

TITLE:

kappa and programmable self-assembly

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ABSTRACT:

We present a visual and concise notation for biological signalling pathways. That notation uses an applied concurrent/agent-based language called 'kappa' (a reference to Kohn molecular maps). Kappa is very close to the BioNetGen language proposed by James Faeder (LANL).

Unlike Kohn maps, and other similar notations such as Kitano's, descriptions in kappa or BNG are executable (as continuous time Markov chains). Moreover, since they are based on rules rather than on flat reactions, descriptions are shorter, easier to relate to actual biology, and demand less kinetic information.

In order to appreciate the computational limits inherent in the combinatorics of kappa, we define a compilation of kappa into a restricted language where interactions can involve at most two agents at a time. That compilation is generic, the blow up in the number of rules is linear in the total rule set size, and relies on an implicit causality analysis. It works for all sets of acyclic rules (meaning the pattern of the rule has no cycles).

