Computational Design of RNA Structure/Function

Rhiju Das
Stanford University
Departments of Biochemistry and (by courtesy) Physics

Abstract:

RNA nanotechnology seeks to create nanoscale machines by repurposing natural RNA modules. The field is slowed by the current need for human intuition during 3D structural design. I will describe how that three distinct problems in RNA nanotechnology can be reduced to a pathfinding problem and automatically solved through an algorithm called RNAMake. First, RNAMake discovers highly stable single-chain solutions to the classic problem of aligning a tetraloop and sequence-distal receptor, with experimental validation from chemical mapping, gel electrophoresis, solution X-ray scattering, and 2.55 Å resolution crystallography. Second, RNAMake automatically generates structured tethers that integrate 16S and 23S ribosomal RNAs into single-chain rRNAs that remain uncleaved by ribonucleases and assemble onto mRNA. Last, RNAMake enables automated stabilization of small-molecule binding RNAs, with designed tertiary contacts improving binding affinity of the ATP aptamer and improving fluorescence and stability of the Spinach RNA in vitro, in Xenopus egg and E. coli extracts, and in living E. coli cells.

Friday, June 7th, 2019, 13:00
Room PH 127

Contact: Hendrik Dietz, Dietz@tum.de, phone: 089-289-11615