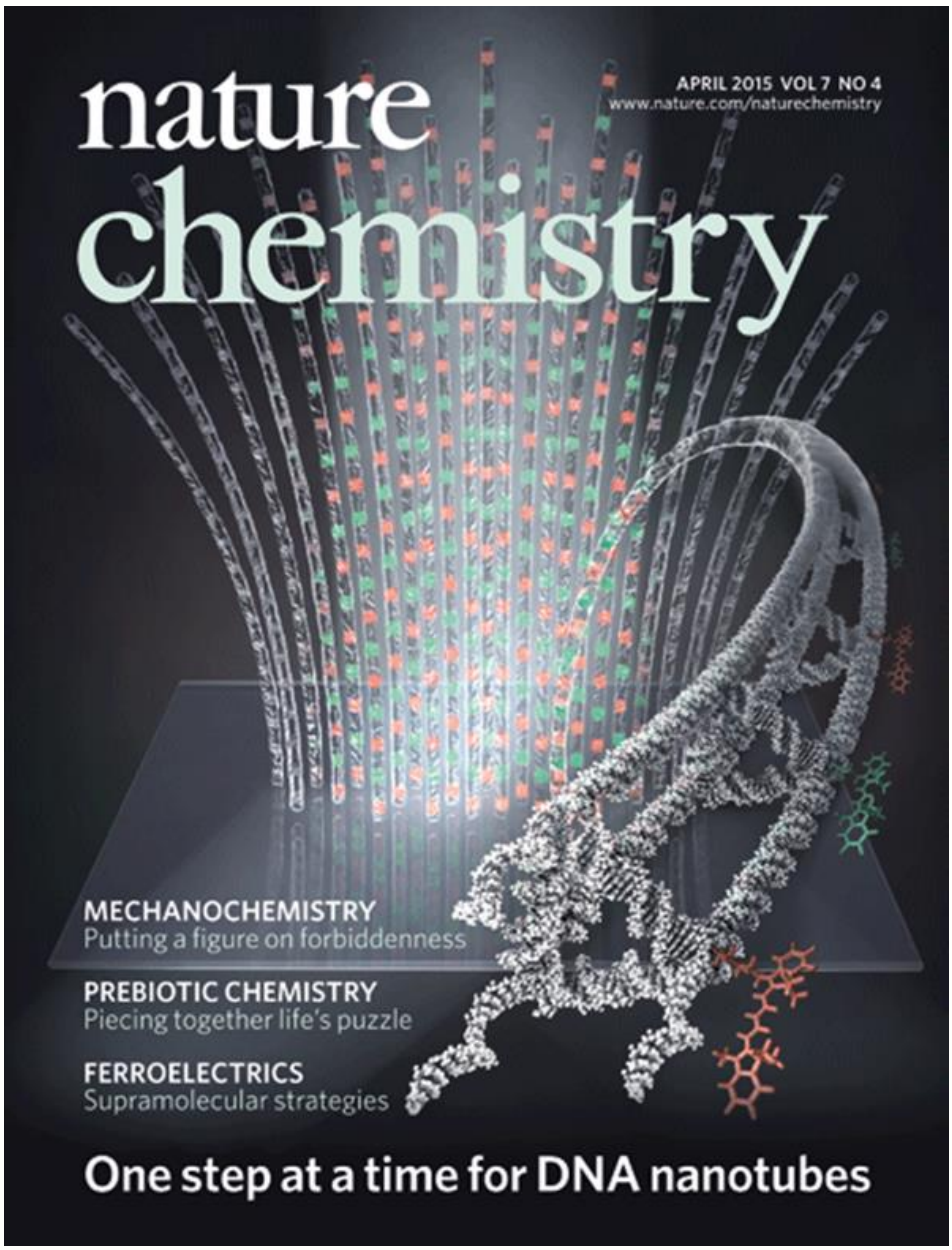
nature chemistry
APRIL 2015 VOL 7 NO 4
www.nature.com/naturechemistry
MECHANOCHEMISTRY
Putting a figure on forbiddenness
PREBIOTIC CHEMISTRY
Piecing together life's puzzle
FERROELECTRICS
Supramolecular strategies
One step at a time for DNA nanotubes

1- Descriptive paragraph

Publication: "Stepwise growth of surface-grafted DNA nanotubes visualized at the single-molecule level", Amani A. Hariri, Graham D. Hamblin, Yasser Gidi, Hanadi F. Sleiman & Gonzalo Cosa, Nature Chemistry **7**, 295–300 (2015). (Selected for the cover, attached)

DNA nanotubes are attractive scaffolds for the assembly of complex arrays. In this regard there is great interest in controlling their polydispersity and the sequence of rungs along their backbone. Many researchers have previously constructed nanotubes using a method that relies on spontaneous assembly of DNA in solution. In this work we have devised a solid-state synthesis to produce surface-grafted robust DNA nanotubes. Just like a "*Tetris game*", where we manipulate the game pieces with the aim of creating a horizontal line of several blocks, we can now build long nanotubes block by block. Different rungs can be incorporated in a stepwise manner, where each one is individually addressable. By using a fluorescence microscope we can further visualize the formation of the tubes at each stage of assembly, as each block is tagged with a fluorescent compound that serves as a beacon. We can then count the number of blocks incorporated in each tube as it is constructed and see their structure, robustness and morphology.

