

Metabolic flux analysis

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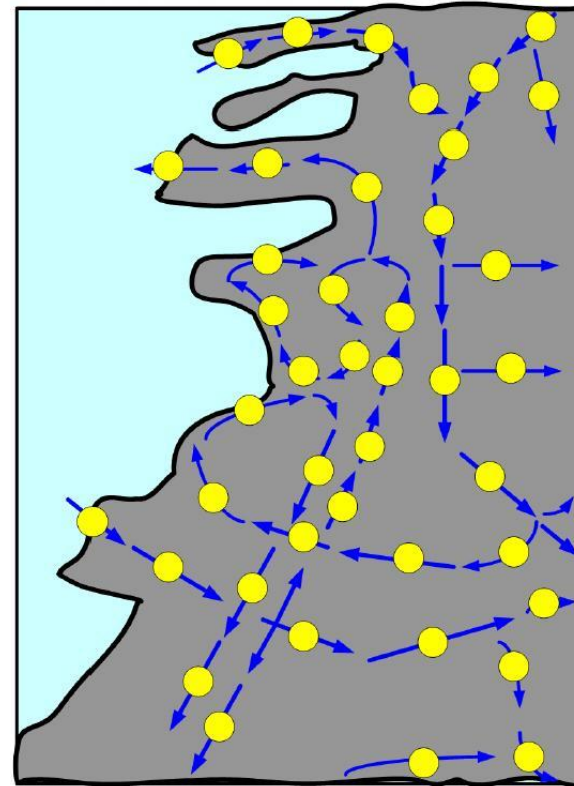
Road Network



Roads, Rivers, Plants

Vehicle Traffic

Metabolic Network

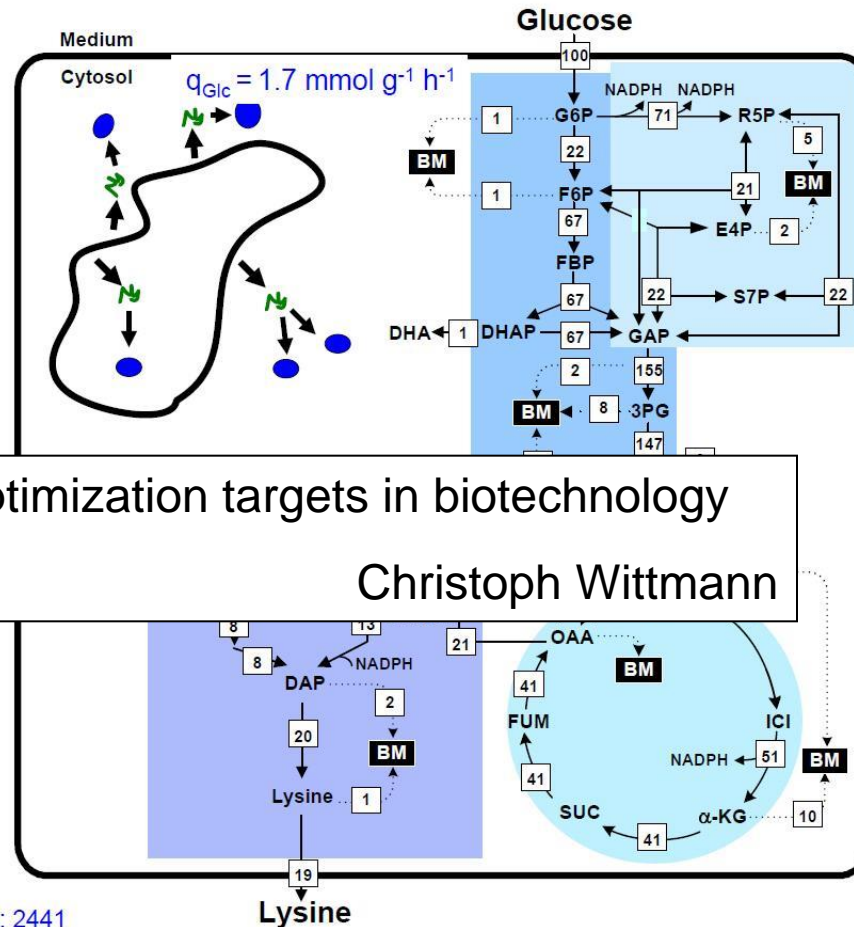


Enzymes, Pathways

Molecule Traffic (Flux)

What are fluxes (fluxome)?

