

Origin and potential role of small proteins in the prebiotic world

*Kosuke Fujishima¹

1. Tokyo Institute of Technology, Earth-Life Science Institute

Life on Earth uses two types of polymers (amino acid- and nucleotide-based) to maintain the core systems of biology, known as metabolism and heredity. Research on the origins of life has often focused on how to make nucleotides from inorganic and low molecular weight organic molecules. However, the abundance of amino acids in prebiotic contexts, their activation and condensation, the simplicity of the recognition motif of metals and coenzymes, and the ability to self-assemble, favour polypeptides as one of the earliest functional polymers. Here we explore the implications of this hypothesis. Recently, we have provided several lines of evidence that polypeptides with a limited set of amino acids can fold and retain essential functions such as RNA-binding. Thus, we propose a 'peptide-polynucleotide stage' in which early peptides played an important role in key prebiotic functions before being 'encoded' on nucleotide templates. In the context of the CO world hypothesis, I will discuss the potential role of small proteins composed of prebiotically accessible amino acids on early Earth before and during the nucleotide world.

Keywords: small protein, amino acids , nucleotides, folding and function