Centre for Biosystems Science and Engineering

Seminar

The Metabolic Marketplace: Regulating the cellular economy of supply and demand

by

Prof. Jan-Hendrik S. Hofmeyr,
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at

4:00 PM, Monday, 18th July 2016,
Seminar Hall, MRDG, Biological Sciences Building.

The central thesis of this talk is that the cellular metabolism is an integrated molecular economy of coupled supply and demand systems. These systems have evolved regulatory mechanisms that enable them to fulfil specific functions such as control of flux or maintenance of homoeostasis. Although conventional accounts of metabolic regulation pay lip-service to this functional view, they effectively treat pathways as isolated blocks, and do not address the all-important question of how these pathways behave when integrated into the whole cellular process. For example, regulation of amino acid biosynthesis is usually discussed without reference to the rate of protein synthesis, despite the direct coupling of these processes.

The speaker will discuss a quantitative framework for metabolic supply-demand analysis that allows the behaviour, control and regulation of metabolism as a whole to be understood quantitatively in terms of the elasticities of supply and demand. Supply-demand analysis shows that flux and concentration control are inextricably linked: the more control either block has over flux, the less it determines the degree of homeostasis of the concentration of the linking intermediate, which becomes the function of the other block. The analysis also predicts how this differentiation of function will vary with the conditions, and these predictions have now been confirmed in a number of experimental studies by different research groups.

About the speaker

Jan-Hendrik (Jannie) Hofmeyr is Distinguished Professor of Biocomplexity and Biochemistry and Co-Director of the Centre for Studies in Complexity at the University of Stellenbosch. His research of the past 30 years has been in the field of computational systems biology where his main focus has been the understanding of regulatory design of metabolism. He obtained his Ph.D. in 1986 at the University of Stellenbosch after collaborating with Henrik Kacser and the enzymologist Athel Cornish-Bowden.

He has made numerous fundamental contributions to the development of metabolic control analysis and computational systems biology, and with Athel Cornish-Bowden developed both co-response analysis and supply-demand analysis as a basis for understanding metabolic regulation.