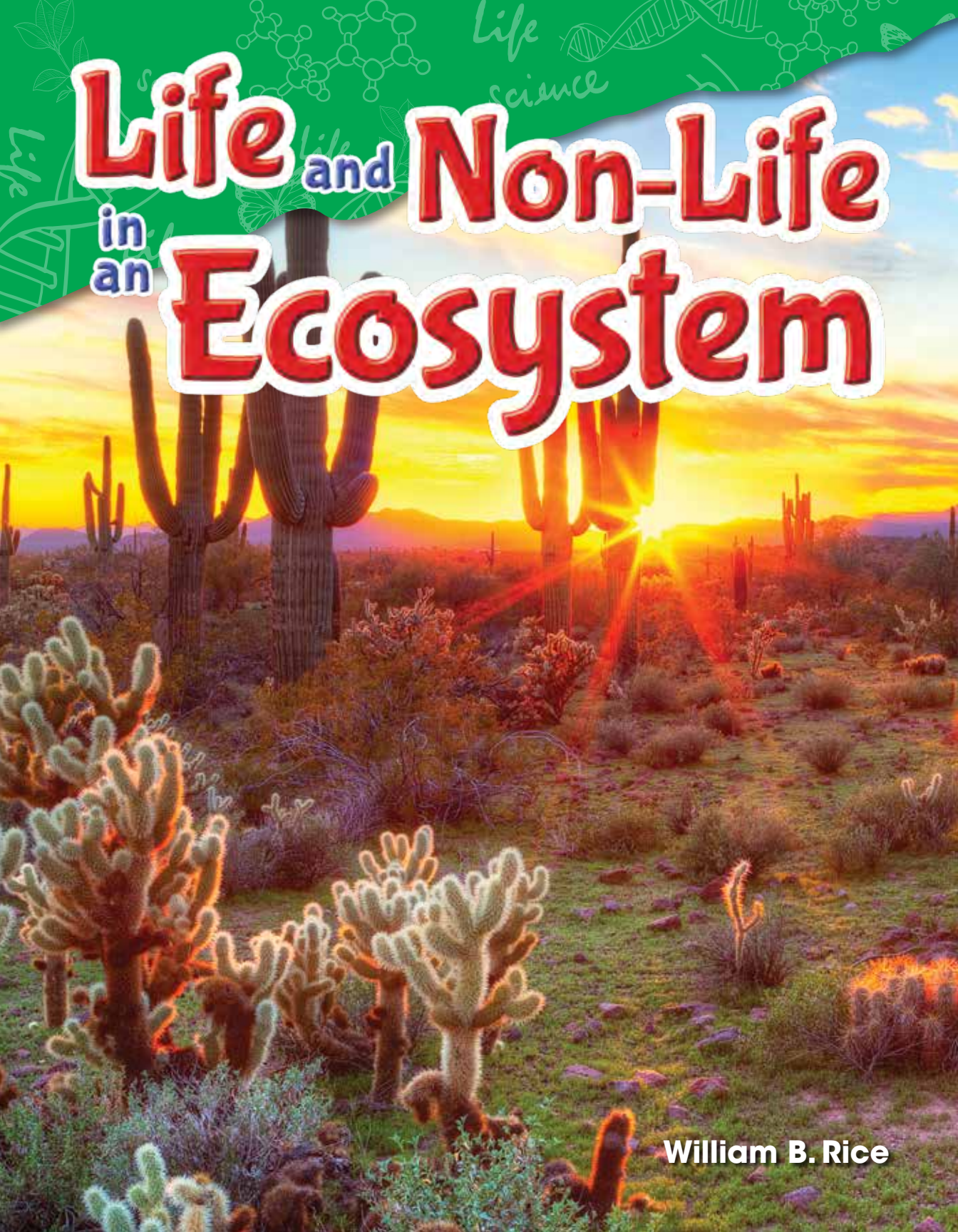
Life and Non-Life in an Ecosystem



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Earth, Our Home

Sure, it's home. But what is it about this place called Earth that makes it as remarkable as we think it is?

