



Centre for Biosystems Science and Engineering

SEMINAR

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Seminar Hall, MRDG, Biological Sciences

Systems Engineering Perspective of Human Metabolism: A Multi-scale Model for Disease Analysis

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Human physiology is an ensemble of various biological processes spanning from intracellular molecular interactions to the whole body phenotypic response. Systems biology endures to decipher these multi-scale biological networks and bridge the link between genotype to phenotype. The structure and dynamic properties of these networks are responsible for controlling and deciding the phenotypic state of a cell. Several cells and various tissues coordinate together to generate an organ level response which further regulates the ultimate physiological state. The overall network embeds a hierarchical regulatory structure, which when unusually perturbed can lead to undesirable physiological state termed as disease. Here, we treat a disease diagnosis problem analogous to a fault diagnosis problem in engineering systems. Accordingly we review the application of engineering methodologies to address human diseases from systems biological perspective. The research work highlights potential networks and modeling approaches used for analyzing human diseases. The application of such analysis is illustrated in the case of diabetes and hypercholesterolemia. We put forth a concept of cell-to- human framework comprising of five modules (data mining, networking, modeling, experiment and validation) for addressing human physiology and diseases based on a paradigm of system level analysis. The work emphasizes on the importance of multi-scale biological networks and subsequent modeling and analysis for drug target identification and designing efficient therapies.

About the speaker:

KV Venkatesh is a professor of Chemical Engineering in IIT Bombay. He got his B. Tech from chemical engineering from IIT Madras and PhD at Purdue University, USA. He joined the faculty of IIT Bombay in 1993. He has extensive research experience in the areas of Systems and Synthetic Biology and Biosystems Engineering. He has contributed significantly to research in the areas of quantification of biological networks including genetic, signaling and metabolic pathways. His research interest also includes food engineering. He has 140 journal articles and book chapter to his credit. In recognition, he has won many national awards like the prestigious Swaranjayanti fellowship from DST, INSA young scientist and INAE Young Engineers awards. He is an associate editor of BMC systems biology.