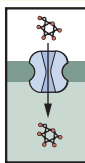


# NUTRIENT TRANSPORT

(A)

carbon transport

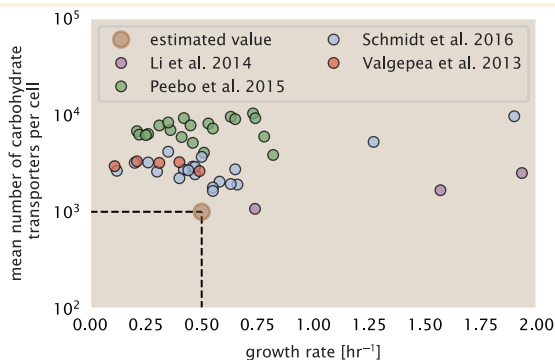


$$r_{\text{transport}} \approx \frac{200 \text{ sugars / sec}}{\text{transporter}} \quad \text{BNID: 103693}$$

$$m_{\text{carbon}} \approx \frac{m_{\text{dry}}}{2} \approx 0.15 \text{ pg} \quad \text{BNID: 100649}$$

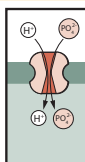
$$N_{\text{carbon}} \approx m_{\text{carbon}} \times \frac{1 \text{ carbon}}{12 \text{ Da}} \times \frac{6 \times 10^{11} \text{ Da}}{1 \text{ pg}} \approx 10^{10} \text{ C}$$

$$N_{\text{transporters}} \approx \frac{10^{10} \text{ carbon}}{\text{cell}} \times \frac{1 \text{ sugar}}{6 \text{ carbon}} \times \frac{1 \text{ sec}}{200 \text{ sugars}} \times \frac{1 \text{ cell}}{6000 \text{ sec}} \approx 1000 \text{ transporters}$$



(B)

phosphorus transport

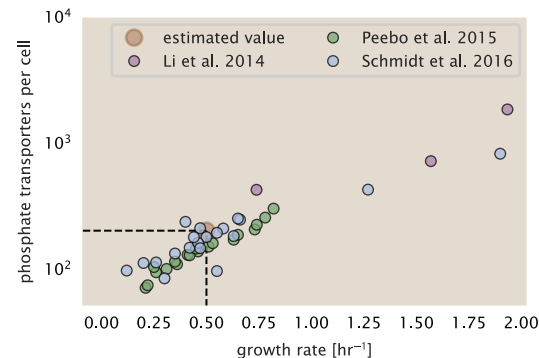


$$r_{\text{transport}} \approx \frac{100 \text{ phosphate / s}}{\text{transporter}}$$

$$m_{\text{phosphorus}} \approx 0.03 \times m_{\text{dry}} \approx 10 \text{ fg} \quad \text{BNID: 100653}$$

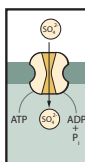
$$N_{\text{phosphorus}} \approx m_{\text{phosphorus}} \times \frac{1 \text{ phosphorus}}{30 \text{ Da}} \times \frac{6 \times 10^8 \text{ Da}}{1 \text{ fg}} \approx 2 \times 10^8 \text{ P}$$

$$N_{\text{transporters}} \approx \frac{2 \times 10^8 \text{ P}}{\text{cell}} \times \frac{1 \text{ phosphate}}{1 \text{ P}} \times \frac{1 \text{ sec}}{100 \text{ phosphate}} \times \frac{1 \text{ cell}}{6000 \text{ sec}} \approx 300 \text{ transporters}$$



(C)

sulfur transport



$$r_{\text{transport}} \approx \frac{10 \text{ sulfate / s}}{\text{transporter}} \quad \text{BNID: 109035}$$

$$m_{\text{sulfur}} \approx 0.01 \times m_{\text{dry}} \approx 3 \text{ fg} \quad \text{BNID: 109665}$$

$$N_{\text{sulfur}} \approx m_{\text{sulfur}} \times \frac{1 \text{ sulfur}}{32 \text{ Da}} \times \frac{6 \times 10^8 \text{ Da}}{1 \text{ fg}} \approx 5 \times 10^7 \text{ S}$$

$$N_{\text{transporters}} \approx \frac{5 \times 10^7 \text{ S}}{\text{cell}} \times \frac{1 \text{ sulfate}}{1 \text{ S}} \times \frac{1 \text{ sec}}{10 \text{ sulfate}} \times \frac{1 \text{ cell}}{6000 \text{ sec}} \approx 1000 \text{ transporters}$$

