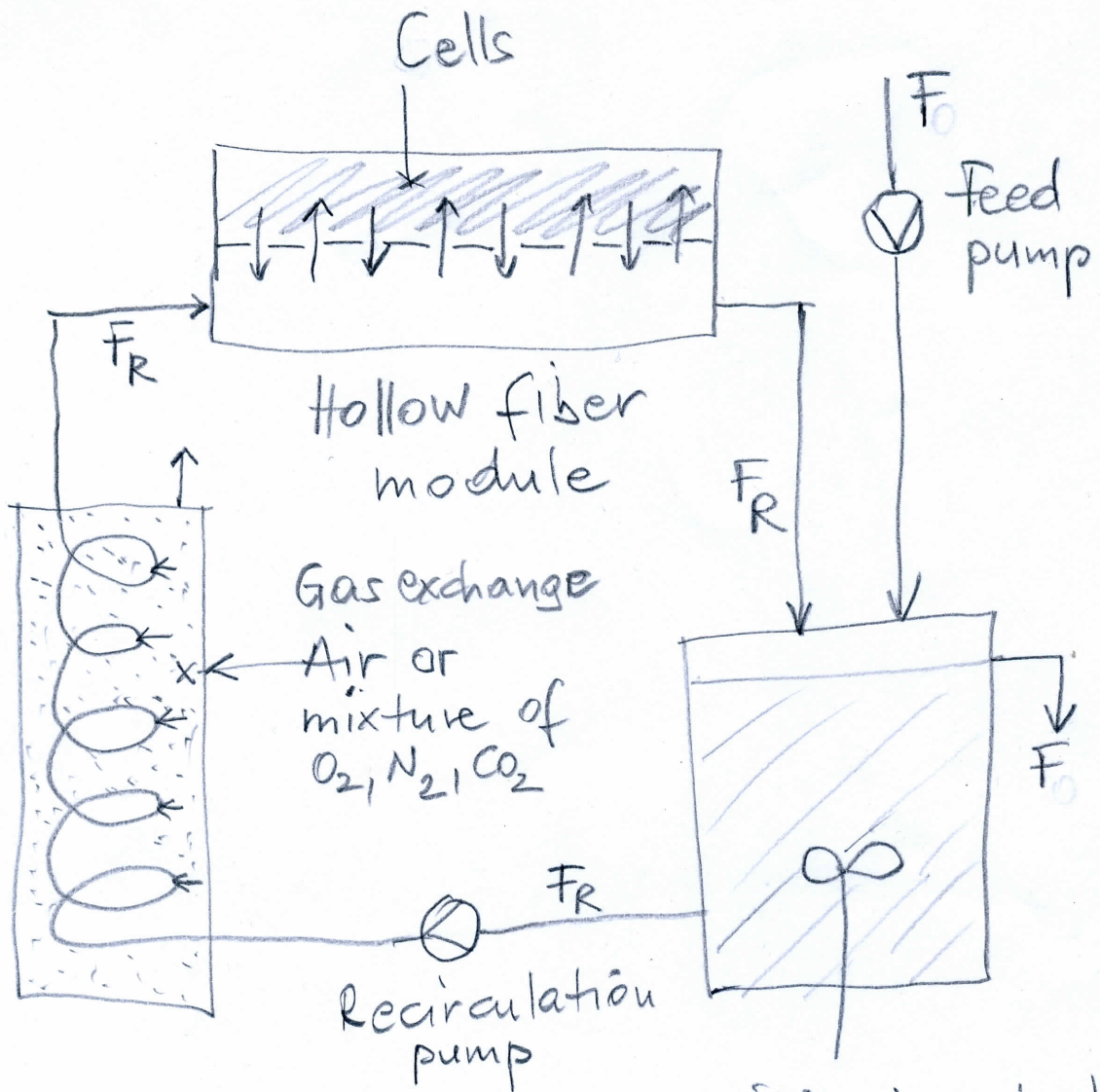


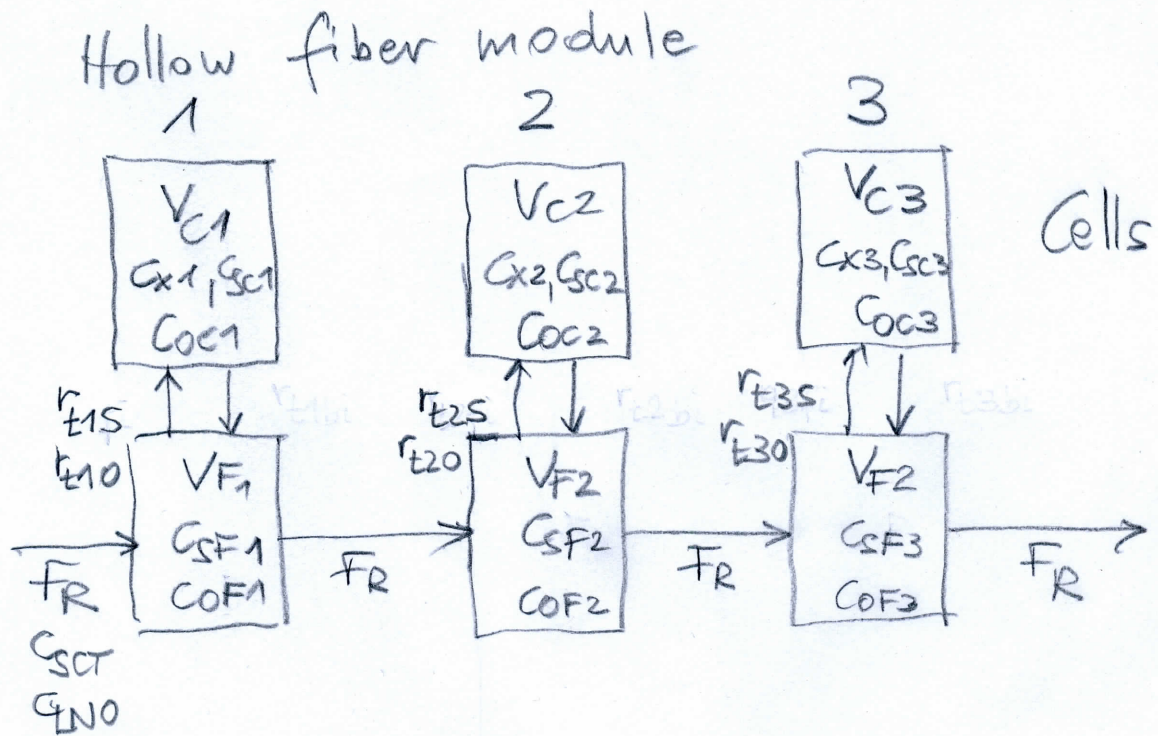
9.3.1

Exercise 1:



- Conditioning tank:
