INVESTIGATING ORIGINS

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"Self-Assembling Structures"

One of the most heated topics in the search for origins is the debate over whether the enormous complexity of living beings is the result of accident or design. Recent breakthroughs in nanotechnology may shed further light on the subject. Chemists and engineers have figured out how to make sophisticated versions of children's pop-up books on a microscopic scale, and they have discovered that these structures, according to the journal *Science News*, start off as two-dimensional and then "fold themselves into final, functional three-dimensional shapes" (Cunningham 2006: 344).

According to George M. Whitesides, a chemist and materials scientist at Harvard, self-folding falls under the broader category of self-assembly, in which scientists design structures that build themselves out of specific components. This self-assembly, in Whitesides' words, "is a strategy for making complex, multicomponent, three-dimensional things" (Ibid.). He further pointed out that nature itself is the ultimate example of self-assembly, stating that "you and I are self-assembled objects." From the proteins that make up our cells, to the cells that make up our bodies, he says, "it all comes together by itself" (Ibid.).

Whitesides' entry into the realm of self-folding began with his knowledge of protein self-assembly. Proteins, which are the building blocks of our bodies, start out as chains of amino acids, which then fold themselves into three-dimensional forms. The sequence of the amino acids, and the interactions among them, dictate the final shapes of the proteins (Ibid.).

In an effort to duplicate this process, Whitesides, along with Derek A. Bruzewicz and their colleagues at Harvard, started with a strip of transparent plastic tape only 12 micrometers thick, 3 millimeters wide, and 50 millimeters long. They then placed 100-nanometer-thick diamond shapes made of copper along one surface of the tape. According to Bruzewicz, each copper diamond can be thought of as an amino acid on a protein chain (Ibid.).

The team then crimped the tape between metal combs with zigzagging teeth as a suggestion for how the structure would ultimately self-fold into its final shape. After dipping the tape into solder and then hot water, "the tape had completely folded into its predetermined shape." The team then moved on to a more complex shape that folded into a helix—the very shape of our DNA, the "blueprint" that makes us what we are (Ibid.).

A team at Johns Hopkins University, led by engineer David H. Gracias, has gone a step further by getting two-dimensional patterns to fold into cubes and pyramids. These "containers," according to Gracias' team, might play host to chemical reactions or even transplantable cells (Ibid. 346).

The central point is that these created structures are parallel to the building blocks of all living beings, including ourselves, and they did not come about by accident or random chance, but by the outside force of highly intelligent scientists. In fact, according to *Science News*, "Whitesides says that[,] as researchers learn more, it might become possible to create new kinds of electronics and displays as well as to begin to uncover nature's assembly techniques. Although the strategy is ubiquitous in nature, for scientists, he says, 'self-assembly is just at the beginning'" (Ibid.)

In other words, the more advances scientists make, the closer they come to replicating the process of intelligent design that created all the life forms that exist or have ever existed.

Reference:
Cunningham, A. 2006. "Chemical Pop-up Books." *Science News* 170, no. 22.

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