THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

WORKING SEMINAR

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Rm 210, Run Run Shaw Building, HKU

Metabolism and the emergence of the first cells

Abstract

The scenario proposed here builds on the critical need for compartmentalisation at the origin of life. In a first step, the surface of minerals compartmentalised and selected the reactive compounds that formed primitive metabolism. Subsequently, RNA molecules replaced mineral surfaces after the discovery of nitrogen fixation and the emergence of ribonucleotides, in parallel with a machinery for synthesis of peptides, coenzymes and lipids. Then, the RNA-metabolism world developed into an RNA-genome world based on RNA as informational templates rather than substrates. Bordered by lipids, the first cells were phagocytes, Protokarya, which put together two compartments stemming from the RNA-metabolism world (the cytoplasm) and the RNA-genome world (the nucleus). Emergence of stable deoxyribonucleotides allowed the clustering together of genes into chromosomes. Phagocytosis created the opportunity for an escape based on an alternative metabolism of membrane lipids and conquest of extreme environments, with the Archaea, and on the emergence of a robust and phagocyte-resistant envelope, with the Bacteria. Reductive evolution allowed bacteria with a modified enveloped to be phagocyted again as symbionts of Protokarya, leading to the final generation of the Eukarya. Continuation of horizontal transfer of the genetic material initially resulting from phagocytosis was carried on with the emergence of gene transfer via specialised conjugation machineries and viruses.

All are welcome