

Introducing Complete Networks of Reversible Binding Reactions

An effort to encompass certain networks ubiquitous in pharmacology

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Presentation Abstract

The purpose of this presentation is to discuss our effort to devise a framework that covers many reaction networks that occur in pharmacology. The networks we consider consist of reversible binding reactions and (regretfully) do not contain isomeric species. For these networks, we propose the class of normal networks and the larger class of complete networks. Completeness consists of structural and kinetic requirements. The structural requirement is that there is a notion of composition that defines species, and that reactions preserve composition. The kinetic requirement is that the law of mass-action applies, and that there is a certain coherence relationship among rate constants that assures detailed balance. Completeness results in some interesting properties. The nonnegative stoichiometric compatibility classes are convex polytopes defined by equations that express the conservation of composition. And within each class, the equilibrium state exists, is unique, and is and globally attracting. Furthermore, it is detailed-balanced and is characterized by a ‘nice’ positive polynomial system. A simple formula gives the deficiency.