**i always refers to different species**
**a and b to resources**

external supply

dilution rates

consumption rate of a by i, per unit concentrations of both

determines the byproducts created when i consumes b

total leakage of b when consumed by i

resource concentrations

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

unit conversion factors

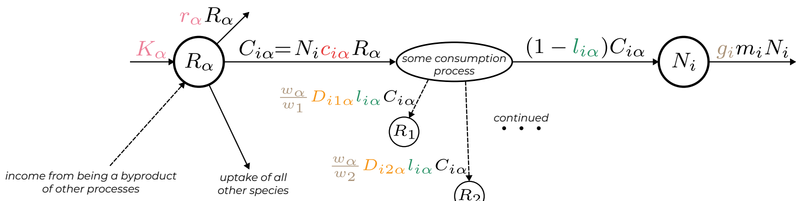
diffusion constants

species concentrations

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

cell upkeep energy consumptionl

## Consumption with byproducts diagram




Note for Wenying: should I instead replace the bigger expressions above with $\propto D_{i1\alpha}$