The Origami Revolution

by Marilyn Loser

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Last week's NOVA broadcast was on "Our Origami World: The Origami Revolution." An online dictionary defines origami as "the Japanese art of folding paper into decorative shapes and figures." Folded cranes immediately come to mind when thinking about origami. But, long before people developed origami, nature was using folding strategies, especially for squeezing large surfaces into small compartments.

According to NOVA, "The way a flower or a bud unfurls its petals or leaves resembles the way a piece of origami might unfold. A couple of simple experiments demonstrate that folded origami shapes, even intricate ones, can be generated spontaneously. This suggests that the patterns we see on display in biology and physics may be a manifestation of some larger texture in our universe."

Frequently cited examples of plant folding are the leaves of the sensitive plant (*Mimosa pudic*), leaves of maple (*Acer*), beech (*Fagus*), and hornbeam (*Carpinus*) trees, and the petals of morning glories (*Ipompea nil*) and cyclamen (*Cyclamen*).

I've never seen the sensitive plant in our area. However, on travels I've seen children squeal with delight as they touch the leaves and watch them quickly fold up. Then, after a few minutes, the leaves unfurl. Scientists believe the folding is a defense mechanism. Of the plants listed, this is the only one that repeatedly folds and unfolds.

Some leaves and flowers are folded inside buds, in a way that not only minimizes space but enables easy unfurling. Beech and hornbeam trees have simple corrugation patterns (accordion-like pleats) that are not simply parallel ridges but radiate in V-shaped arrays from a central stem, like the folds of a fan. Maples leaves have a more complex pattern, involving seven elements of corrugation, according to Dr. De Focatiis of the University of Cambridge.

I don't know of any beech or hornbeam trees in our area, but we do have quite a few maples. This spring, take a look at how the buds tend to unfurl rather than just grow from a small leaf into a larger one. Likewise, watch morning glories in the garden open up. I have a cyclamen on my window sill and love to watch through the day as new blossoms unfold – cyclamens are a house plant in our area of the world.

So why are scientists interested in this relatively new field of studying folding patterns in nature? Much of the research is from a mechanical point of view. The goal is to design artificial deployable structures.

One of the most notable scientists exploring folding is Dr. Koryo Miura who developed a pattern of peaks and valleys that allows a map to be unfolded all at once, with one pull of a corner. The result of his work,

the Miura-ori origami pattern, has been used for solar arrays as well as maps. Scientists at Stanford University's department of aeronautics and astronautics spend a lot of time folding paper and use newly developed computer programs to help them learn how to fold a three-dimensional object into a near flat package.

According to an online British Broadcasting Corporation story, "Packing away parachutes in a form that is compact yet guaranteed to unfold easily and reliably is obviously useful; but there is also a growing demand for sheet-like structures on spacecraft, such as solar panels, telescope mirrors, thermal shields and solar sails. With space at a premium on rocket launches, any way to package these systems more effectively can save money."

While creating an origami crane and other simple animal structures usually involve less than 30 folds, scientific applications often involve hundreds of folds.

It is fascinating what we can learn from nature and expand upon!

"*A morning-glory at my window satisfies me more than the metaphysics of books*." Walt Whitman

"*...a cyclamen that looks like a flight of butterflies, frozen for a single, exquisite moment in the white heart of Time...*" Beverley Nichols in Down the Garden Path