- addition of fresh media
 - pH control
 - Temperature control

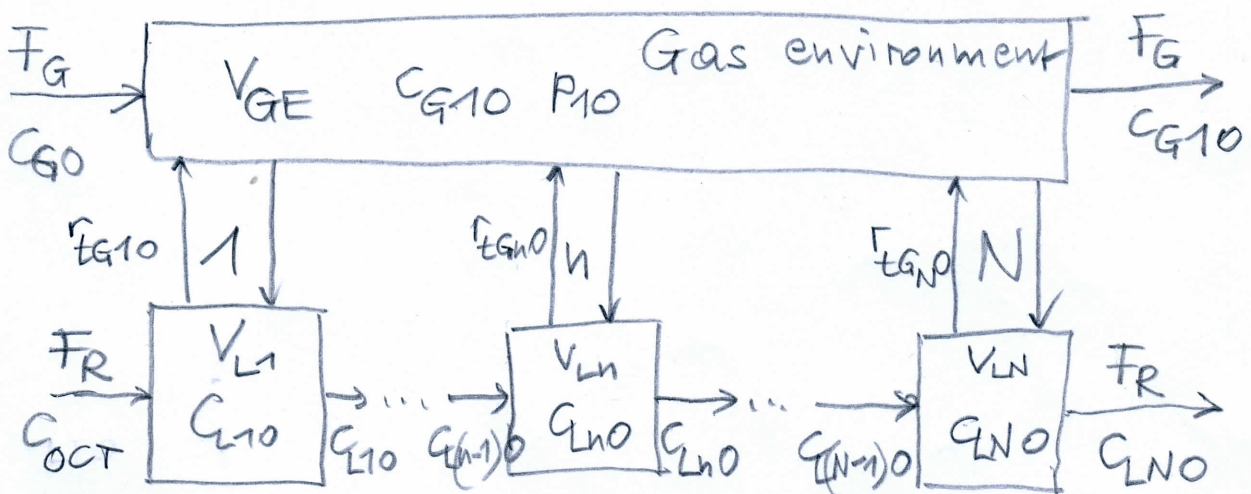
Exercise 2:



