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Title:
An Invitation to Pharmacostatics

Abstract:
Pharmacology, the study of interactions between biological processes and therapeutic agents, is traditionally presented as consisting of two subdisciplines: pharmacokinetics, which is about the distribution and metabolism of drugs in organisms; and pharmacodynamics, which is about the organisms' response to drugs. In discovery-stage pharmacology however, one primary concern is what we call pharmacostatics, the characterization of equilibrium parameters and states of core interactions of physiologic and therapeutic interest. This usually takes the form of studying dose-response curves, without consideration for the relevant qualitative properties of the underlying reaction networks, e.g. the existence, multiplicity and stability of steady states. Furthermore, steady state calculations usually employ manually derived formulas based on approximating assumptions. While these formulas may seem adequate most of the time, the assumptions need not apply, and there are rare but genuine cases where this approach fails to explain non-monotone dose-response curves. We will discuss results and prospects surrounding these issues.