Oh, my stars and hexagons! DNA code shapes gold nanoparticles

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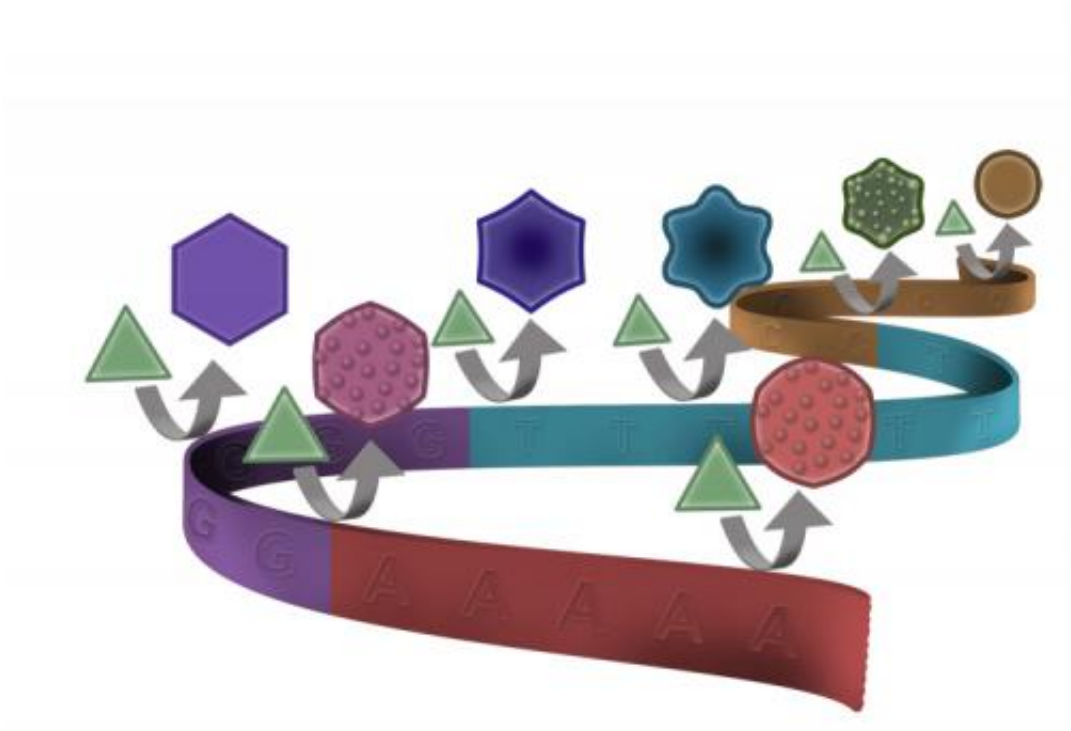


University of Illinois chemists found that DNA can shape gold nanoparticle growth similarly to the way it shapes protein synthesis, with different letters of the genetic code producing gold circles, stars and hexagons. Graphic by Li Huey Tan, Zidong Wang and Yi Lu

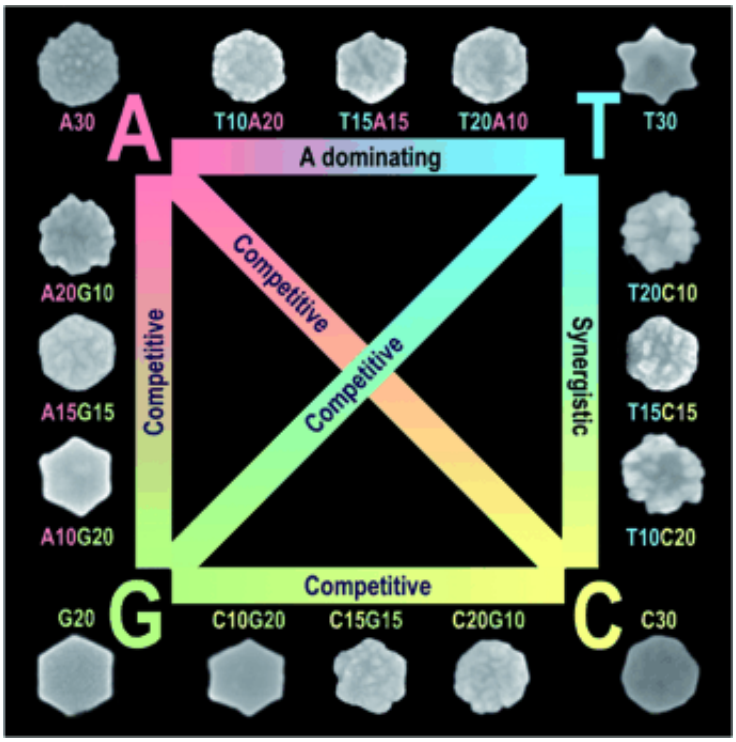
(Phys.org) -- DNA holds the genetic code for all sorts of biological molecules and traits. But University of Illinois researchers have found that DNA's code can similarly shape metallic structures.

The team found that DNA segments can direct the shape of gold nanoparticles – tiny gold crystals that have many applications in medicine, electronics and catalysis. Led by Yi Lu, the Schenck Professor of Chemistry at the U. of I., the team published its surprising findings in the journal *Angewandte Chemie*.

"DNA-encoded nanoparticle synthesis can provide us a facile but novel way to produce nanoparticles with predictable shape and properties," Lu said. "Such a discovery has potential impacts in bio-nanotechnology and applications in our everyday lives such as catalysis, sensing, imaging and medicine."

Gold nanoparticles have wide applications in both biology and materials science thanks to their unique physicochemical properties. Properties of a gold nanoparticle are largely determined by its shape and size, so it is critical to be able to tailor the properties of a nanoparticle for a specific application.

"We wondered whether different combinations of DNA sequences could constitute 'genetic codes' to direct the nanomaterial synthesis in a way similar to their direction of protein synthesis," said Zidong Wang, a recent graduate of Lu's group and the first author of the paper.



Gold nanoparticles are made by sewing tiny gold seeds in a solution of gold salt. Particles grow as gold in the salt solution deposits onto the seeds. Lu's group incubated the gold seeds with short segments of DNA before adding the salt solution, causing the particles to grow into various shapes determined by the genetic code of the DNA.

The DNA alphabet comprises four letters: A, T, G and C. The term genetic code refers to the sequence of these letters, called bases. The four bases and their combinations can bind differently with facets of gold nanoseeds and direct the nanoseeds' growth pathways, resulting in different shapes.

In their experiments, the researchers found that strands of repeating A's produced rough, round gold particles; T's, stars; C's, round, flat discs;

G's, hexagons. Then the group tested DNA strands that were a combination of two bases, for example, 10 T's and 20 A's. They found that many of the bases compete with each other resulting in intermediate shapes, although A dominates over T.

Next, the researchers plan to investigate exactly how DNA codes direct nanoparticle growth. They also plan to apply their method to synthesize other types of nanomaterials with novel applications.

More information: The paper, "Discovery of the DNA 'Genetic Code' for Abiological Gold Nanoparticle Morphologies," is available online. dx.doi.org/10.1002/anie.201203716

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