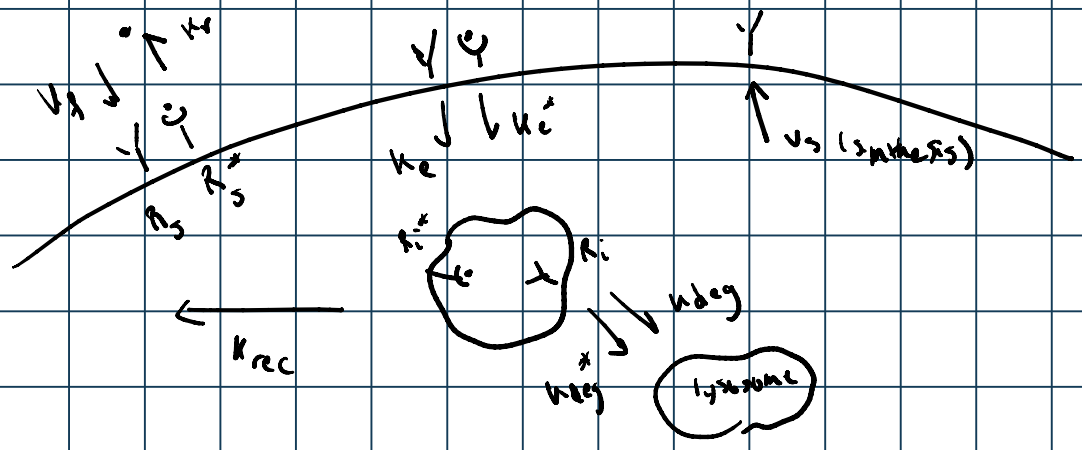
HW #5 Problem 1

Tuesday, May 5, 2020 6:05 PM



Mass Balances:

free surface receptor :
$$\frac{dR_s}{dt} = -k_f L R_s + k_r R_s^* - k_e R_s + k_{rec} R_i + v_s \quad (1)$$

bound surface receptor :
$$\frac{dR_s^*}{dt} = k_f L R_s - k_r R_s^* - k_e^* R_s^* + k_{rec} R_i^* \quad (2)$$

total internal receptor :
$$\frac{dR_i^T}{dt} = k_e R_s + k_e^* R_s^* - k_{deg} R_i^T - k_{rec} R_i^T \quad (3)$$

$$R_i^T = R_i + R_i^*$$

internal active receptor :
$$\frac{dR_i^*}{dt} = k_e^* R_s^* - k_{deg} R_i^* - k_{rec} R_i^* \quad (4)$$

internal receptor :
$$\frac{dR_i}{dt} = k_e R_s - k_{deg} R_i - k_{rec} R_i \quad (5)$$

SS Soln Unknowns: R_s, R_s^*, R_i, R_i^* & 4 eqns.

Solved in Matlab $R_s = R_s^*$ $R_i = R_i^*$ $RT = R^*_{Total}$

Solved in Matlab $R_{ss} = R_s^*$, $R_{is} = R_i^*$, $RT = R^{*Total}$

To find R^{*Total}_{max} take limit as $L \to \infty$

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>> PS5_P1

S =

  struct with fields:

    Ri: [1×1 sym]
    Rs: [1×1 sym]
   Rss: [1×1 sym]
   Ris: [1×1 sym]


RssSol =

(Kf*L*Vs*(Kdeg + Krec)^2)/(Kdeg^2*Ke*Kes + Kdeg^2*Ke*Kr + Kdeg*Ke*Kr*Krec + Kdeg^2*Kes*Kf*L +
Kdeg*Kes*Kf*Krec*L)


RisSol =

(Kes*Kf*L*Vs*(Kdeg + Krec))/(Kdeg^2*Ke*Kes + Kdeg^2*Ke*Kr + Kdeg*Ke*Kr*Krec + Kdeg^2*Kes*Kf*L +
Kdeg*Kes*Kf*Krec*L)


RT =

(Kf*L*Vs*(Kdeg + Krec)^2)/(Kdeg^2*Ke*Kes + Kdeg^2*Ke*Kr + Kdeg*Ke*Kr*Krec + Kdeg^2*Kes*Kf*L +
Kdeg*Kes*Kf*Krec*L) + (Kes*Kf*L*Vs*(Kdeg + Krec))/(Kdeg^2*Ke*Kes + Kdeg^2*Ke*Kr +
Kdeg*Ke*Kr*Krec + Kdeg^2*Kes*Kf*L + Kdeg*Kes*Kf*Krec*L)


RTMax =

(Kf*Vs*(Kdeg + Krec)^2)/(Kes*Kf*Kdeg^2 + Kes*Kf*Krec*Kdeg) + (Kes*Kf*Vs*(Kdeg +
Krec))/(Kes*Kf*Kdeg^2 + Kes*Kf*Krec*Kdeg)

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Due to the recycle the max concentration of active receptors increases. The recyle serves to decrease the effect of the endosome uptake.