In vivo activities of enzymes and pathways in the intact, living cell

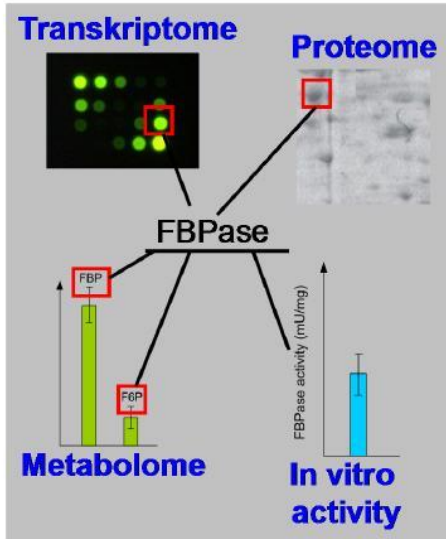


100–200 reactions
of central carbon
core metabolism

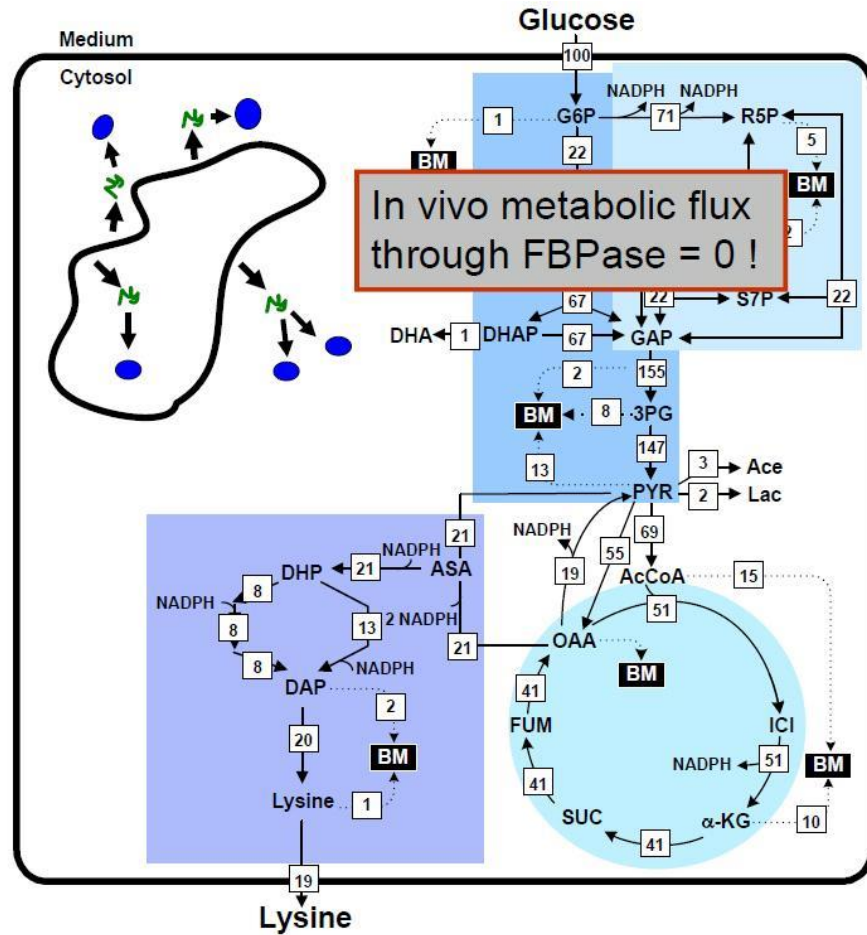
Wittmann & Heinzle (2001) Eur. J. Biochem. 268: 2441

