Docket #: S19-111

Systems and Methods for Designing RNA Nanostructures + RNAMake software

Stanford inventors from Professor Rhiju Das's lab have developed a method to optimize nucleic acids, including aptamers and messenger RNAs to be more effective in clinical settings. Aptamers were discovered in the early 1990's but have been difficult to bring to clinical uses due to the necessity of high concentrations to be effective and to expensive modifications needed to ensure chemical stability. These inventors have been able to stabilize and optimize existing aptamers to have tighter binding to their targets and increased stability to degradation in complex biological environments. This is achieved through the computational design of three-dimensional scaffolds that lock aptamers into their desired, binding-ready conformations remarkably, folding RNAs into these three-dimensional structures imparts resistance to cleavage and unwinding by ribonucleases, leading to notably improved chemical and biological stability. Finally, this technology allows for the stabilization of small-molecule binding RNAs with tertiary contacts to improve on the binding of the aptamers and improving fluorescence.

Applications

- Customized messenger RNA vaccines for cancer immunotherapy and infectious disease
- Diagnostics for cancer and other diseases
- RNA therapeutics for genetic diseases, including neurological diseases such as spinal muscular atrophy
- Detection of proteins and small molecules for environmental assessments
- In vivo biomedical imaging through smart 'light-up' sensors.
- Stabilization of RNA vaccines and therapeutics for long term storage or increased lifetime in patients.

Advantages

- There is no current approach to take an aptamer discovered through in vitro evolution and to improve its affinity for its target through 3D computational design.
- There is no current approach to take an RNA designed for biological and chemical stability through computationally designed 3D structure.

Patents

- Published Application: 20220259590

Innovators

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