Chemists create novel DNA assembly line

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Chemists at New York University and China's Nanjing University have created a DNA assembly line that has the potential to create novel materials efficiently on the nanoscale. Their work is reported in the latest issue of the journal *Nature*.

"An industrial assembly line includes a factory, workers, and a conveyor system," said NYU Chemistry Professor Nadrian Seeman, the study's senior author. "We have emulated each of those features using DNA components."

The assembly line relies on three DNA-based components.

The first is DNA origami, a composition that uses a few hundred short DNA strands to direct a very long DNA strand to form structures to any desired shape. These shapes are approximately 100 x 100 nanometers in area, and about 2 nm thick (a nanometer is one billionth of a meter). DNA origami serves as the assembly line's framework and also houses its track.

The second are three DNA machines, or cassettes, that serve as programmable cargo-donating devices. The cargo species the researchers used are gold nanoparticles, which measure 5 to 10 nanometers in diameter. Changing the cassette's control sequences allows the researchers to enable or prevent the donation of the cargoes to the growing construct.

The third is a DNA "walker," which is analogous to the chassis of a car being assembled. It moves along the assembly line's track, stopping at the DNA machines to collect and carry the DNA "cargo."

As the walker moves along the pathway prescribed by the origami tile track, it encounters sequentially the three DNA devices. These devices can be switched between an "on" state, allowing its cargo to be transferred to the walker, and an "off" state, in which no transfer occurs. In this way, the DNA product at the end of the assembly line may include cargo picked up from one, two, or three of the DNA machines.

"A key feature of the assembly line is the programmability of the cargo-donating DNA machines, which allows the generation of eight different products," explained Seeman.

Provided by New York University

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