

$$1a) B = \langle m_c \rangle \bar{N}_c V$$

$$V = 1 \text{ mL}$$

$$\bar{N}_c = 1 \times 10^8 \text{ cells/mL}$$

need mass of LacZ mRNA) in gDW/copy

$$B =] \text{ gDW}$$

$$b) \dot{m}_i = r_{xi} \bar{u}_i - (\mu + \theta_{mi}) m_i$$

$$@ \text{ SS } \dot{m}_i = 0 = r_{xi} \bar{u}_i - (\mu + \theta_{mi}) m_i$$

for lacZ mRNA $m_i = m^*$

$$m^* = \frac{r_{xi} \bar{u}_i}{\mu + \theta_{mi}}$$

$$m^* = K_x \bar{u}_i$$

$$K_x = \frac{r_{xi}}{\mu + \theta_{mi}}$$

degradation $(\frac{-\ln(1/2)}{5 \text{ min}})$
dilution
(assume negligible)

$$W = \exp\left(\frac{-G}{RT}\right)$$

$$u(I) = \frac{W_1 + W_2 f_I}{1 + W_1 + W_2 f_I}$$

$$\text{where } f_I = \frac{I^n}{K^n + I^n}$$

$$r_{xi} = k_{E,xi} R_{x,T} \left(\frac{G_i}{(Z_{xi} K_{x,i} + (Z_{xi} + 1) G)} \right)$$

kinetic rate of transcription (PS2)
total mRNA in system (B:64)
transcription characteristic initiation time (PS2)
transcription saturation constant (PS2)
2 copies cell

$$\text{When } I = 0, f_I = 0, m^* = K_x \left(\frac{W_1}{1 + W_1} \right)$$

$$m^* (1 + W_1) = K_x W_1$$

$$m^* = W_1$$

$$K_x - m^*$$

$$\text{At large } I, f_I \rightarrow 1, m^* \approx K_x \left(\frac{W_1 + W_2}{1 + W_1 + W_2} \right)$$

$$m^* (1 + W_1 + W_2) = K_x (W_1 + W_2)$$

$$m^* (1 + W_1) = K_x W_1$$

$$K_x - m^*$$