

On April 13, 2012, PED Seminar Series Presents

The Origin of Autocatalytic Biopolymers - How did the RNA World get started?

by [Professor Paul Higgs](#)

The creation of an autocatalytic reaction system controlled by polymers such as RNA is the key step in the origin of life. I will discuss scenarios for the origin of the RNA World using mathematical models of RNA polymerization. These models have two stationary states. In the non-living state, polymerization is possible at a slow spontaneous rate, but the system is dominated by monomers and short oligomers. In the living state, reaction rates are controlled by ribozymes and there is a significant concentration of long polymers. In an infinite system, the non-living state is dynamically stable indefinitely. However, in a finite sized region, concentration fluctuations can cause a stochastic transition from the non-living to the living state. I will discuss the roles of polymerases, nucleotide synthetases, and recombinases in this transition. I will also consider a simplified generic model of replicators that has the same essential features as our RNA polymerization models. This allows us to investigate the effect of the spatial distribution of replicators on the stochastic transition that leads to the origin of life. When the diffusion rate of replicators is fast, the system is well-mixed and the transition to life is very difficult. When diffusion is slow, local concentration fluctuations allow a fairly rapid transition to life in a localized region. The living patch then spreads deterministically across the lattice until the whole system is in the living state. We argue that these features are generic, and that the origin of life occurred by a spatially localized stochastic transition.