Self-replication of informational polymers in non-equilibrium environments: The fidelity issue

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Accurate copying of sequence information is essential for self-replicating and evolving systems. Modern cells achieve error rates as low as 1 per billion with sophisticated enzymatic machineries that use free energy to repeatedly discriminate between correct and incorrect nucleotides. In contrast, experiments probing template-directed, nonenzymatic extension of RNA and DNA as potential prebiotic copying processes find error rates as high as 10% per base pair, preventing reliable information transmission. I will describe how non-equilibrium environmental conditions can help to increase the copying accuracy above an important threshold for the maintenance of sequence information.