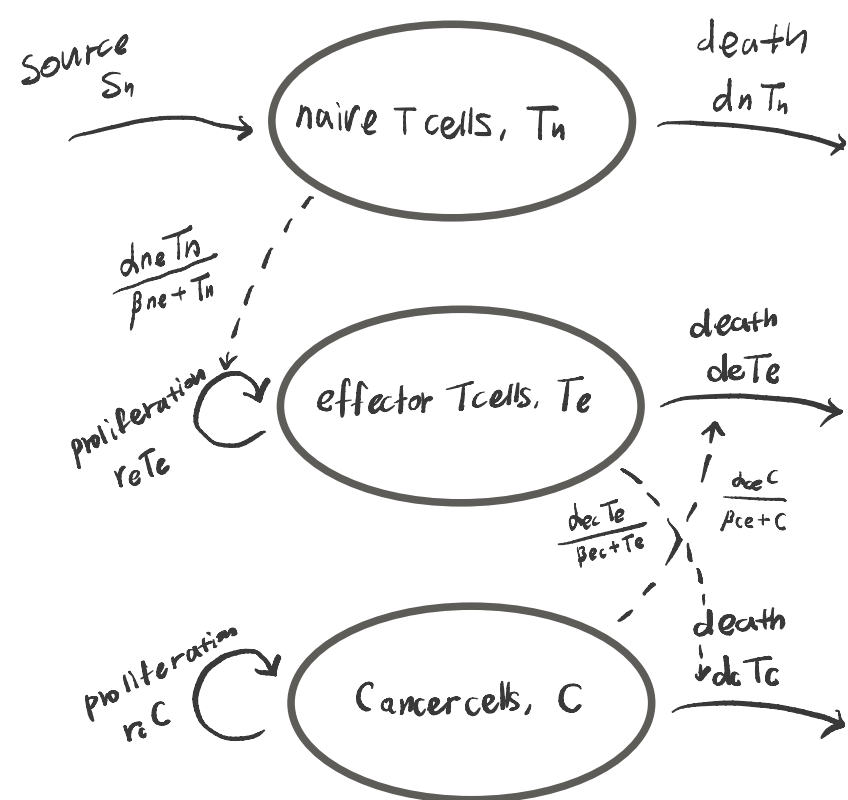$$J(\eta_1, \eta_2) = \int_{t_{initial}}^{t_{final}} \left[T(t) - \left(w_{00} I_{00}(t) + w_{01} I_{01}(t) + w_{10} I_{10}(t) + w_{11} I_{11}(t) \right) - \frac{1}{2} \beta_1 \eta_1^2(t) - \frac{1}{2} \beta_2 \eta_2^2(t) \right] dt$$
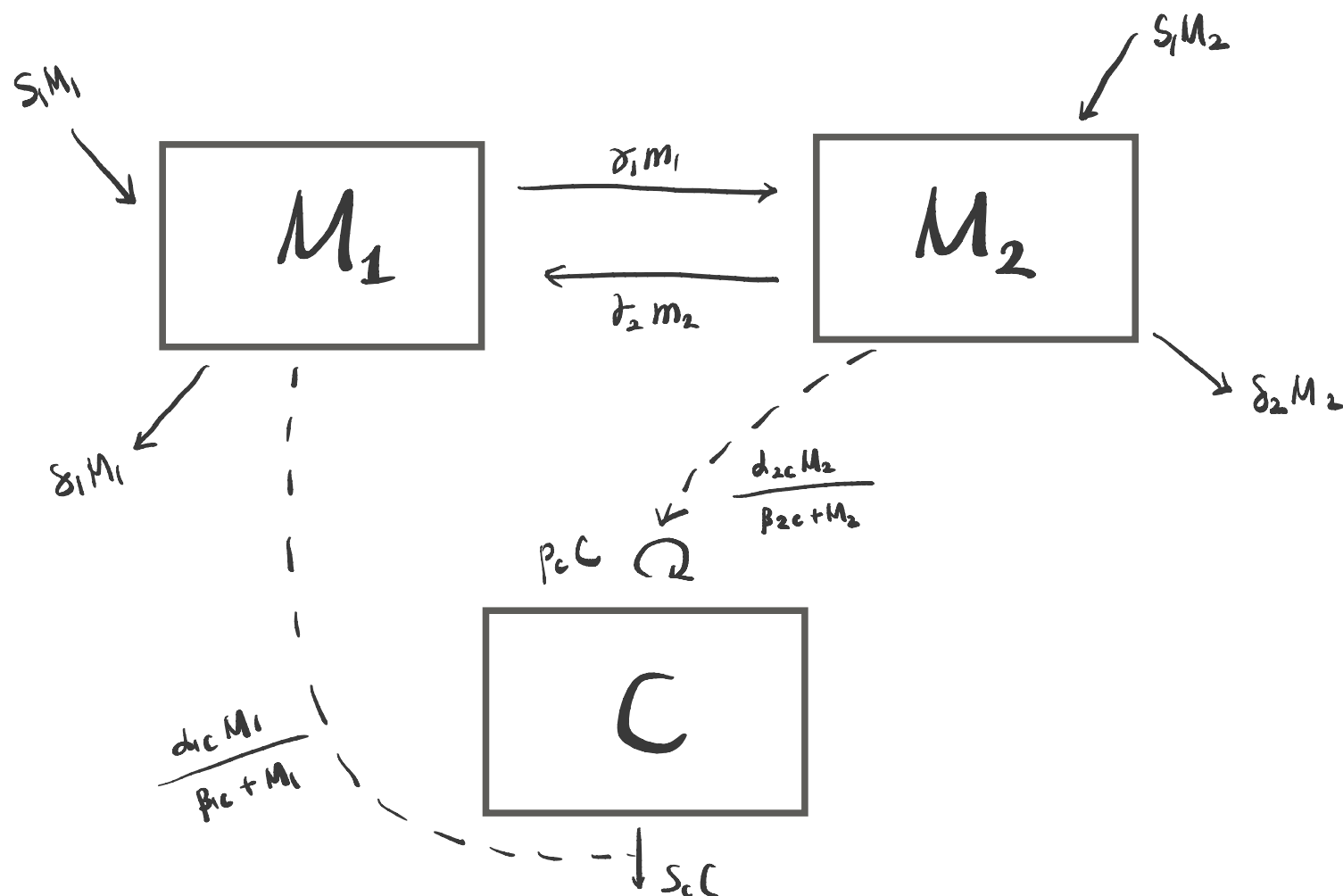
Semi-mechanistic dynamical systems models of diseases

$$\frac{dT_n}{dt} = S_n - d_n T_n$$

$$\frac{dT_e}{dt} = r_e T_e \left(\frac{d_{ne} T_n}{\beta_{ne} + T_n} \right) - d_e T_e \left(\frac{d_{ce} C}{\beta_{ce} + C} \right)$$

$$\frac{dC}{dt} = r_c C - d_c T_c \left(\frac{d_{ec} T_e}{\beta_{ec} + T_e} \right)$$

$$\frac{dM_1}{dt} = s_1 M_1 + \delta_1 M_1 - \gamma_1 m_1 - \gamma_2 m_2$$

$$\frac{dM_2}{dt} = s_1 M_2 + \gamma_1 m_1 - \gamma_2 m_2 - \delta_2 M_2$$

$$\frac{dC}{dt} = P_c C \left(\frac{d_{2c} M_2}{\beta_{2c} + M_2} \right) - S_c C \left(\frac{d_{1c} M_1}{\beta_{1c} + M_1} \right)$$