Wittmann, Biosystems Engineering,
Braunwald, 2012

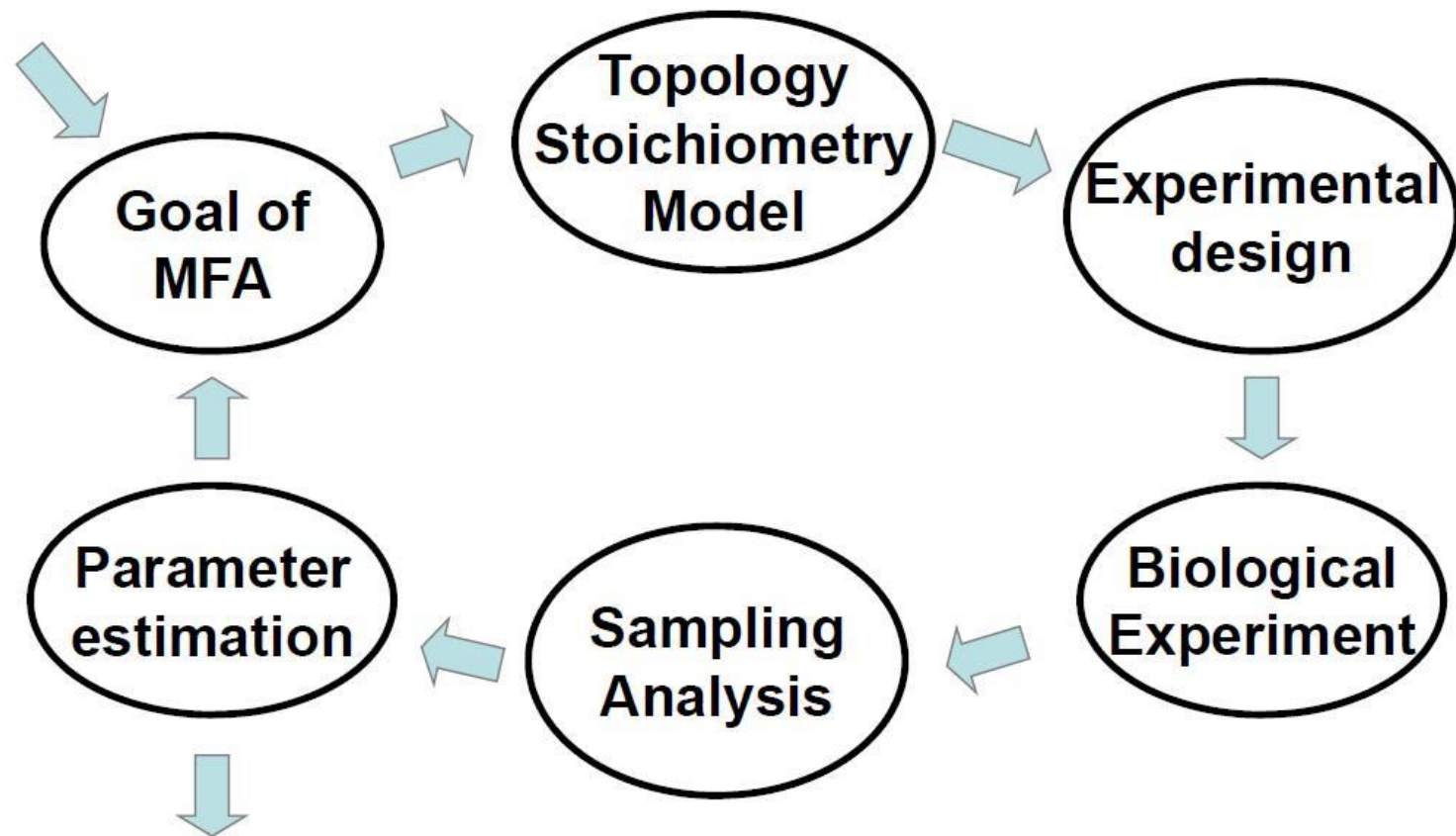
Why fluxes?



