DESIGN PRINCIPLES FOR CONTROL OF METABOLISM: ROLE OF ENZYMATIC REGULATION, REDUNDANCY AND ORTHOGONALITY

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Improved understanding of the organization of metabolic networks can enable the more effective control of metabolism for several applications ranging from metabolite overproduction to treatment of metabolic diseases. Advances in computational modeling techniques have allowed the development of genome-scale models of metabolism in several organisms. These models have become the basis for analysing the potential of metabolic networks and to understand their organization. In this talk, we examine the design principles underlying the evolution of enzymatic regulation in metabolic networks using a model-based approach. We then evaluate the role of these regulatory networks in maintaining flux to a desired target metabolite. In the second part, we analyze the role of redundancy of metabolite production pathways and its implications for the robust production of the target metabolites. These observations shed light on the role of redundant modes of regulation and metabolic pathways for robust control of metabolic fluxes. Finally, we will discuss how orthogonality of production pathways can facilitate the effective control of fluxes through target metabolites and their implications for the evolution of modular pathways in metabolic networks