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Robust mathematical models for metabolic supply chains

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In recent years, mathematical modeling became more and more important for life science applications. The models differ from models in physics or engineering, and an increasing variety of models are built of mechanisms which are not completely quantified. Often, only a selection of qualitative properties of these mechanisms are known. Nevertheless, mathematical models present a conceptual frame, and observations are discussed and understood within this frame.

We present typical examples of mathematical models using uncertain mechanisms like models for the human energy metabolism, appetite regulation and metabolic supply chains in general. We show that some robust implications can be found anyway, which are independent on the particular specification of the uncertain mechanisms.

In particular, aspects of the Selfish-brain-theory will be addressed. This theory, founded by Achim Peters, discusses the human energy metabolism and the development of metabolic diseases with an supply-chain-approach where the brain is the final energy consumer in competition with other energy consumers in the human metabolic system. Consequently, mathematical models concerning the Selfish-brain-theory deal with integrated and uncertain mechanisms on an abstracted individual level, and it is necessary to discuss the validity of their implications.