

NATURE'S LABORATORY

"So the rains that arose from [the sea] return again in rivers."

--Rachel Carson

With the last leaves of fall descending to earth, the crisp winter has settled in. And with winter comes rain. Rain quenches the parched soils of summer, invigorates the placid creeks and rivers, and laces the air with a clean, fresh tang. But for a phenomenon we take for granted as we huddle beneath outstretched umbrellas, even a raindrop plummeting to earth holds secrets.

Rain, also known as precipitation, is defined as a liquid deposit with a diameter bigger than one half millimeter that falls from the atmosphere to the earth's surface. Even so, rain is essentially water. While we usually think of water as the liquid found in oceans, lakes and streams, water can also exist as ice (a solid) or as vapor (a gas). Sleet, hail and snowflakes are different types of solid rain, while fog is a type of gaseous rain.

All of Earth's water is already on the planet and in its atmosphere. No matter its form, Earth's water goes through a cycle vital to life. Rainfall brings most water to the Earth's surface where it enters lakes, streams, rivers and underground water tables, in time reaching the ocean. Along the way, plants and animals are able to take a drink. Eventually, water can either freeze, or evaporate into a gas and move upward into the skies and recharge the atmosphere's clouds. Every year, the continental United States receives enough rainfall to cover the land under 30 inches of water.

Just how much water is there? People's bodies are made of about 70 percent water and there are more than 5.9 billion people on earth. But all of that water accounts for less than one percent of earth's water. Three-fourths of the earth's surface is covered with water. The oceans make up more than 97 percent of the water supply while ice caps and glaciers hold another two percent. The rest of the water is bound up in groundwater, lakes, soil, atmosphere, streams, rivers and life, which includes plants, animals, fungi and other cellular beings.

Some people notice that rain often has a particular smell. Scientists have attributed the smell to two different sources, petrichor and geosmin. Petrichor, the name for the smell of rain on dry ground, is from oils given off by vegetation, absorbed onto neighboring surfaces, and released into the air after a first rain. Geosmin is a particular earthy chemical produced by Actinomycete bacteria known as *Streptomyces*. After hot, dry

weather, *Streptomyces* are blown about the ground, only to be kicked up into the air when it begins to rain. When either become airborne, we are able to smell them in rain.

Have you ever noticed how it tends to rain on weekends, the days you set aside for fishing trips or a family barbecue? Scientists think these rainy weekends occur because of pollutants that build up during the weekdays as people in big cities drive to work and back. By Saturday, the clouds are so full of pollutants and evaporation that they cause rainstorms. This phenomenon has been nicknamed the “Sunday effect.”

Worms too can be affected by rain showers. If you go outside after it stops raining, you might find earthworms crawling across the sidewalk. Although some people have guessed that worms hit the streets to avoid drowning, scientists have offered different explanations. Worms need to keep their skin moist so they can absorb oxygen to breathe. While they could live for a long time in water, they would suffocate in the surface’s dry air. But when it rains, the surface is moist enough that worms can move about and not dry out. Scientists speculate that worms emerge during rain to find new mates or to relocate to different areas. Now we know why the worm crossed the road – to get to the other side!

Hands On: *Adult supervision is a must!* To demonstrate to your children how precipitation forms, try these simple experiments. Bring to a boil a tea kettle filled with water. When the kettle begins to emit steam, hold a frying pan filled with one half inch of water and some ice cubes above the steam. As the gaseous steam hits the saucepan’s cold underside, it cools down and condenses into water drops. When the drops get large enough, they succumb to gravity and fall to earth like raindrops. This same experiment happens in miniature every time you place warm food into a cold fridge. Look under the lid of a tupperware container or a bowl sealed with plastic wrap; the moisture from the warm food should have condensed into water droplets.

To see evaporation in action, fill a glass with water and mark where the top of the water is with a dry erase marker. Set the water on a countertop where it won’t be disturbed. Every day for a week, mark the water level. Each day, the water should sink lower and lower. All of that water is evaporating into the atmosphere and will one day fall to earth as rain. That’s why the water level in a fish tank always drops – the water is evaporating.

Even though worms won’t drown in the rain, they might get squooshed in the street. Take a worm walk and relocate stragglers to some moist soil. Worms are great for your garden, and it’s a wonderful opportunity to study worms.

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