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Evaluating the role of hydrophobic molecules in DNA nanostructures

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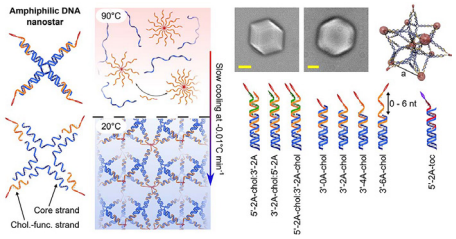
Amphiphilic DNA nanostructures enable the formation of crystals with a structure independent of the hydrophobic molecules used.



Self-assembling nanostructures are highly sought-after for many applications, including electronics, sensing, and drug delivery. DNA is an ideal medium for building these nanostructures due to its customizable nature and self-assembling properties.

Walczak et al. studied a unique type of DNA nanostructure, termed “C-stars,” that bind together and crystallize due to the addition of hydrophobic molecules linked to the DNA. They evaluated how changing these hydrophobic molecules affects crystal structure.

The team believed that changing the specific molecule would alter the phase of the crystalline structure or disrupt it entirely.

“We found that this is in fact not the case, and the crystal structure seems to be primarily determined by C-star topology,” said author Lorenzo Di Michele. “It’s always great when unexpected results emerge, because they generate new questions to address!”

This result demonstrates that the structure is determined by the topology of the DNA constructs themselves. Crucially, this means the hydrophobic functional groups can be changed independently of the crystalline structure. This also means that changing the topology can potentially produce new phases.

“The possibility of changing the hydrophobic molecules without influencing the materials’ structure is very valuable for drug delivery, as it allows us to program the material to encapsulate a hydrophobic drug independently from structure,” said Di Michele.

The authors plan to expand their research by evaluating the effect of DNA topology on structure and further adapt their materials for drug delivery.

“In addition, we are interested in creating heterogeneous materials that form from micro-phase separation in mixtures of C-stars with various sizes and topologies,” said Di Michele.

Source: “Influence of hydrophobic moieties on the crystallization of amphiphilic DNA nanostructures,” by Michal Walczak, Ryan A Brady, Adrian Leathers, Jurij Kotar, and Lorenzo Di Michele, *Journal of Chemical Physics* (2023). The article can be accessed at https://doi.org/10.1063/5.0132484.

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