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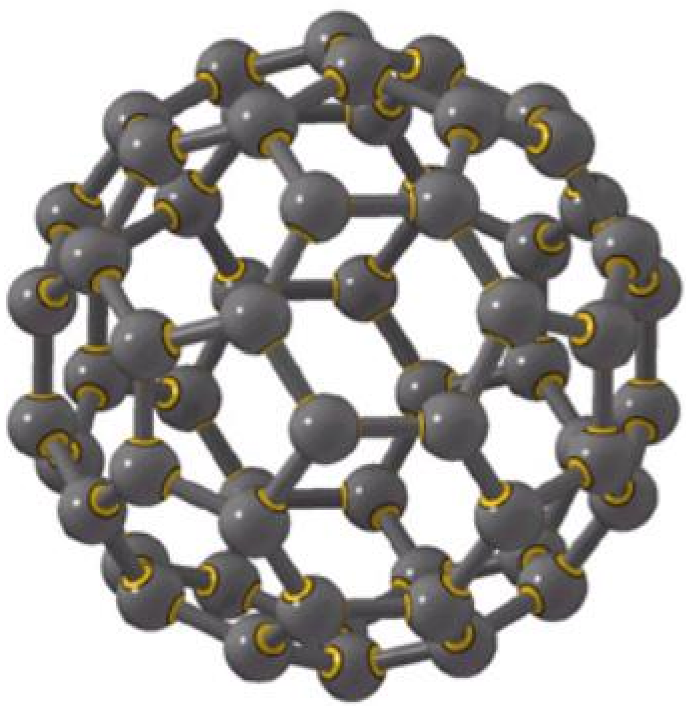
Buckminsterfullerenes

By Glenn Fishbine

Humanity is acquiring all the right technology for all the wrong reasons.

--R. Buckminster Fuller

If I take 60 carbon atoms and shape them into a ball I will get something that looks like this:



…There is a lot of nanotechnology on the brink of breakthrough. There is also a lot of nanotechnology that is merely on the brink…

This is a buckeyball. A collection of carbon atoms in a spheroid shape composed of a 60 carbon atoms each
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bonded to three of its neighbors. The discovery of fullerenes resulted in the award of the 1996 Nobel Prize for chemistry to Curl, Kroto, and Smalley. What the Swedes giveth, no man can take away. Since the time of the first research into these exotic structures in the early 1970s, fullerenes, especially buckeyballs, have been suggested as the building block solution for a number of problems including dating meteor strikes of mass extinctions, storage media for hyper-dense gases, and my favorite and focus of this article, corrosion resistant paint.

Any time nature provides us with a regular structure people go quietly nuts imagining the possibilities. For some reason, symmetrical structures appeal to the imagination like little else. Perhaps because of the inherent simplicity in a symmetrical object people can imagine shaping and stuffing symmetrical objects into all kinds of thought experiments. By contrast, hemoglobin, which has a well-known function of providing oxygen transport to most multi-cellular organisms, looks like an irregular blob of silly putty dripping from a wall. With approximately 600 amino acids, thousands of individual atoms, this ungainly structure houses a single Iron ion, which on a good day lets your respiration transfer oxygen throughout your body and keeps your blood-pressure at a manageable level. Nature, however, has provided a precedent that if you stick something at the center of a structure, it may provide benefits, provided it can get out. The problem with a buckeyball is that, well, it's too damned simple. Once we stuff the insides with something of interest, we have to rip open the walls at some point to get it out. By its very nature, a buckeyball doesn't like getting ripped open. It has one of those symmetric characters in nature, which is inherently and intensely stable. This stability has made many serious researchers focus on other members of the fullerene family, which have less stable and more interesting irregular structures that have a real chance of dynamically interacting with their surroundings.

This isn't to suggest that buckeyballs are useless. From a research point of view, thousands of careers will undoubtedly be spent studying the dynamics and possibilities of buckeyballs in their various incarnations. In fact, there are numerous areas where buckeyballs can make a real contribution, like, paint. Kobe Steel, one of Japan's many conglomerates, has discovered that if you liberally sprinkle buckeyballs into a can of Sherwin Williams, something remarkable happens. The buckeyballs, when dispersed through the solution, force the paint mixture into regular structures which become highly resistant to wear, and more importantly, resistant to salt spray. Thus, while buckeyballs may not be the finest fullerene to command the world's attention, they do have a practical use in lining the hulls of ocean going vessels, if we can ever figure out how to make more than a few grams at a time. Now this may be a far cry from creating immortal humans, but the odds are, if you can paint your boat once every decade, they will come.

Next time, we'll take a look at a different fullerene. My favorite—The Single Walled Carbon Nanotube. The question here is not that it is potentially useful, but will we see any commercial value in our lifetime?

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