

SPECIAL SEMINAR

“EXPLORING EVOLUTION THROUGH SYNTHETIC APPROACHES”

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In this talk, I will discuss our investigations into two key theories of evolution of life: (i) RNA world hypothesis and (ii) Endosymbiotic theory of organelle evolution. Almost five decades ago Rich, Crick, Orgel and others proposed the RNA world hypothesis. Subsequent studies have raised the possibility that RNA might be able to support both genotype and phenotype, and the function of RNA templates has been studied in terms of evolution, replication and catalysis. In our efforts to engineer strains of *E. coli* in which a large fraction of 2'-deoxycytidine in the genome is substituted with the modified base 5-hydroxymethyl-2'-deoxycytidine, we generated mutant strains of *E. coli* that showed significant (~40-50%) ribonucleotide content in their genome. We characterized the properties of these chimeric genomes and the corresponding strains to determine the circumstances under which *E. coli* can incorporate high levels of ribonucleotides into its genome. These studies have potential to investigate various aspects of the hypothesized transition from RNA world to DNA world. In the next part of my talk, I will discuss our synthetic approach to experimentally evolve mitochondria-like organelles in a laboratory setting. The endosymbiotic theory suggests that mitochondria evolved from free-living prokaryotes which entered the host cell and were retained as endosymbionts. We modeled the first stage of the endosymbiotic theory of mitochondrial evolution by engineering endosymbiosis between two genetically tractable model organisms, *E. coli* and *S. cerevisiae*. In this model system, we engineered *E. coli* strains to survive in the yeast cytosol, and provide ATP to a respiration-deficient yeast mutant. In a reciprocal fashion, yeast provided thiamin to an endosymbiotic *E. coli* thiamin auxotroph. This readily manipulated chimeric system was stable for more than 40 doublings and should allow us to investigate various aspects of the endosymbiotic theory of organelle evolution.

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TIME:
3:30 PM

LOCATION:
SEMINAR HALL
1315 CHEMISTRY



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