Kinetics and thermodynamics of reversible polymerization

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Biological systems make extensive use of reversible polymerization:
peptides are assembled from amino-acids, actin filaments are assembled
from G-actin and glucans (carbohydrates) are assembled from monosaccharides.

In this talk, inspired by a recent experimental study on the metabolism
of glucans, we study the self-assembly of such polymers from the point
of view of non-equilibrium thermodynamics.
We first consider a closed system in which polymers dynamically evolve
towards equilibrium where detailed balance is satisfied and the entropy
is maximum. We then consider open systems, in which the polymers are in
contact with chemostats, characterized by fixed concentrations of polymers
of a given length. In accordance to a general theoretical result, we find
new dynamic regimes when the number of chemostats is larger
than the number of conservation laws of the chemical network.

We will then discuss extensions of this framework for the self-assembly
of polymers which carry information in their sequence.

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[2] Glucans monomer exchange dynamics as an open chemical network,
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