System wide cofactor turnovers can propagate metabolic stability between pathways - DTU Orbit (08/11/2019)

System wide cofactor turnovers can propagate metabolic stability between pathways

Metabolic homeostasis, or low-level metabolic steady state, has long been taken for granted in metabolic engineering, and research priority has always been given to understand metabolic flux control and regulation of the reaction network. In the past, this has not caused concerns because the metabolic networks studied were invariably associated with living cells. Nowadays, there are needs to reconstruct metabolic networks, and so metabolic homeostasis cannot be taken for granted. For metabolic steady state, enzyme feedback control has been known to explain why metabolites in metabolic pathways can avoid accumulation. However, we reasoned that there are further contributing mechanisms. As a new methodology developed, we separated cofactor intermediates (CIs) from non-cofactor intermediates, and identified an appropriate type of open systems for operating putative reaction topologies. Furthermore, we elaborated the criteria to tell if a multi-enzyme over-all reaction path is of in vivo nature or not at the metabolic level. As new findings, we discovered that there are interactions between the enzyme feedback inhibition and the CI turnover, and such interactions may well lead to metabolic homeostasis, an emergent property of the system. To conclude, this work offers a new perspective for understanding the role of CIs and the presence of metabolic homeostasis in the living cell. In perspective, this work might provide clues for constructing non-natural metabolic networks using multi-enzyme reactions or by degenerating metabolic reaction networks from the living cell.

General information
Publication status: Published
Organisations: Department of Systems Biology, Department of Chemical and Biochemical Engineering, CHEC Research Centre, East China University of Science and Technology
Contributors: Yang, Y., Guan, Y., Villadsen, J.
Number of pages: 9
Pages: 196-204
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Metabolic Engineering Communications
Volume: 3
ISSN (Print): 2214-0301
Ratings:
Scopus rating (2016): CiteScore 3.19 SJR 0.928 SNIP 0.77
Original language: English
Electronic versions:
1_s2.0_S2214030116300190_main.pdf
DOIs:
10.1016/j.meteno.2016.06.002

Bibliographical note
© 2016 International Metabolic Engineering Society. Published by Elsevier B.V. International Metabolic Engineering Society. All rights reserved.
Source: FindIt
Source ID: 2305947964
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review