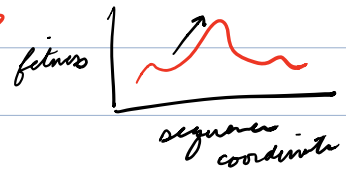
Biophysics Seminar - Irene Chen 3/12/13

Title: "Evolutionary Landscapes of Functional RNA"

Affiliation: University of California Santa Barbara

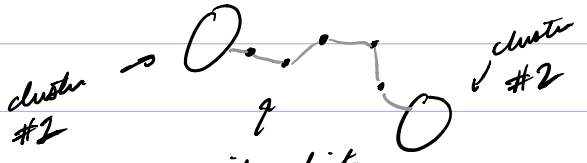
- RNA marked the rise of evolution and natural selection
- RNA World Hypothesis: RNA is the primordial biomolecule
- Evolution is a walk along the fitness landscape

look this up a bit, its interesting




natural selection: biased random walk climbing the fitness landscape.

- fitness measurement is very noisy for individual sequences
- Evolution requires functional proteins to form a continuum which does not pass through non-functional forms.
  - by John Maynard Smith.
- Evolutionary paths of functional sequences between clusters do exist, though they are few and far between




intermediate, of one mutation each, which survived selection.

- looking at ribozymes which catalyze amino-acylation reactions

↳ definition of fitness relies on rate constants

- epistasis: interaction of two mutations

$\varepsilon_{ab}$ = (fitness of double mutant) − (fitness of a) − (fitness of B)

Weinreich et al 2005 Evolution

↳ found that synergistic and antagonistic mutations occur at ~ the same frequency

↳ found that the network is "frustrated"

↳ three motifs which have intermediate of baseline rate between them

↳ different motifs have different mechanisms of amino-acylation.

- Frustration has several effects

1) difficult optimization
2) degenerate pathways
3) different (small) perturbations ⇒ large difference in final outcome.