Docket #: S19-111

Systems and Methods for Designing RNA Nanostructures + RNAMake software

Stanford researchers in Professor Rhiju Das's lab have devised a method called RNAMake to optimize nucleic acids, such as aptamers and messenger RNAs, and enhance their effectiveness for clinical settings. Aptamers were discovered in the early 1990's, but are difficult to use clinically due to high concentrations needed to be effective and expensive modifications to ensure chemical stability. Via RNAMake software, the Das Lab successfully optimized existing aptamers to have tighter binding to their targets and increased stability to degradation in complex biological environments. The computational design of three-dimensional scaffolds lock aptamers into their desired, binding-ready conformations, folding RNAs into three-dimensional structures that impart resistance to cleavage and unwinding by ribonucleases, which leads to improved chemical and biological stability. this technology stabilizes small-molecule binding RNAs with tertiary contacts, enhancing the binding of aptamers and improving fluorescence.

Stage of Development
Pre-clinical

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

- First in class approach to take an aptamer discovered through in vitro evolution and to improve its affinity for its target through 3D computational design.
- First in class approach to take an RNA designed for biological and chemical stability through computationally designed 3D structure.
- Improved efficiency, versatility, stability, and performance.

Publications

- Yesselman, J. D., Eiler, D., Carlson, E. D., Gotrik, M. R., d'Aquino, A. E., Ooms, A. N., Kladwang, W., Carlson, P.D., Shi, X., Costantino, D., Herschlag, D., Lucks, J.B., Jewett, M.C., Kieft, J.S., & Das, R. (2019). Computational design of three-dimensional RNA structure and function. *Nature nanotechnology, 14*(9), 866-873.

Patents

- Published Application: WO2020215092
- Published Application: 20220259590

Innovators

- Rhiju Das
- Joseph Yesselman
- Kalli Kappel

Licensing Contact

Sam Rubin

Licensing Associate, Life Science

Email