(A) density-dependent scaling of surface area to volume

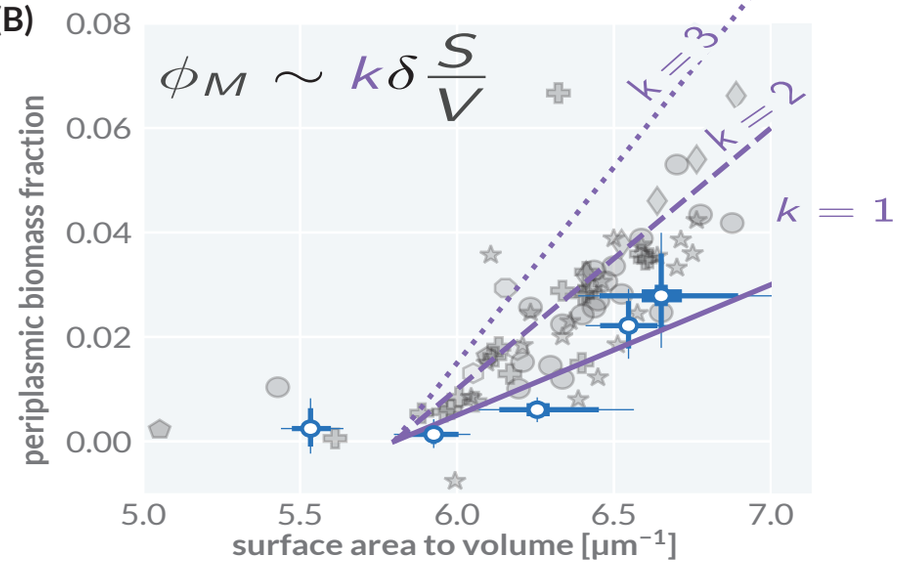
biomass density ratio

periplasmic biomass fraction

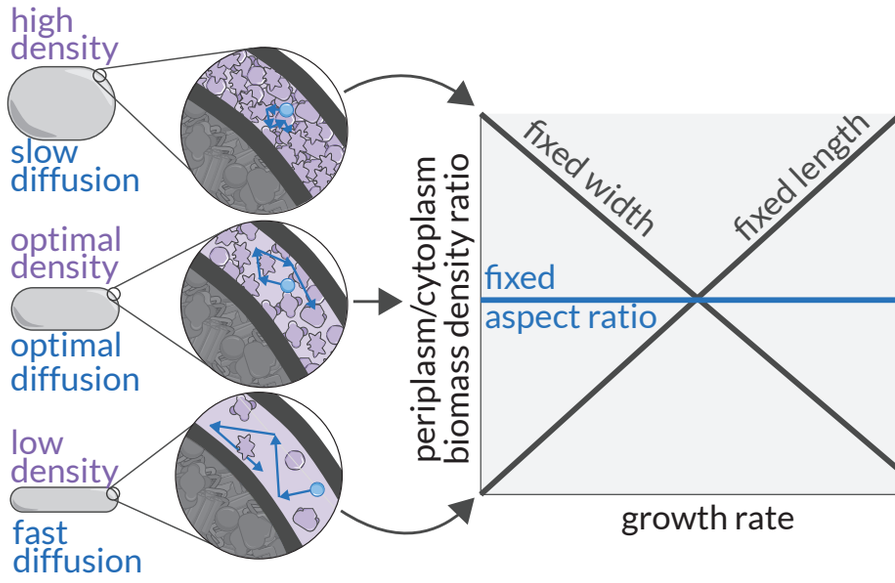
$$k \propto \frac{\rho_{peri}}{\rho_{cyt}} = \frac{M_{peri}/M_{cyt}}{\delta \frac{S}{V}} = \frac{\phi_M}{\delta \frac{S}{V}}$$

surface area to volume

(B)



(C) density-dependent scaling of surface area to volume



(C) crowder model for cell width control

(D)

$$w \sim \frac{12\alpha\delta k}{3\alpha - 1}\frac{1}{\phi_M}$$

relative density coefficient