(ii) Fluxes link components to functional network operation

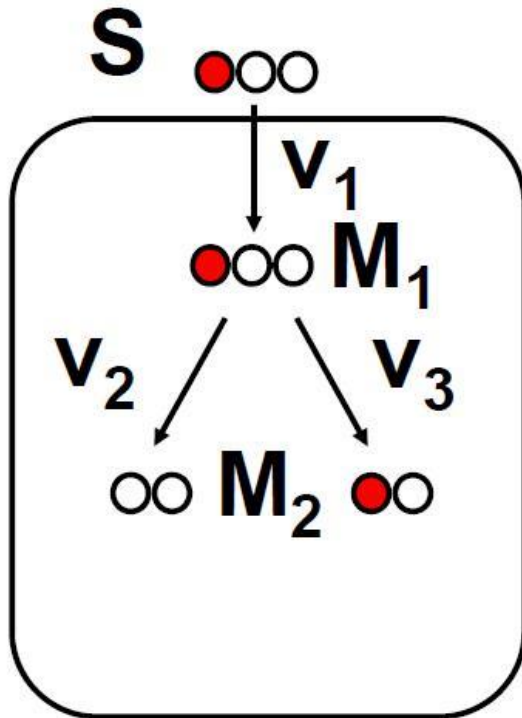


Metabolic flux analysis workflow

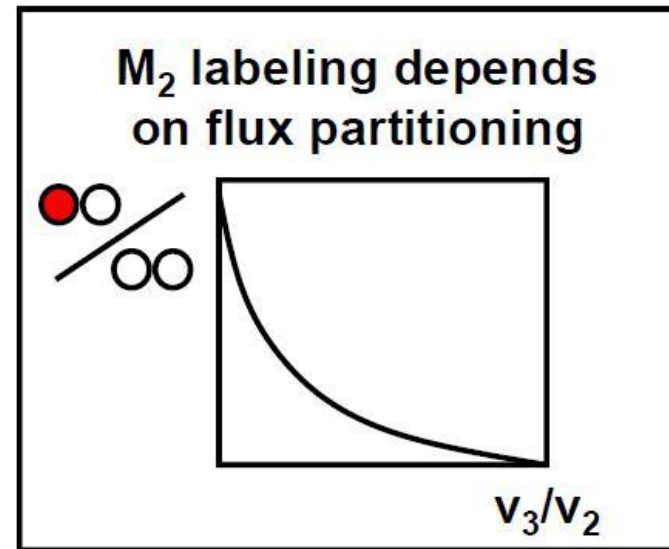


^{13}C Labeling Analysis

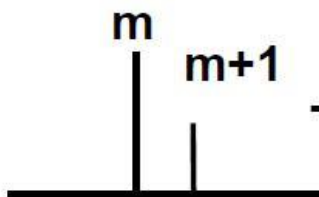
^{13}C Labeling Analysis



Substrate labeled on carbon 1



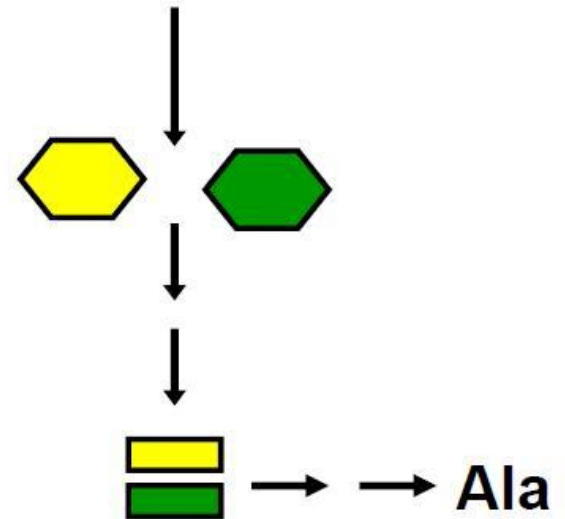
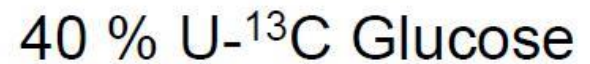
MS analysis of M₂

