determines the byproduct of each reaction, specifically if strain i consumes resource beta then $D_{i\alpha\beta}$ is the fraction of the leaked energy of that reaction that produces resource alpha

external supply rate

dilution rate

consumption rate by an ***i*** individual per unit of ***a***

conversion from alpha to beta

conversion of β to aby i

leakage of β by i

Resource abundance

$$\frac{\partial R_\alpha}{\partial t} = K_\alpha - r_\alpha R_\alpha - \sum_i \underbrace{N_i c_{i\alpha} R_\alpha}_{\textit{total consumption of a by species i}} + \sum_{i,\beta} \frac{w_\beta}{w_\alpha} D_{i\alpha\beta}\, l_{i\beta} \underbrace{N_i c_{i\beta} R_\beta}_{\textit{total consumption of β by species i}} + D_{R_\alpha} \nabla^2 R_\alpha$$

contribution to alpha due to conversion from leaked resources

conversion from energy to cell

cell upkeep energy consumption - in E/T/cell

retained

Species abundance

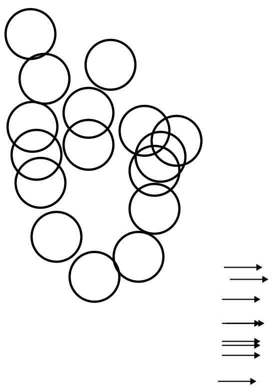
$$\frac{\partial N_i}{\partial t} = N_i \left(g_i \sum_\alpha w_\alpha (1 - l_{i\alpha}) \underbrace{c_{i\alpha} R_\alpha}_{\textit{fmole/cell/hr}} - m_i \right) + D_{N_i} \nabla^2 N_i$$

energy/fmole

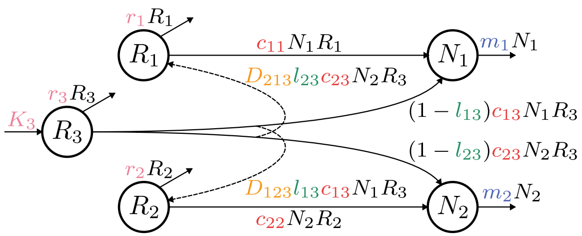
cell/energy

energy/cell/hr

diffusion constants



Simple example showing crossfeeding (cosmo)



General diagram