Whether you live in a big city, a gentle rural countryside, or somewhere in between, you can see that there is a lot to life on Earth. Take a look at the birds and butterflies. Notice mountains and clouds, rocks and soils, smells and sounds. Notice the refreshing shade under a majestic tree. Notice the elegant smell of a rose on a sunny day and the vibrant smell of the air after it rains. Notice the unique sounds of cackling and cawing crows and the magical sound of a zipping hummingbird. Notice, too, the changing seasons throughout the year.

Life Out There

Many scientists believe that a planet must have plenty of carbon, water, and a few other elements for life to exist. Also, the planet must be the right size and distance from its star. However, we don't know for sure, as we have not found life anywhere else besides Earth.



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Each of these things is noteworthy. But the importance of them is not in their beauty or usefulness. No, what makes them remarkable—what makes Earth remarkable—is the simple fact that on this planet, we have both life and non-life. And in all this vast universe, Earth is the only place *we know for sure* has this combination.

Now *that* is remarkable!

Searching for More

In 2003, NASA sent two robotic rovers to Mars. Their mission was to look around and send data back to Earth. Beginning in January 2014, the rovers began looking for any evidence of ancient life on Mars.



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Developing Life

Earth wasn't always like this. Earth has undergone a lot of changes during its long existence. There was a time when Earth first formed that it was very hot and had a molten volcanic surface. There was no life.

However, over time, Earth cooled. Solid crust began forming. Liquid water began pooling. The **atmosphere** had very little oxygen and would not have been able to support creatures that are alive on Earth today. But over time, primitive **organisms** developed. They could live in these challenging conditions. These organisms began changing Earth little by little. They particularly began to change the atmosphere.

Here or There?

What we know about life comes from our studies of Earth. If life exists elsewhere in the universe, we might discover differences between life here and life there. Our definition of life may have to change.



This is what Earth may have looked like about 300 million years ago.

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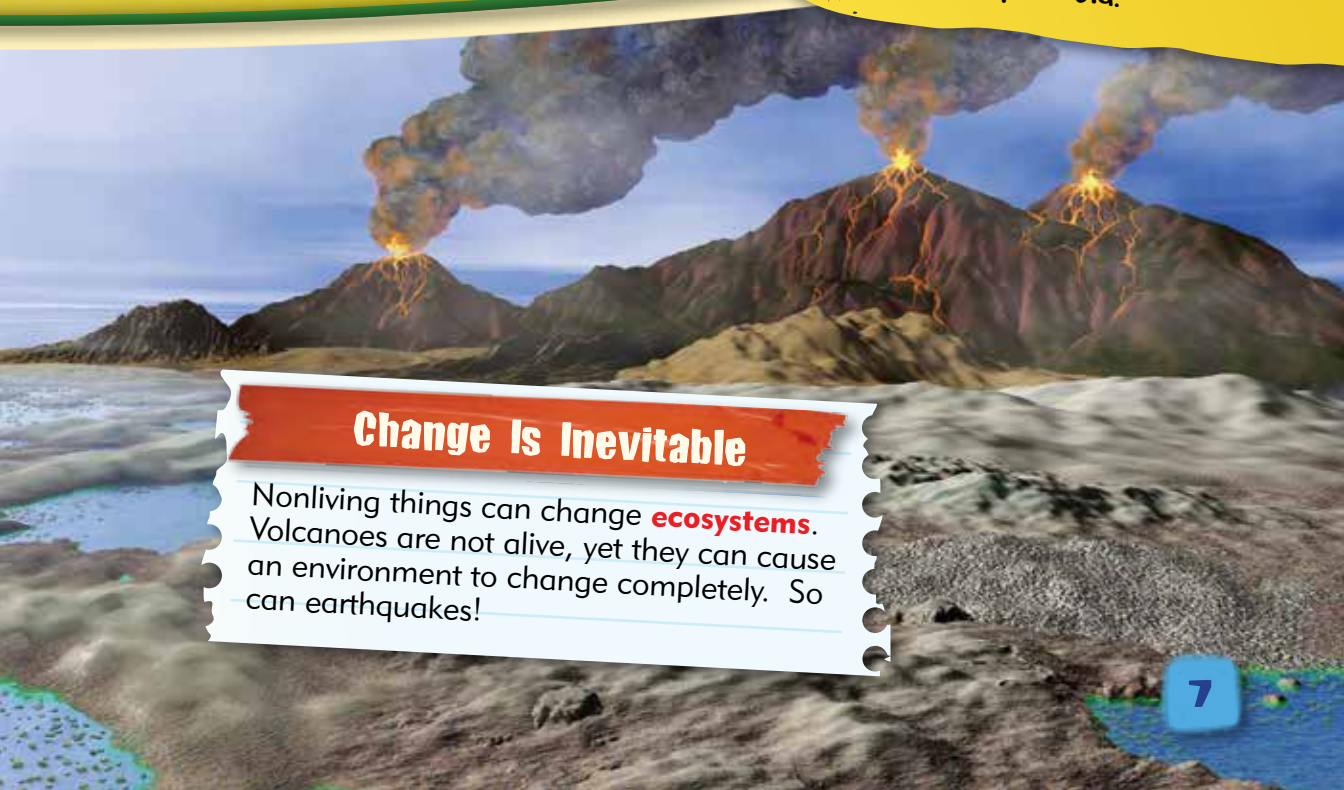
There are many ways this planet could have developed. But the story of how life evolved here includes all the right conditions somehow coming together. That's good news for every living thing on Earth!

