$$\frac{\partial[glu]}{\partial t} = D\left\{\frac{\partial^2[glu]}{\partial x^2}\right\} + k_{-1}(U_{max} - U) - k_1 U[glu] + \frac{dG}{dt} + \frac{dN_{2A}}{dt} + \frac{dN_{2B}}{dt} + \frac{dN_{2D}}{dt}$$

$$\frac{dU}{dt} = (k_{-1} + k_2)(U_{max} - U) - k_1 U[glu] \qquad\qquad U + glu \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} U : glu \xrightarrow{k_2} glu_{in} + U$$

$$\frac{dG}{dt} = k_{-1}(G_{max} - G) - k_1 G[glu] \qquad\qquad G + glu \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} G : glu$$

$$\frac{dN_{2A}}{dt} = k_{-1}(N_{2A:max} - N_{2A}) - k_1 N_{2A}[glu] \qquad\qquad N_{2A} + glu \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} N_{2A} : glu$$

$$\frac{dN_{2B}}{dt} = k_{-1}(N_{2B:max} - N_{2B}) - k_1 N_{2B}[glu] \qquad\qquad N_{2B} + glu \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} N_{2B} : glu$$

$$\frac{dN_{2D}}{dt} = k_{-1}(N_{2D:max} - N_{2D}) - k_1 N_{2D}[glu] \qquad\qquad N_{2D} + glu \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} N_{2D} : glu$$