Self-Assembling DNA Structures for Nanofabrication and Computation

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Construction with "Smart" Building Blocks
Counting with Self-assembling DNA tiles

8 tile types needed, indexed according to each row in the truth table.
“String Tile” Addition. Example.

- Anneal strands to form assembly.
- Ligate reporter strand segments.
- Purify reporter strand and read values by PCR.

\[
\begin{array}{c}
\begin{array}{c}
101 \\
+ 001 \\
= 110
\end{array}
\end{array}
\]
AFM Images Showing Parallel Assembly of Visual Readout XOR

500x500nm

750x750nm
Directed Nucleation Assembly of Barcode Patterned DNA Lattices

Hao Yan, Thomas H. LaBean, Liping Feng, John H. Reif

• Three major strategies for formation of patterned DNA tiling lattice self-assemblies:
  - Unmediated Algorithmic Self-assembly
  - Sequential Step-wise Assembly Techniques
  - Directed Nucleation Assembly Techniques
Self-assembly of a Ribbon Lattice from Repeating DNA Barcode Units
Future Work:

- Apply directed nucleation technique to DNA computing.
- 2D patterns might also be encoded in the same way using a scaffold strand.
Expanding the toolbox of available structures for DNA nanotechnology and DNA computing.
Corrugated
2-Step procedure Au Metallization of 4x4 ribbon and Conductivity Measurement
Scaffolding for 2D Protein Arrays

4x4 DNA lattice

Streptavidin

4x4 DNA lattice
Future Directions:

- Increase size and complexity of 2D aperiodic tilings.
- Diversify attachment and metallization chemistries.
- Prototype more novel tiles and tilings.
- Error reduction: theoretical and experimental.
- Organize/template devices, circuits, and systems.
New Directions in Computer Architecture enabled by DNA NanoTech

Alvin Lebeck, CS
Dan Sorin, ECE

Using DNA for Targeted SWNT Connections