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Systems Pharmacology for Drug Discovery and Development: Paradigm Shift or Flash in the Pan?

Dr. Anu Jauhan

Data Sciences-Pharmacometrics, Grünenthal GmbH, Aachen, Germany

Abstract: Pharmaceutical industry is facing unprecedented challenge to their sustainability due to decreasing number of truly innovative medicines, increasing costs of drug development and ever-tightening regulatory controls. Meanwhile, science and technology breakthroughs in big data and artificial intelligence are forecasting the coming years to be a digital revolution. Pharmaceutical industry is recognizing the need to expand from traditional target exposure and modulation approaches to much wider systems-level questions like, “What is the best pathway/target to invest exploratory resources in”, and patient-centric questions like, “How to personalize the treatment based on patient”. Systems pharmacology is one of the approaches which can deal with such questions. The most pressing challenge is that models must be developed rapidly (in months, not years) and efficiently if they are to be of value in pharmaceutical research. That is a challenge given the complexity of systems-level organization of biology and ever increasing “omics” and digital data, but one that needs to be urgently addressed if this approach is to live up to its full potential. These concepts are of interest to academia, but they are more urgent in industrial settings given the high attrition in proof-of-concept–phase II studies. I would like to discuss: where, how and to what extent systems pharmacology approaches can be integrated into traditional pharmacological approaches of modeling.

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