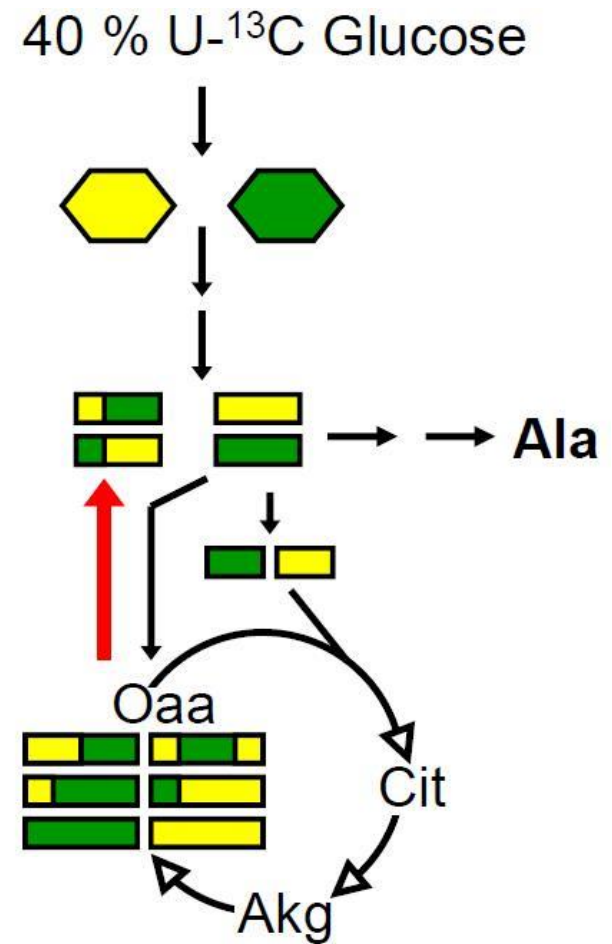
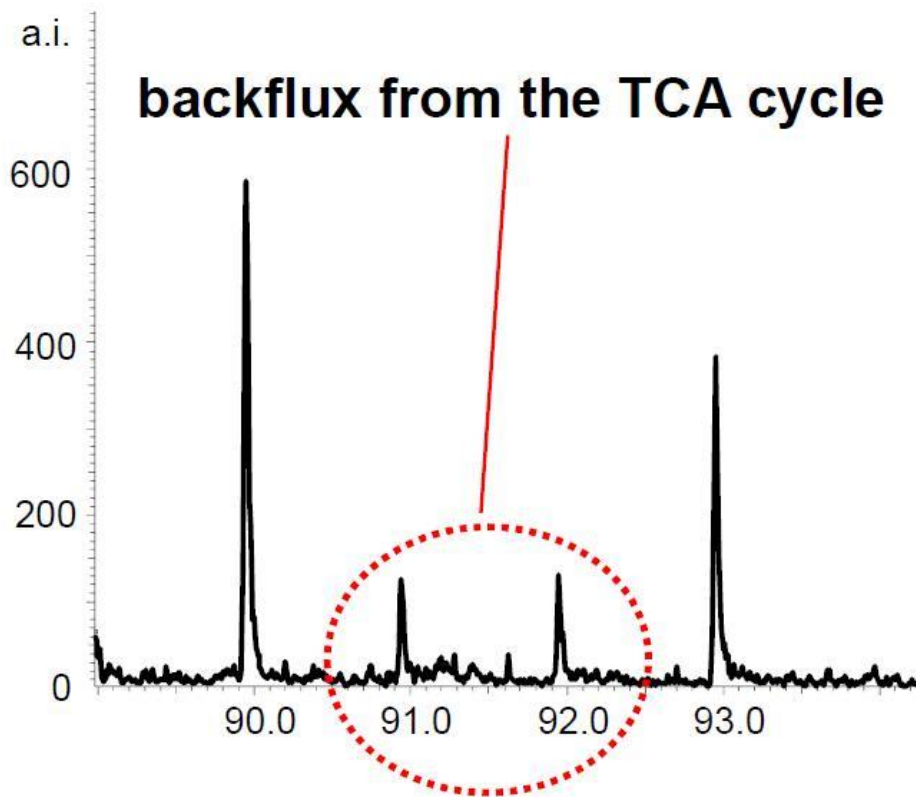


$$v_3/v_2 = I_{m+1}/I_m$$

Heinzle, Biosystems Engineering,
Braunwald, 2012

m and $m+3$





Quantification of intracellular reactions by ^{13}C tracer studies

