

Beautiful math of fractals

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(PhysOrg.com) -- What do mountains, broccoli and the stock market have in common? The answer to that question may best be explained by fractals, the branch of geometry that explains irregular shapes and processes, ranging from the zigs and zags of coastline to Wall Street market risk.

Because fractal geometry is relatively new -- the term was coined in 1975 by the late Benoit Mandelbrot, -- it is a concept not well understood by a portion of the population.

Casey Donoven, one of Montana State University's newest recipients of the prestigious Goldwater Scholarship for excellence in science and math, uses <u>fractals</u> in his research to understand variations in heartbeats.

Donoven, who hails from a family farm outside Kremlin-Gilford, first learned about fractals while a student at Havre High School. At MSU, he



has been studying under math professor Lukas Geyer.

What is a fractal?

A fractal is a geometric pattern that repeats at every level of magnification. Another way to explain it might be to use Mandelbrot's own definition that "a fractal is a geometric shape that can be separated into parts, each of which is a reduced-scale version of the whole." Think of Russian nesting dolls.

Fractals are common in nature and are found nearly everywhere. An example is broccoli. Every branch of broccoli looks just like its parent stalk. The surface of the lining of your lungs has a fractal pattern that allows for more oxygen to be absorbed. Such complex real-world processes can be expressed in equations through fractal geometry. Even to the everyday person, fractals are generally neat to look at even if you don't understand what a fractal is. But to a mathematician, it is a neat, neat subject area.

Why are fractals important?

Fractals help us study and understand important scientific concepts, such as the way bacteria grow, patterns in freezing water (snowflakes) and brain waves, for example. Their formulas have made possible many scientific breakthroughs. Wireless cell phone antennas use a fractal pattern to pick up the signals better, and pick up a wider range of signals, rather than a simple antenna. Anything with a rhythm or pattern has a chance of being very fractal-like.

Why do we hear so much about fractals now?

Actually, some fractals were understood long before Mandelbrot coined



the term. He popularized the concept with computer graphics and pictures of fractal patterns in nature. While, the Mandelbrot set and Julia sets (two well-known fractals) were investigated in the early 20th century, they never left the mathematical/physical "ghetto" until fast computers and good computer graphics came along, which in turn led to a wave of new research and better understanding.

More information: If you would like to learn more about fractals, an easy place to begin is: <u>en.wikipedia.org/wiki/Fractal</u>

Provided by Montana State University

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