Emergent by-products of evolution

Irene A. Chen
UCLA
ireneachen@ucla.edu

The earliest living systems may have used RNA to both carry genetic information and catalyze chemical reactions. The sequence-activity relationship of RNA can be captured by a 'fitness landscape', or the mapping of activity over all possible sequence space. Fitness landscapes describe the emergence of functional RNA by delineating possible evolutionary pathways as well as capturing the absolute frequency of functional sequences. We have developed a method to map fitness landscapes for catalytic RNA, revealing the fundamental structure of the evolutionary landscape. We also study how RNA fitness is affected by encapsulation inside an experimental model of simple cells (membrane vesicle 'protocells'). Biophysical effects of encapsulation on the RNA can lead to emergent properties influencing RNA evolution in this system.