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**Spontaneous emergence of autocatalytic information-coding polymers** ALEXEI TKACHENKO, SERGEI MASLOV, Brookhaven National Laboratory — Self-replicating systems based on information-coding polymers are of crucial importance in biology. They also recently emerged as a paradigm in design on nano- and micro-scales. We present a general theoretical and numerical analysis of the problem of spontaneous emergence of autocatalysis for heteropolymers capable of template-assisted ligation driven by cyclic changes in the environment. Our central result is the existence of the first order transition between the regime dominated by free monomers and that with a self-sustaining population of sufficiently long oligomers. We provide a simple mathematically tractable model that predicts the parameters for the onset of autocatalysis and the distribution of chain lengths, in terms of monomer concentration, and two fundamental rate constants. Another key result is the emergence of the kinetically-limited optimal overlap length between a template and its two substrates. Template-assisted ligation allows for heritable transmission of information encoded in oligomer sequences thus opening up the possibility of long-term memory and evolvability of such systems.

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