$$\frac{k_s}{k_g} = \frac{k_g k_M G}{k_M + G} \qquad k_s \approx \frac{k_M' G}{k_M + G}$$ where $k_M' = k_M k_g^L$ . .

$$\frac{\partial G}{\partial t} = D\frac{\partial^2 G}{\partial x^2} - KG$$

K depends on:
# of mitochondria
length of the cell.

at eqm

$$D\frac{\partial^2 G}{\partial x^2} = KG$$

$$\frac{\partial^2 G}{\partial x^2} = \frac{K}{D}G$$

$$G = Ae^{\sqrt{\frac{K}{D}}x} + Be^{-\sqrt{\frac{K}{D}}x} + C$$

we have $G(x=0) = G_0$
$G(x=L) = G_0$

$$\therefore \quad A+B+C = G_0$$

$$Ae^{\sqrt{\frac{K}{D}}L} + Be^{-\sqrt{K/D}L} + C = G_0$$

~~set c=0~~ set $c=0$

$$A\left(1-e^{\sqrt{\frac{K}{D}}L}\right) + B\left(1-e^{-\sqrt{K/D}L}\right) = 0$$

also $A + B = G_0$

$$(G_0 - B)\left(1-e^{\sqrt{\frac{K}{D}}L}\right) + B\left(1-e^{-\sqrt{\frac{K}{D}}L}\right) = 0$$

$$G_0\left(1-e^{\sqrt{\frac{K}{D}}L}\right) - B\left(1-e^{+\sqrt{\frac{K}{D}}L}\right) + B\left(1-e^{-\sqrt{\frac{K}{D}}L}\right) = 0$$

$$G_0\left(1-e^{+\sqrt{\frac{K}{D}}L}\right) = B\left(e^{-\sqrt{\frac{K}{D}}L} - e^{\sqrt{\frac{K}{D}}L}\right)$$

$$B = G_0\frac{\left(e^{\sqrt{\frac{K}{D}}L} - 1\right)}{\left(e^{\sqrt{\frac{K}{D}}L} - e^{-\sqrt{\frac{K}{D}}L}\right)}$$

$$A = G_0 - B = G_0\left[\frac{\cancel{e^{\sqrt{\frac{K}{D}}L}} - e^{-\sqrt{\frac{K}{D}}L} - \cancel{e^{\sqrt{\frac{K}{D}}L}} + 1}{e^{\sqrt{K/D}L} - e^{-\sqrt{\frac{K}{D}}L}}\right]$$

$$A = G_0 \left[\frac{1 - e^{-\sqrt{\frac{K}{D}}L}}{e^{\sqrt{K/D}L} - e^{-\sqrt{K/D}L}} \right]$$

$\therefore G(x) = A e^{\sqrt{\frac{K}{D}}L} + B e^{-\sqrt{\frac{K}{D}}L}$ where A & B are as given below

s. s. mitochondria distribution eq^n

1. $0 = -v \frac{dm_+}{dx} - k_{stop}(x) m_+ + \frac{k_{start}}{2} m_{stop}$

2. $0 = v \frac{dm_-}{dx} - k_{stop}(x) m_- + \frac{k_{start}}{2} m_{stop}$

3. $0 = k_{stop}(x) (m_+ + m_-) - k_{start} m_s$

Adding these 3 eq^ns together

$$v\frac{dm_-}{dx} - v\frac{dm_+}{dx} - k_{stop}(x) (m_+ + m_-) + \cdots = 0$$

(2-1) $v \left(\frac{dm_-}{dx} + \frac{dm_+}{dx} \right) + k_{stop}(x) (m_+ - m_-) = 0$

$$v \frac{d}{dx} \underbrace{(m_+ + m_-)}_{A} + k_s(x) \underbrace{(m_+ - m_-)}_{B} = 0$$

$$v \frac{d}{dx} (m_+ - m_-) = 0$$

2 eq^ns. $v \frac{dB}{dx} = 0 \Rightarrow B = \text{const} = B$

$$v \frac{dA}{dx} + k_s(x) B = 0$$

$$K_s \approx \frac{K_M' G}{K_M + G}$$ where $K_M' = K_m kg^2$

$$v \frac{dA}{dx} + K_s(x) B = 0$$

$$\frac{dA}{dx} + K_s(x) \frac{B}{V} = 0$$

$$\frac{dA}{dx} = -\frac{B}{V} K_s(x)$$

$$\int_{x=0}^{x=\cancel{x}} dA = -\frac{B}{V} \int_0^x K_s(x)\, dx$$

$$A = m_+(x) + m_-(x) + K$$

$$m_+(x) + m_-(x) = -\frac{B}{V} \left[\frac{K_m'}{\sqrt{K/D}} \left(\cancel{} \ln \left(\frac{e^{\sqrt{\frac{K}{D}} x} G_0 + K_M}{G_0 + K_m} \right) \right) \right]$$

also $K_{s\cancel{top}}(x)\, A = K_{start}\, m_s$

$$m_s = \frac{K_s(x) A}{K_{start}}$$

$$m_s(x) + m_+(x) + m_-(x)$$

$$= A \left[1 + \frac{K_s(x)}{K_{start}} \right]$$ where A is as above.