$$\frac{\mathrm{d}([\mathrm{Bid}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(1)}[\mathrm{casp8}][\mathrm{Bid}] - \mathrm{k2}_{(1)}[\mathrm{casp8.Bid}])) \\ -((\mathrm{k1}_{(18)}[\mathrm{casp3}][\mathrm{Bid}] - \mathrm{k2}_{(18)}[\mathrm{casp3.Bid}])) \tag{1}$$

$$\frac{\mathrm{d}([\mathrm{casp8}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(1)}[\mathrm{casp8}][\mathrm{Bid}] - \mathrm{k2}_{(1)}[\mathrm{casp8.Bid}])) \\ +(\mathrm{k1}_{(2)}[\mathrm{casp8.Bid}]) \tag{2}$$

$$\frac{\mathrm{d}([\mathrm{casp8.Bid}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(1)}[\mathrm{casp8}][\mathrm{Bid}] - \mathrm{k2}_{(1)}[\mathrm{casp8.Bid}])) \\ -(\mathrm{k1}_{(2)}[\mathrm{casp8.Bid}]) \tag{3}$$

$$\frac{\mathrm{d}([\mathrm{tBid}_{\mathrm{Cyto}}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(2)}[\mathrm{casp8.Bid}]) \\ +(\mathrm{k1}_{(19)}[\mathrm{casp3.Bid}]) \\ -(\mathrm{k1}_{(20)}[\mathrm{tBid}_{\mathrm{Cyto}}]) \tag{4}$$

$$\frac{\mathrm{d}([\mathrm{Apaf1}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(3)}[\mathrm{cyc}_{\mathrm{Cyto}}][\mathrm{Apaf1}] - \mathrm{k2}_{(3)}[\mathrm{cyc.Apaf1}])) \tag{5}$$

$$\frac{\mathrm{d}([\mathrm{cyc}_{\mathrm{Cyto}}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(3)}[\mathrm{cyc}_{\mathrm{Cyto}}][\mathrm{Apaf1}] - \mathrm{k2}_{(3)}[\mathrm{cyc.Apaf1}])) \\ +(\mathrm{k1}_{(23)}[\mathrm{Bax2}][\mathrm{cyc}_{\mathrm{Mito}}]) \\ +(\mathrm{k1}_{(28)}[\mathrm{Bak2}][\mathrm{cyc}_{\mathrm{Mito}}]) \tag{6}$$

$$\frac{\mathrm{d}([\mathrm{cyc}_{\mathrm{Cyto}}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(3)}[\mathrm{cyc}_{\mathrm{Cyto}}][\mathrm{Apaf1}] - \mathrm{k2}_{(3)}[\mathrm{cyc.Apaf1}])) \\ +(\mathrm{k1}_{(23)}[\mathrm{Bax2}][\mathrm{cyc}_{\mathrm{Mito}}]) \\ +(\mathrm{k1}_{(28)}[\mathrm{Bak2}][\mathrm{cyc}_{\mathrm{Mito}}]) \tag{7}$$

$$\frac{\mathrm{d}([\mathrm{cyc}_{\mathrm{Cyto}}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(3)}[\mathrm{cyc}_{\mathrm{Cyto}}][\mathrm{Apaf1}] - \mathrm{k2}_{(3)}[\mathrm{cyc.Apaf1}])) \\ +(\mathrm{k1}_{(23)}[\mathrm{Bax2}][\mathrm{cyc}_{\mathrm{Mito}}]) \\ +(\mathrm{k1}_{(28)}[\mathrm{Bak2}][\mathrm{cyc}_{\mathrm{Mito}}]) \tag{8}$$

$$\frac{\mathrm{d}([\mathrm{cyc.Apaf1}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(3)}[\mathrm{cyc}_{\mathrm{Cyto}}][\mathrm{Apaf1}] - \mathrm{k2}_{(3)}[\mathrm{cyc.Apaf1}])) \\ -7((\mathrm{k1}_{(4)}[\mathrm{cyc.Apaf1}]^{7} - \mathrm{k2}_{(4)}[\mathrm{apop}])) \tag{9}$$

