DNA origami innovation increases accessibility, lowers cost

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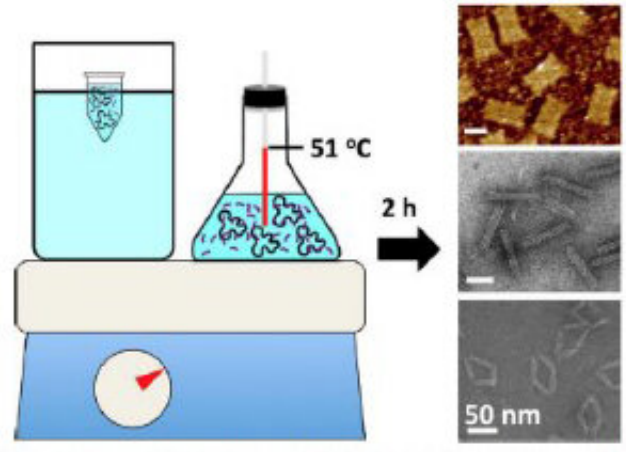

Ohio State researchers have developed a new approach to fabricate DNA origami using low-cost and widely available equipment such as hot plates, water baths and laboratory burners. Credit: The Ohio State University

Researchers have developed a faster, cheaper and simpler alternative to typical DNA origami fabrication, increasing the technique's accessibility and potential impact in industry and clinical settings.

DNA origami refers to an assembly technique that folds single-stranded DNA template molecules into target structures. In the journal *Nano Research*, Carlos Castro and colleagues from The Ohio State University report a simplified approach to folding DNA origami nanostructures that is fast, robust and scalable.

Despite promising potential for applications such as drug delivery and biosensing, the development of nanodevices for practical use in research and education has been hindered by the time, effort and cost associated with DNA origami.

Simple and robust methods to perform and scale the DNA origami self-assembly process are critical, said Castro, an associate professor of mechanical and aerospace engineering. His team has developed a fabrication method that scales at approximately 100–1,500-fold higher than typical scales. The team also developed an approach they've named low-cost efficient annealing (LEAN) self-assembly that leads to effective fabrication of a range of DNA origami structures tested.

"Usually fabrication protocols are customized for each device. One of the goals of the study was to come up with protocols that work well for many different devices that are consistent with the scalable and easy folding," said Castro, who also serves as director of the Nanoengineering and Biodesign Lab.

Castro's previous work includes using DNA origami to build simple microscopic tools like rotors and hinges, and even a "Trojan horse" out of DNA for delivering drugs to cancer cells.

In contrast to other methods for scaling DNA origami assembly, the LEAN approach can be implemented using inexpensive and widely available equipment, such as hot plates, water baths and laboratory burners. It also uses standard recipes and materials so it can be readily applied to any existing or new DNA origami designs.

"We envision these methods can facilitate device development for commercial applications and facilitate broader use of DNA origami in research and education," said Castro. "The combination of simple and fast folding with cheap and portable equipment fits nicely with porting

the fabrication into a classroom, which we have also been doing over the last year."

Other co-authors on the paper include Patrick Halley and Randy Patton, Department of Mechanical and Aerospace Engineering; chemical engineering alumnus Amjad Chowdhury; and John Byrd, Division of Hematology.

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More information: Patrick D. Halley et al. Low-cost, simple, and scalable self-assembly of DNA origami nanostructures, *Nano Research* (2019). DOI: 10.1007/s12274-019-2384-x

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