Assumption:

Transport between cell compartment is negligible

Aeration tube



9.3.3

Exercise 3:

We show only balances of sector 2 elements.

Cell compartment:

$$V_{c2} \frac{dC_{x2}}{dt} = r_{x2} \cdot V_{c2}$$

$$V_{c2} \frac{dC_{sc2}}{dt} = r_{s2} \cdot V_{c2} + r_{t2s} - r_{tbs}$$

$$V_{c2} \frac{dC_{oc2}}{dt} = r_{o2} \cdot V_{c2} + r_{t2o} - r_{tbo}$$

Lumen of the fiber:

$$V_{f2} \frac{dC_{sf2}}{dt} = F_R (C_{sf1} - C_{sf2}) - r_{t2s}$$

$$V_{f2} \frac{dC_{of2}}{dt} = F_R (C_{of1} - C_{of2}) - r_{t2o}$$

9.3.4

Exercise 4:

Hollow fiber section 2:

$$r_{t2O} = -k_{Lo} A_2 (C_{OF2} - C_{OC2})$$

Aeration tube section n:

lumen

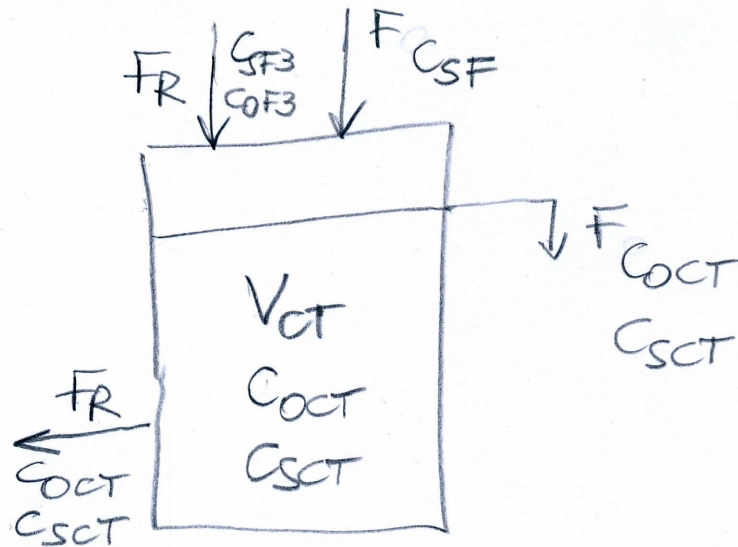
$$r_{tGnO} = -k_{Go} A_n (C_{OLn} - C_{OLn}^*)$$

$$C_{OLn}^* = \frac{p_o}{H_o} = \frac{C_{G10} R.T}{H_o}$$

9.3.5

Exercise 5

Only balances of conditioning tank are concerned



$$V_{CT} \cdot \frac{dC_{SCT}}{dt} = F(C_{SF} - C_{SCT}) + F_R(C_{SF3} - C_{SCT})$$

$$V_{CT} \cdot \frac{dC_{OCT}}{dt} = F(C_{OF} - C_{OCT}) + F_R(C_{OF3} - C_{OCT})$$

no aeration in conditioning tank