Snowflakes offer a lesson in the study of evolution

Charles Krauthammer's "Nothing's more divine than evolution" (Sunday Republican, 11/20/05) was a wonderful essay on how ridiculous it is "to make evolution the enemy of God."

As he notes, "What could be more elegant, more simple, more brilliant, more economical, more creative, indeed more divine than a planet with millions of life forms, distinct and yet interactive, all ultimately derived from accumulated variations in a single double-stranded molecule (the evolution of DNA)?"

Part of the debate over the teaching of evolution stems from scientific illiteracy in our country. But there is something more subtle at work here too – the immensity of time and changes over time that are necessary for an understanding of evolution. Many people do not have a real enough understanding of this immensity to be able to fathom evolution. In my classes, snowflakes often substitute as a simple concrete analogy for grappling with the many immensities in our universe.

Soon "millions" of snowflakes will be falling. They are "nothing more" than symmetric, hexagonal ice crystals formed as water vapor crystallizes around smaller crystals falling through the atmosphere. Subtle changes in temperature and humidity over scales as small as inches make tremendous changes in the beautiful, delicate shape of the final snowflake. The snowflakes evolve in response to simple differences in their local conditions. (See **www.bentley.sciencebuff.org** for wonderful images of snowflakes and more on the rich scientific study of them.) Universally we cling to the tenet that "no two snowflakes are alike." Despite this we still can't imagine "simple" evolution resulting in such varied, complex life-forms as we find on earth? This is strange irony, based largely on "innumeracy."

A good-sized Nor'easter, the kind that visits us most winters, will deposit as many as 1 hexillion snowflakes on the Northeast. This number, one followed by 21 zeroes, is relatively close in size to the total number of individual vertebrates that have ever lived on Earth! In other words, we should be no more surprised at the natural diversity which biological evolution has blessed us with as we are to be charmed by the lack of twin snowflakes.

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