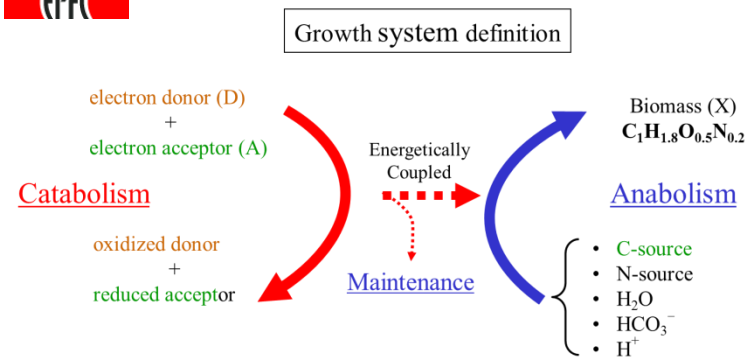

Growth is irreversible and requires a lot Energy

$$-(\dots)\text{elec donor} - (\dots)\text{elec acceptor} + (\dots)\text{oxyd. elec donor} + (\dots)\text{reduc. elec acceptor}$$
$$+ (\dots)\,H_2O + (\dots)\,HCO_3^- + (\dots)\,H^+ + \frac{1}{Y_{GX}^{max}}\textbf{Gibbs energy} + (\dots)\,\text{Heat}$$

$$\Delta G_R^0 = \delta.\Delta G_{fD}^0 + \gamma.\Delta G_{fC}^0 - \alpha.\Delta G_{fA}^0 - \beta.\Delta G_{fB}^0$$

ΔG_f^{01} : pH = 7; 298 °K; 1 mole.L^{-1}; 1 atm

HETEROtrophic growth

$$\frac{1}{Y_{GX}^{max}} = 200 + 18*(6-C)^{1.8} + e\,xp\left\{\left[\left(3.8-\gamma_c\right)^2\right]^{0.16}(3.6+0.4*C)\right\}$$

AUTOtrophic growth

$$\frac{1}{Y_{GX}^{max}} = 1000 \quad (\textit{Without RET})$$
$$= 3500 \quad (\textit{With RET})$$

→ Gibbs Energy new balance for growth stoichiometry

Max. Gibbs Energy Capacity

$$q_G^{max} = \frac{3.(-\Delta G_{cat})}{\gamma_D}\exp\left(\frac{-69000}{R}\left(\frac{1}{T}-\frac{1}{298}\right)\right)$$

$$m_G = 4.5\exp^{\left(\frac{-69000}{R}\left(\frac{1}{T}-\frac{1}{298}\right)\right)}$$

$$m_S = \frac{m_G}{-\Delta G_{cat}}$$

→

$$\mu^{max} = (q_G^{max} - m_G)Y_{GX}^{max}$$

$$\mu^{max} = \left(\frac{3.(-\Delta G_{cat})}{\gamma_D} - 4.5\right).Y_{GX}^{max}\exp^{\left(\frac{-69000}{R}\left(\frac{1}{T}-\frac{1}{298}\right)\right)}$$

Predicted μ^{max}(25 °C) [h^{-1}]				
Glucose	Glc ,O_2 → CO_2, H_2O	1.5	Glc → ethanol, CO_2	0.10
Acetate	Acetate, O_2 → CO_2, H_20	0.7	Acetate → CH_4, CO_2	0.015
CO_2 (+RET)	$NH_4^+ + O_2$ → NO_2^-	0.04		

Heat of sludge:1 g org. matter. = 1.366 g COD = 19.7 kJ

Heat production (aerobic bioprocess) ΔT = f (BOD) = f (Y_{COD})

$$Q = V_l.C_x.\frac{1}{Y_{HX}}.\mu \qquad Q = 0.12\times R_{O_2}$$