

Advanced Biomolecular Engineering - Spring 2020

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The material balanced equation for concentration of mRNA m_i and translated protein p_i is given by the equations below

$$\begin{aligned}\dot{m} &= r_{X,i}U_i - (\mu + \theta_{m,i})m_i + \lambda_i \quad \text{where } i = 1, 2, \dots, N \\ \dot{p} &= r_{L,i}W_i - (\mu + \theta_{p,i})p_i\end{aligned}$$

The term ' μ ' is a dilution term where,

$$\begin{aligned}\mu &= \beta^{-1}\dot{\beta} \\ \beta^{-1}\dot{\beta} &= X^{-1}\dot{X} + V_R^{-1}\dot{V}_R\end{aligned}$$

Where X denotes Cellmass concentration in culture and V_R denotes volume of the culture.

Since this is a cell free system with a constant working volume V_L , \dot{X} and \dot{V}_L will be equal to zero.

Consequently, μ will be zero. Hence the above equations will become

$$\begin{aligned}\dot{m} &= r_{X,i}U_i - \theta_{m,i}m_i + \lambda_i \quad \text{where } i = 1, 2, \dots, N \\ \dot{p} &= r_{L,i}W_i - \theta_{p,i}p_i\end{aligned}$$