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Bridging from Replication to Translation with a Thermal, Autonomous Replicator Made from Transfer RNA[1] DIETER BRAUN, FRIEDERIKE M. MÖLLER, Systems Biophysics, Center for Nanoscience, LMU Munich, HUBERT KRAMMER, Systems Biophysics, Physics Department, Center for Nanoscience, Ludwig Maximilians Universität München — Central to the understanding of living systems is the interplay between DNA/RNA and proteins. Known as Eigen paradox, proteins require genetic information while proteins are needed for the replication of genes. RNA world scenarios focus on a base by base replication disconnected from translation. Here we used strategies from DNA machines to demonstrate a tight connection between a basic replication mechanism and translation [1]. A pool of hairpin molecules replicate a two-letter code. The replication is thermally driven: the energy and negative entropy to drive replication is initially stored in metastable hairpins by kinetic cooling. Both are released by a highly specific and exponential replication reaction that is solely implemented by base hybridization. The duplication time is 30s. The reaction is monitored by fluorescence and described by a detailed kinetic model. The RNA hairpins usetransfer RNA sequences and the replication is driven by the simple disequilibrium setting of a thermal gradient [2] The experiments propose a physical rather than a chemical scenario for the autonomous replication of protein encoding information.

[1] Physical Review Letters 108, 238104 (2012).
[2] Physical Review Letters 104, 188102 (2010)

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