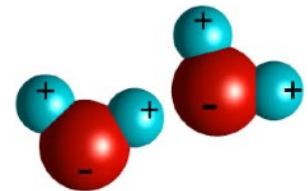
In a water molecule, the electrons spin around the atoms of hydrogen and oxygen. But they are like little kids; they wander. Because oxygen has a bigger nucleus, it is the bigger atom when compared to shrimp hydrogen (Hydrogen is the smallest atom in the universe—IT IS tiny!!!).

The electrons spinning around the hydrogen atom get pulled by the bigger oxygen, and they spend extra time hanging around the oxygen atoms. Guess what this does? (and this is critical for swimming and for the basilisk lizard's running and for life— and a million other things!) Your existence depends on some very tiny electrons in water that wander from the hydrogen atom to the oxygen atom.

When the hydrogen electrons are drawn to the big oxygen atom, they give the oxygen atom a charge. **U-Think:** What charge do the wondering electrons give oxygen? **Negative**. Because these wandering electrons move away from the hydrogen, guess what atom has a slightly **positive** charge? The hydrogen! This makes for the miracle of water. Let me explain.

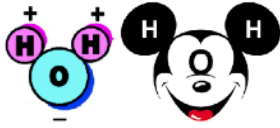


Joe, one of our sons, married Hanna, one of our students!



Lizards & Polarity & More!

pg.3



Water molecules look like Mickey Mouse.

Positive attracts negative. I don't think anyone on earth—or even Einstein knows why—but it does.

U-THINK: Because hydrogen is slightly negative and oxygen is slightly positive in water molecules, what do you water molecules do to each other when water molecules are all around each other? Think Think. **THEY ATTRACT EACH OTHER!** This is what is so important...and quite amazing about water.

Stop here for a few minutes and do the Nickel Drop experiment below.

The Polarity of Water's Effect on Water

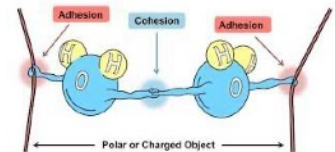
Did you do it? Ok, good. Then you have seen the effects of the polarity of water. Let me explain. First, you have to realize that a water molecule looks a little like Mickey Mouse's head. The hydrogens are like his ears, and the oxygen atom is like his face.

A teaspoon of water has a sizable amount of molecules of water in it... mmmmm...ahhh..Would you believe more than all the sand grains on earth? That is not even possible to comprehend, but it's true.



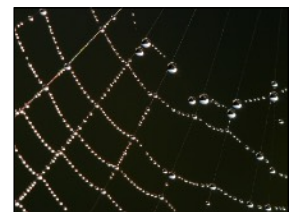
Whenever there is water, all the H₂O molecules are right next to each other. The positively-charged hydrogen Mickey Mouse ears of one molecule are attracted to the negatively-charged big oxygen atom of another molecule. In science, this is called a "**Hydrogen Bond**." This causes the molecules to stick together. Remember how your drops on the nickel began to make a water bubble?

This water bubble on the nickel is held together because the hydrogen and oxygen atoms are weakly attracted to each other. This is because water is **POLAR**, which means it is charged on opposite ends.



Cohesion & Adhesion

In this experiment, you'll do things like make needles float on water. You are able to because water "sticks" to itself. In science words, this is called cohesion...and we'll be exploring cohesion in the area of surface tension, which is how the surface of water is especially good at making a layer that sticks to itself. You'll also learn about something that can break the power of surface tension. Adhesion sounds like cohesion, but it is different. It is when water sticks to other things. Spiderwebs and grass blades with water droplets on them are examples of water sticking to other things.



Why Water's Polarity & Surface Tension Is Reeeeeaaaaaalllly Important!

How exactly is all of life on earth depends on the polarity of water and how water sticks to itself in cohesion? Glad you asked!



Imagine if you had an Anti-Polarity Gun that could zap away the polarity of water molecules. Your friend could be swimming in a pool, floating on his favorite inflatable seahorse, and you sneak up and shoot. Blango! All the attraction of water molecules to each other stops.

U-Think: What will happen? Here's a hint. When you boil water in a pan, what happens?

Here's the answer. When you boil water in a pan, the molecules speed up. Because they speed up, they break the hydrogen bonds between each other little-by-little. AND, little-by-little, they jump away from the water molecules in the pan and hit the road to realms unknown as they float away from the pan and up into the atmosphere.

Lizards & Polarity & More!

pg.4



If you suddenly zapped away the polarity of every water molecule in the pool, it'd be a gigantic POOF!!! And all the water would explode into steam instantly. Your poor friend would CRASH on the bottom of the pool because the water would be all gone!

Can you imagine if you turned your de-polarizing gun on a lake? Or the ocean? Instantly it'd one HUGE bye-bye!

The polarity of water is essential for a gazillion reasons. One HUGE one is so we can have liquid water. If there was no liquid water on earth, there would be no possibility of making it to tomorrow morning still kicking! Liquid water is essential to life!

Wrap-Up

The basilisk lizard has hairs on the bottom of his feet that help hold him up on top of the water by using the surface tension of the water. But, if he stopped running, he'd sink just like the rest of us!

