Nice piano music

Hello! It's me, Gretchen. Let's dive right into this podcast. Sit back, relax, and . . .

Lightning strike with thunder

Sorry if that made you jump, but I wanted to get you thinking about lightning. Close your eyes and think about a bolt of lightning. Is it one straight line spanning from a thundercloud to the ground? Of course not. It's much more complicated than that with branches, tendrils, and wisps coming together in a flash of blinding electricity. James Gleick says that "the interesting feature of a lightning bolt's path is not its direction, but rather the distribution of zigs and zags."

Now think about a head of broccoli. Rather than just being one stalk with one head, the broccoli is comprised of many stalks and many heads, getting smaller and smaller until it eventually is one small green nub (that usually ends up stuck between someone's teeth.

Anyway, both broccoli and lightning can be described as fractals. Now hold up. I know you might be wondering, "But what is a fractal? What does that mean, and why does it matter to me?" Hang with me, and keep listening.

So, what is a fractal? A quick google search says that "Fractals are infinitely complex patterns that are self-similar across different scales." (1) No wait, that's a little complicated. Think back to the head of broccoli. From zoomed out, it looks like one head and one stalk. If you zoom in, again it may look like one head and one stalk. But we know that broccoli is made up of many heads and stalks, scaled up and scaled down. The heads and stalks are the self-similar pieces. Beyond the broccoli example, fractals have come to be known as a way to "describe, calculate, and think about shapes that are irregular and fragmented, jagged and broken-up" (Gleick, pg 94).

Quick music break

Fractals can be purely mathematical, but they are also integral in many aspects of nature. For example, think about the earth's surface. From far away, the earth looks like a smooth sphere. As you slowly zoom in, you will notice mountain ranges and coastlines. If you continue to zoom into the mountain, there will be smaller and similar branching patterns. The same can be said about coastal shore lines. Mountains and shore lines both have fractal characteristics! This characteristic is due to the self-similarity of fractals. Now matter how zoomed in you are when looking at a fractal coast, the overall "roughness" or "jaggedness' will look the same.

Think now about tornadoes. Tornadoes are classified by their wind speed and "violentness." They can be a large category 5 and all the way down to category 0. But think about seeing small twisters in a field. Or, on an even smaller scale, think about loose leaves in the street billowing in a circular pattern. This is another example of fractal-like behavior. The same swirling motion is happening at all levels. We don't necessarily classify the leaves blowing in the street as a tornado, but in essence, it's the same motion, just on a smaller scale.

Music

Finally, I want to talk about different fractal structures found in the human body. The circulatory system in the body (the system that pumps blood) is built in a fractal manner. Consider the blood vessels. We have arteries, veins, and capillaries. However, these vessels are really on a continuum of measurement. They are all connected, flowing smaller and smaller, reaching nearly every cell in the body. Looking at a picture of the circulatory system shows the self-similarity of the vessels. Additionally, the lungs and intestines have a similar function. The folding, branching, and ballooning of the cells in these systems allows for the highest capacity of function. Because of the fractal-like nature of our lungs, we are able to get oxygen throughout the whole body. And because of the folds in the intestines, our body is able to absorb all the nutrients we need to survive. In this sense, we should care about fractals because they are a huge part of why our bodies function properly.

Over and over, the world displays this regular irregularity. This variation gives the world beauty and function. While fractals in nature may not be perfectly mathematical, they still give bring insights, complexity, and beauty to the world around us.

Music

I'll wrap things up with a quote from Benoit Mandelbrot, a leading pioneer in fractal geometry. He said, "Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth, nor does lightning travel in a straight line. The new geometry (fractals) mirrors a universe that is rough, not rounded, scabrous, not smooth."

Thanks for listening today. Now go out and look for fractals in the world around you!

Music