This solid-phase synthesis strategy and its visualization through single-molecule spectroscopy promises to yield fewer structural flaws than the spontaneous-assembly method. Additionally, by controlling the size and patterns of the structures, this method paves the way for the production of custom-made DNA nanotubes. It can also be extended to the construction of other DNA or macromolecular nanostructures assembled in a stepwise, controlled manner, rather than relying on their spontaneous assembly in solution. The ability to analyse the fidelity and incorporation at each stage of the assembly will, in turn, allow an in-depth analysis of the growth mechanism of the new structures.

2- Media coverage

- **Media coverage by the McGill newsroom**: "Building tailor-made DNA nanotubes step by step"

  Follow the link below for the article:

https://www.mcgill.ca/newsroom/channels/news/building-tailor-made-dna-nanotubes-step-step-243039

Article:

Building tailor-made DNA nanotubes step by step

News

New, block-by-block assembly method could pave way for applications in opto-electronics, drug delivery

PUBLISHED: 23 FEB 2015

Researchers at McGill University have developed a new, low-cost method to build DNA nanotubes block by block – a breakthrough that could help pave the way for scaffolds made from DNA strands to be used in applications such as optical and electronic devices or smart drug-delivery systems.

Many researchers, including the McGill team, have previously constructed nanotubes using a method that relies on spontaneous assembly of DNA in solution. The new technique, reported today in *Nature Chemistry*,promises to yield fewer structural flaws than the spontaneous-assembly method. The building-block approach also makes it possible to better control the size and patterns of the DNA structures, the scientists report.

"Just like a Tetris game, where we manipulate the game pieces with the aim of creating a horizontal line of several blocks, we can now build long nanotubes block by block," said Amani Hariri, a PhD student in McGill's Department of Chemistry and lead author of the study. "By using a fluorescence microscope we can further visualize the formation of the tubes at each stage of assembly, as each block is tagged with a fluorescent compound that serves as a beacon. We can then count the number of blocks incorporated in each tube as it is constructed."

This new technique was made possible by the development in recent years of single-molecule microscopy, which enables scientists to peer into the nano-world by turning the fluorescence of individual molecules on and off. (That groundbreaking work won three U.S.- and German-based scientists the 2014 Nobel Prize in Chemistry.)

Hariri's research is jointly supervised by chemistry professors Gonzalo Cosa and Hanadi Sleiman, who co-authored the new study. Cosa's research group specializes in single-molecule fluorescence techniques, while Sleiman's uses DNA chemistry to design new materials for drug delivery and diagnostic tools.

The custom-built assembly technique developed through this collaboration "gives us the ability to monitor the nanotubes as we're building them, and see their structure, robustness and morphology," Cosa said.

"We wanted to control the nanotubes' lengths and features one-by-one," said Sleiman, who holds the Canada Research Chair in DNA Nanoscience. The resulting "designer nanotubes," she adds, promise to be far cheaper to produce on a large scale than those created with so-called DNA origami, another innovative technique for using DNA as a nanoscale construction material.

Funding for the research was provided by the Natural Sciences and Engineering Research Council of Canada, the Canada Foundation for Innovation, NanoQuébec, the Canadian Institutes of Health Research and the Fonds de recherché du Québec – Nature et technologies.

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- **Scientific blogs**

  a- Building tailor-made DNA nanotubes step by step: (Science Daily - SciGuru.com Brightsurf Science News and Current Events - Phys.org - EurekAlert! - Health Canal - Newswise)

  b- McGill university (canada) researchers build DNA nanotubes block by block: (FrogHeart)

  c- Stepwise growth of surface-grafted DNA nanotubes visualized at the single molecule level: (Bioportfolio)

  d- DNA nanotube assembly method shows promise for optoelectronics, drug delivery: (BioOptics World)

  e- Building tailor-made DNA nanotubes step by step: new, block-by-block assembly method: (Nanotechnology Now)

  f- Next generation bio materials … DNA nanotubes: (SciConcilium)

- Selected for the cover of *Nature Chemistry* (see attached)