The early evolution of life was in a great extent driven by the competition for access to hydrogen. Decline of the primary sources of hydrogen mentioned above made life to switch for the simple hydrogen compounds such as H_2S, CH_4, NH_3, and at last, H_2O in the case of oxygenic photosynthesis, and later on to more complex hydrogen compounds. The succession and degree of involvement of these molecules into early metabolic evolution could correlate to the energy required for breaking their chemical bonds in the conditions of early Earth. This concept helps to understand the historical causes of the atmosphere chemistry, in particular, the high content of nitrogen and oxygen as the byproducts of hydrogen metabolism.

Early kinds of biochemistry, once established, have been saved throughout of the later history of life via compartmentalization and addition of complementary metabolic modules in respond to the irreversible changes of the environment. These processes were resulted the higher biological complexity. Distribution of metabolic types along the environmental gradients in the present day biosphere as well as the structure of the metabolic pathways in the living cells can be interpreted in terms of the co-evolution of life and the physical-chemical conditions on early Earth.

Oct. 17 (Sat.) 12:00-12:20

Traversing Fitness Landscapes by Changing Environments

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Since its introduction by Sewall Wright (1932), the fitness landscape has been a popular metaphor for describing how populations evolve. In these landscapes, where elevation represents fitness, populations move via small, mutational steps. In cases of strong selection, a population can become trapped on a sub-optimal peak, unable to further improve its fitness. Wright explanation for how populations escape these sub-optimal peaks involves genetic drift. However, an understudied mechanism for escaping sub-optimal peaks is the effect of changing enviroments (Fisher 1932). Using two rapidly evolving systems - E. coli and Avida (an artificial life platform for studying evolutionary biology) - we take a top-down approach that involves repeatedly evolving populations, manipulating the environment with fine precision. We find that populations exposed to varying environments reach global optima faster than when the environment is held constant.