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Kauffman Model on a Network of Containers

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Abstract : In the description of the origin of life, there are still some open gaps, e.g., the formation of macromolecules cannot be fully explained so far. The Kauffman model proposes the existence of autocatalytic sets of macromolecules which mutually catalyze reactions leading to each other's formation. Usually, this model is simulated in one well-stirred pot only, with a continuous inflow of small building blocks, from which larger molecules are created by a set of catalyzed ligation and cleavage reactions. This approach represents the picture of the primordial soup. However, the conditions on the early Earth must have differed geographically, leading to spatially different outcomes whether a specific reaction could be performed or not. Guided by this picture, the Kauffman model is simulated in a large number of containers in parallel, with neighboring containers being connected by diffusion. In each container, only a subset of the overall reaction set can be performed. Under specific conditions, this approach leads to a larger probability for the existence of an autocatalytic metabolism than in the original Kauffman model.

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