We have several videos we want you to watch. The first couple are on the basilisk lizard. Next is one with NASA. The polarity of water causes water to stick to itself.

U-Think: What do you think will happen when astronauts spill water in the space station? Watch the video and see.

This third video is especially astonishing—if you really understand what is going on. I'm not going to say anything. I just want you to watch it and see if you really understand how cat and dog drinking is dependent on the polarity of water...both *adhesion* (water sticking to itself) and *cohesion* (water sticking to other things.) After you are done, head to the experiments!



Jesus Lizard

[Basilisk lizard runs on water to catch a butterfly](#)
[DOG SLOBS AND CATS](#)

[Peanut Butter and Jelly in Space](#)
[Moving Water in Space](#)
[More Surface Tension on the ISS](#)
[Pizza Night!](#)
[Life on Station](#)



Wouldn't it be fun to visit the space station?!





Experiment: Polarity Wonders! pg.1 30 min

SUPPLIES:

- ☐ Whole Milk
- ☐ Pie tin, or a piece of kitchen glassware
- ☐ Food coloring
- ☐ Soap
- ☐ A sewing needle, paperclip and spool of thread.
(Paperclips are in the Pak)
- ☐ A couple cups or bowls. Bowls are better



PROCEDURE:

1. Nickel Drop Presentation



Before your family or friends, put a nickel on a flat surface in front of them. Ask them, "How many drops can I put on this nickel before it spills over?" (**U-Think:** What is your answer?) Using a pipette you have from the Pak previously (or an eye dropper), begin adding drops gently to the center of the nickel from a height of about 1/2". After you have a decent bubble, begin a little lesson on the polarity of water and how it makes cohesion happen. Talk about some things from your Concept Pages, like the "Anti-Polarity Gun" (it's make-believe, but tell them what would happen if it were real), or the basilisk lizard, or something else. Ask, "Does anyone want to revise their guess?" Continue until the bubble breaks. Rehash your lesson briefly and say, for example, "The cornea is the outer clear part of your eye, the part where Lasik surgery occurs. Have you ever seen the cornea of a cat's eye?"

Look at how much the bubble looks like it! And, take a bow! Good job!

2. Milk Swirl

Get a pie tin, any larger dish or piece of glassware. Pour in enough barely lukewarm whole milk in it to make it 1/4-1/2" deep. Add 10 drops or so of food coloring towards the center (vary the number.) Add a few drops of soap in various places. (Use your finger and let it drip off, a toothpick or a cotton swab.) What do you see happening? Add more drops slowly until the action stops. Try it again and position the drops and the soap in different places. Vary the temperature of the milk from ice cold to very warm. What do you see happen with the different temperatures of milk?



U-Think: Why is this happening, and why is it happening differently at different temperatures?

The water in the milk is attracted to itself by cohesion. The soap breaks this "bond" as the "destroying soap" moves through the milk. It moves the milk because it destroys the water's hold on itself. The process speeds up when the milk is warmer because heat is the movement of molecules, and just like diffusion in hot water is faster than in the cold, the movement of the milk-water destroying polarity is faster in hot milk.

When water "bubbles up" on fabric, it is due to its polarity





Experiment: Polarity Wonders! pg.2 30 min

SUPPLIES:

- ☐ Whole Milk
- ☐ Pie tin, or a piece of kitchen glassware
- ☐ Food coloring
- ☐ Soap, Pepper
- ☐ A sewing needle, paperclip and spool of thread.
(Paperclips are in the Pak)
- ☐ A couple cups or bowls. Bowls are better



PROCEDURE:

3. Amazing Floaters!

You will need several cups of water for this experiment. You cannot use the same cup without it being entirely clean of soap.



Paperclips

Bend your paperclip into the shape below. Place your small paperclip onto it crossways and gently lay it on the water's surface in your cup. It should float. If it doesn't, try again. You can try with the large paperclip, but it is much harder. Place a drop of soap in the cup. What happens? (Note: You can use a toothpick or q-tip to add a drop of soap.)



When water "bubbles up" on a leaf, it is due to its polarity

Sewing Needle

Try the same with a sewing needle.



< The bent paperclip serves as a handy holder to lay things gently on the surface of water.

Thread

Tie a 4-inch piece of thread into a circle. Put it into your bowl. Let the circle close. Add a drop of soap to the inside of the circle of thread. What happens?

Pepper

Sprinkle pepper flakes over the surface of the water in a bowl. What do you see? **U-Think:** Why?

The pepper spaces itself evenly because of the polarity of water that causes cohesion which spaces the pepper. Just as a water droplet becomes round in space to equalize all the forces acting on it, likewise the pepper spaces itself evenly for the same reason. Add a drop of soap in the middle. What happens?

U-Think: Why?

The pepper is pulled to the sides of the bowl because cohesion is still in effect on the outside edge of the bowl. The inside area's cohesion has been destroyed. **U-Think:** What will happen if you use milk instead of water and add pepper and food coloring, too? (DO IT and test your guess!)

Additional Activity

1. Make a Polarity **Destroying Paper Boat**.
2. Make a Polarity experiment or your own.



You can use a fork as a handy holder, too.

Make a triangle, and add a drop of soap in between

