Chemists color world of 3-D crystals with advances in self-assembly

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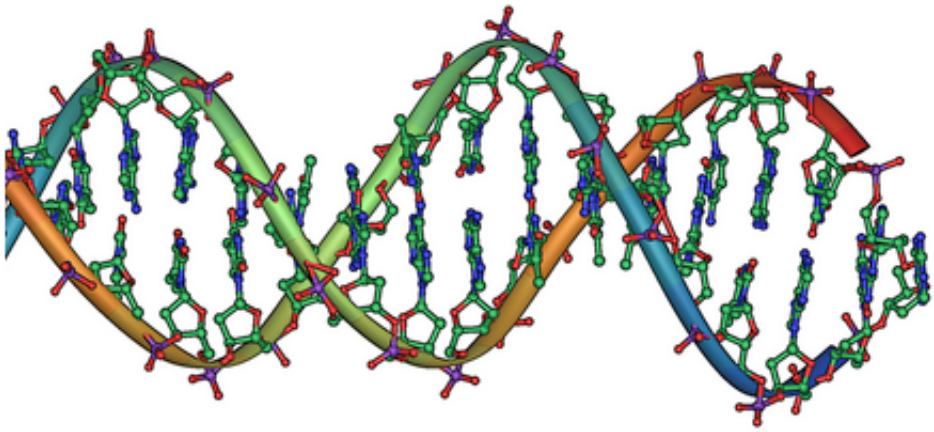

DNA double helix. Credit: public domain

A team of New York University chemists has created self-assembled, three-dimensional DNA crystals that can bind a separate, dye-bearing strand—a breakthrough that enhances the functionality of these tiny building blocks. The advance, reported in the journal *Nature Chemistry*, offers promise for the creation of enhanced synthetic chemistry.

"The work shows that we can change the contents of a crystal by adding moveable components a billionth of a meter in size," explains Nadrian

Seeman, a professor in NYU's Department of Chemistry and the paper's senior author.

Previously, Seeman and his colleagues created self-assembled, 3D DNA structures as well as 2D DNA structures that can also take on a range of shapes. The innovation reported in *Nature Chemistry* shows that "what could previously be done only in 2D systems can now be done in 3D systems," he observes. "The internal contents of crystals can be manipulated after they are formed."

Specifically, the development raises the possibility of "scaling up" nanomechanical devices—in 3D, these creations can potentially be more complex and sophisticated than their 2D counterparts.

"We can now move on to controlling nanomechanical assembly lines using the same approach," Seeman notes.

The authors demonstrated a small-scale 2D assembly line a few years ago.

As reported in *Nature Chemistry*, the scientists merged a self-assembled 3D DNA crystal with a strand bearing either blue or red colored dyes. They commenced with a clear crystal, which they sought to bind with either a red-dye-bearing or a blue-dye-bearing strand. In both instances, the linkage was successful: when the 3D DNA crystal combined with the red-dye-bearing strand, the crystal turned red; when the red-dye-bearing strand was removed and it was combined with the blue-dye-bearing strand, the crystal turned blue. This cycle, using different-colored strands, can be repeated numerous times, the researchers discovered.

"We can change the state of a crystal after it has been self-assembled by adding and removing strands," Seeman notes. "The colors just show that we can do it."

More information: A device that operates within a self-assembled 3D DNA crystal, *Nature Chemistry*, nature.com/articles/doi:10.1038/nchem.2745

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