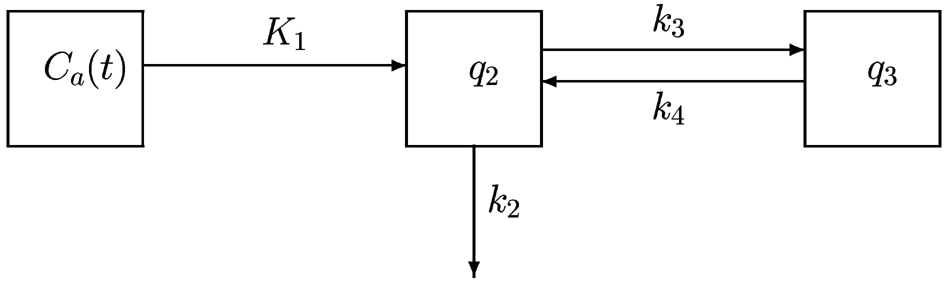
FDG MODEL



Compartment 1 - FDG in vascular space

Compartment 2 - FDG in extravascular space

Compartment 3 - FDG-6-P in extravascular space

The following set of differential equations describes the kinetics of activity in the two extravascular compartments.

$$\frac{dq_2(t)}{dt} = K_1 C_a(t) - (k_2 + k_3) q_2(t) + k_4 q_3(t) \tag{1}$$

$$\frac{dq_3(t)}{dt} = k_3 q_2(t) - k_4 q_3(t) \tag{2}$$

Solutions to the differential equations are as follows:

$$q_2(t) = \frac{K_1}{\beta - \alpha}[\,(k_4 - \alpha)e^{-\alpha t} + (\beta - k_4)e^{-\beta t}\,] * C_a(t) \tag{3}$$

$$q_3(t) = \frac{k_3 K_1}{\beta - \alpha}[\,e^{-\alpha t} - e^{-\beta t}\,] * C_a(t) \tag{4}$$

$$\beta = \left[k_2 + k_3 + k_4 + \sqrt{(k_2 + k_3 + k_4)^2 - 4k_2k_4}\,\right]/2 \tag{5}$$

$$\alpha = \left[k_2 + k_3 + k_4 - \sqrt{(k_2 + k_3 + k_4)^2 - 4k_2k_4}\,\right]/2 \tag{6}$$

where the * denotes convolution. Total PET activity (PET counts/ml) in a region of interest is given by

$$q_{pet}(t) = V_1 C_a(t) + q_2(t) + q_3(t) \tag{7}$$

where V_1 is the fractional blood volume. Values for the 4 parameters K_1, k_2, k_3,and k_4 are estimated by a nonlinear least-squares algorithm based on Marquaradt's method