What exactly makes something "living"? That is a complicated definition with many points of view. But most scientists agree on some basics. Living things…

- are complex and highly organized in their makeup.
- take in **energy** from their surroundings and use that energy.
- stay in **homeostasis**—balanced conditions internally that stay mainly the same.
- grow and develop.
- reproduce.
- respond to **stimuli**.
- evolve.
- have DNA or RNA.



In 1999, Scientists found bacteria that were 250 million years old.



Change Is Inevitable

Nonliving things can change **ecosystems**. Volcanoes are not alive, yet they can cause an environment to change completely. So can earthquakes!

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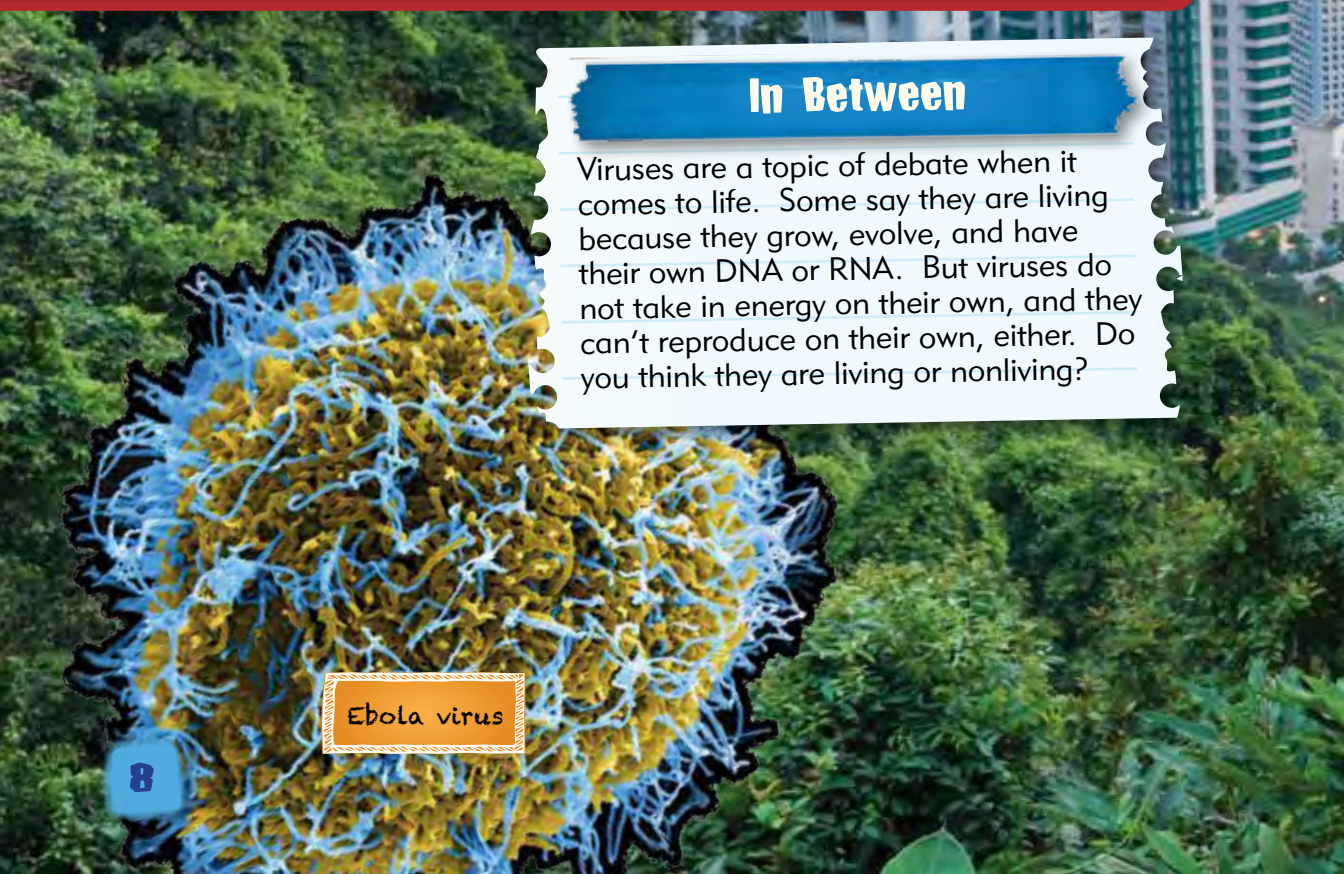
Sometimes the differences between life and non-life can seem fuzzy. For example, there are nonliving things such as crystals that grow and respond to stimuli. But they are not alive. Entire books are written on just the definition of life! And every day, scientists make new discoveries. They understand life a little bit more.

No matter how we define it, we know that life developed on Earth through very particular conditions. What's more, life has affected the planet so that new life continues to evolve! For example, Earth's atmosphere today is what it is because of the life that has populated the planet over time. The atmosphere now is quite different from its earliest makeup. And life has affected Earth's **geology**. Some rocks are made of materials that were once part of living organisms!

Life and non-life in ecosystems affect each other in more ways than we know. Life depends on non-life for its existence. And non-life is changed by the existence of life. Because of this, planet Earth is an evolving system. If we could take a peek into the far distant future, who knows what we'd see!

In Between

Viruses are a topic of debate when it comes to life. Some say they are living because they grow, evolve, and have their own DNA or RNA. But viruses do not take in energy on their own, and they can't reproduce on their own, either. Do you think they are living or nonliving?



Ebola virus

Digging Deep

Even things as small as worms can affect nonliving things. They add air and water to soil. They also break down dead plants and turn them into matter plants can use. Worm poop is actually a fertilizer, which helps plants grow.



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Large areas of plant life help to create an atmosphere that allows animals such as humans to live.

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Think Like a Scientist

How do life and non-life affect each other? Experiment and find out!

What to Get

- 5–6 earthworms
- dark paper or cloth
- gardening gloves
- gardening soil
- large glass container with a lid, such as a bowl or an aquarium
- leaves
- sand
- water

