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DNA Gridiron

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Inventors

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Invention Description

Self-assembling nucleic acid molecules have been utilized extensively for constructing unique nanoscale structures, and designing increasingly complex structures is a top nanotechnology challenge. Current methods to create NDA nanostructures are restricted to discrete domains of parallel lines as a result of the double crossover based unit motif, which doesn't lend itself to highly complex nanostructures. There is a need for increased complexity and functionality in these DNA nanostructures that isn't achievable using current design strategies.

Researchers at the Biodesign Institute of Arizona State University have developed a novel design strategy to overcome the problem of the double crossover based unit motif. Using their unique method, 2D and 3D gridiron-like structures, in which the scaffold strand and corresponding double helices are not restricted to 1D parallel raster fill pattern, can be achieved. They've constructed a series of DNA Gridiron networks having highly complex, wireframe geometries.

The gridiron structures already achieved with this technology range from finite 2D arrays with reconfigurability, to multi-layer and 3D structures and even curved objects, highlighting the versatility and programmability of this novel strategy.

Potential Applications

- Construction of DNA gridiron networks with complex wireframe geometries such as two-dimensional arrays with reconfigurability, three-dimensional structures and curved objects:
  - Nanodevices - molecular scale electronics
  - Nanorobotics
  - Nanomedicine – personalized medicine
  - Biosensors
  - Smart drug delivery - nanocarriers

Benefits and Advantages

- Many gridiron units can be connected to form a variety of 2D and 3D lattices and are not restricted to only stacked multilayer structures
- Highly programmable and amenable to dynamic controls
- Flexible joints allow for control or reconfiguration of the gridiron structure using external forces on selected corners
- Yield analysis shows high yields (~36% for the gridiron tweezers, ~85% for the gridiron screw, ~89% for the four-layer gridiron and ~51% for the gridiron sphere)
- The scaffold strands can travel in multiple directions

Intellectual Property Status:

Patent Pending

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