

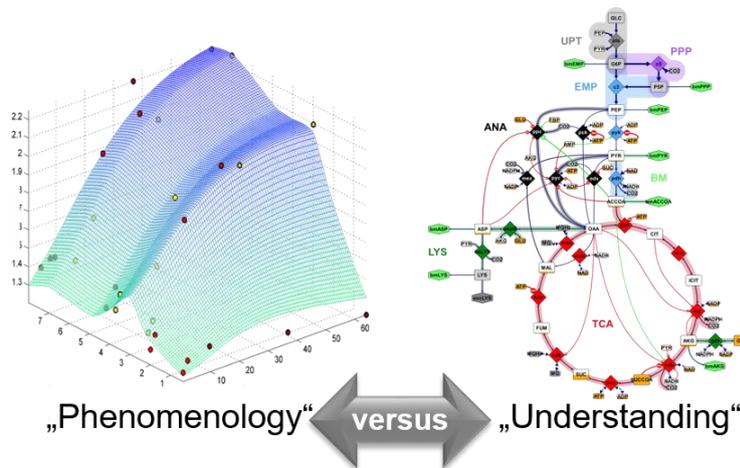
Systems Biotechnology between Phenomenology and Understanding

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The dichotomy of phenomenology and understanding is a basic conceptual problem of all quantitative sciences. Here, (pure) “phenomenology” means to collect experimental data followed by data generalization using some kind of interpolation or extrapolation whereas rigorous “understanding” means to give some “deeper” explanation of a phenomenon by the interaction of more elementary processes. Systems biology has always been revolving around these two extremes: “Phenomenologists” are collecting huge amounts of omics data and interpret them (top down approach), whereas “modelers”, try to build up mechanistic models for the cellular behavior based on first principles (bottom up approach).



Currently, in all scientific disciplines we are experiencing a boom of data driven approaches (i.e. phenomenology) caused by the general hype of digitalization, big data analysis, deep learning etc. Also – putting systems bio(techno)logy into the applied context of sustainable bioeconomy – two general questions arise: “Can models really help in these complex scenarios?” and “How much understanding is really needed in order to efficiently engineer biological systems?” In fact, the emerging synthetic biology toolbox and the ever-increasing experimental throughput driven by miniaturization and automation might lead to the situation that, at the end of the day, computational models of biological systems become superfluous. In other words: “Isn’t the cell the better computer for predicting the effect of genetic or environmental modifications?”

The talk will elaborate on the relation between phenomenology and understanding by discussing several examples from recent research in the Jülich institute of bio- and geosciences 1 (IBG-1:Biotechnology). By discussing the present limitations of both approaches it will be shown how in practice a combination of phenomenology and understanding has the highest efficiency for practical problem solving.