

Nature's Fractals

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Ink and pencil

Some of nature's most common features are fractals: patterns that are self-similar at different scales. While fractals that occur in nature do not continue infinitely, there are numerous examples with vastly different scopes. My drawing depicts the fractals within an oak tree at four different scales: the tree, a branch, a leaf, and a section of leaf capillaries. Despite differences in size, the branching pattern appears remarkably similar in each case. I added the structures that constitute fractals using ink, and supporting details using light pencil shading, in order to emphasize the fractal patterns. I decided not to use color, so the focus remains on the line art and complexity of structure.

These beautiful patterns are formed because they are the most efficient form of infrastructure. By branching out repeatedly, trees form a three-dimensional canopy that maximizes surface area, allowing them to maximize their absorption of sunlight while minimizing their use of energy. These branches also allow for the efficient transportation of water and nutrients, allowing trees to grow hundreds of feet tall. Due to this powerful efficiency, branching fractals are the natural choice for many seemingly unrelated structures. Watersheds branch out to maximize the transport of water towards the sea, ice crystallizes into snowflakes to maximize surface area, dendrites branch out to maximize neural connections, and even lightning branches out to maximize the transport of electricity. In fact, humans and other large animals can only exist because our respiratory and circulatory systems utilize these same branching structures. Fractals are an incredible innovation that makes life as we know it possible.