$$\frac{\mathrm{d}([\mathrm{apop}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(4)}[\mathrm{cyc.Apaf1}]^{7} - \mathrm{k2}_{(4)}[\mathrm{apop}])) \\ -((\mathrm{k1}_{(5)}[\mathrm{apop}][\mathrm{pro9}] - \mathrm{k2}_{(5)}[\mathrm{apop.pro9}])) \\ +((\mathrm{k1}_{(9)}[\mathrm{apop.casp9}] - \mathrm{k2}_{(9)}[\mathrm{apop}][\mathrm{casp9}])) \tag{10}$$

$$\frac{\mathrm{d}([\mathrm{apop.pro9}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(5)}[\mathrm{apop}][\mathrm{pro9}] - \mathrm{k2}_{(5)}[\mathrm{apop.pro9}])) \\ -((\mathrm{k1}_{(6)}[\mathrm{apop.pro9}][\mathrm{pro9}] - \mathrm{k2}_{(6)}[\mathrm{apop.(pro9)2}])) \tag{11}$$

$$\frac{\mathrm{d}([\mathrm{pro9}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(5)}[\mathrm{apop}][\mathrm{pro9}] - \mathrm{k2}_{(5)}[\mathrm{apop.pro9}])) \\ -((\mathrm{k1}_{(6)}[\mathrm{apop.pro9}][\mathrm{pro9}] - \mathrm{k2}_{(6)}[\mathrm{apop.(pro9)2}])) \tag{12}$$

$$\frac{\mathrm{d}([\mathrm{apop.(pro9)2}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(6)}[\mathrm{apop.pro9}][\mathrm{pro9}] - \mathrm{k2}_{(6)}[\mathrm{apop.(pro9)2}])) \\ -(\mathrm{k1}_{(7)}[\mathrm{apop.(pro9)2}]) \tag{13}$$

$$\frac{\mathrm{d}([\mathrm{apop.(casp9)2}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(14)}[\mathrm{apop.(casp9)2}][\mathrm{IAP}] - \mathrm{k2}_{(14)}[\mathrm{apop.(casp9)2.IAP}])) \\ -((\mathrm{k1}_{(16)}[\mathrm{apop.(casp9)2}][\mathrm{pro3}] - \mathrm{k2}_{(16)}[\mathrm{apop.(casp9)2.pro3}])) \\ +(\mathrm{k1}_{(17)}[\mathrm{apop.(casp9)2.pro3}]) \\ +(\mathrm{k1}_{(7)}[\mathrm{apop.(pro9)2}]) \\ -((\mathrm{k1}_{(8)}[\mathrm{apop.(casp9)2}] - \mathrm{k2}_{(8)}[\mathrm{apop.casp9}][\mathrm{casp9}])) \tag{14}$$

$$\frac{\mathrm{d}([\text{apop.(casp9)2}]V_{\text{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(14)}[\text{apop.(casp9)2}][\text{IAP}] - \mathrm{k2}_{(14)}[\text{apop.(casp9)2.IAP}]))$$
$$-((\mathrm{k1}_{(16)}[\text{apop.(casp9)2}][\text{pro3}] - \mathrm{k2}_{(16)}[\text{apop.(casp9)2.pro3}]))$$
$$+(\mathrm{k1}_{(17)}[\text{apop.(casp9)2.pro3}])$$
$$+(\mathrm{k1}_{(7)}[\text{apop.(pro9)2}])$$
$$-((\mathrm{k1}_{(8)}[\text{apop.(casp9)2}] - \mathrm{k2}_{(8)}[\text{apop.casp9}][\text{casp9}])) \tag{15}$$

$$\frac{\mathrm{d}([\text{casp9}]V_{\text{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(11)}[\text{casp9.pro3}])$$
$$-((\mathrm{k1}_{(12)}[\text{casp9}][\text{IAP}] - \mathrm{k2}_{(12)}[\text{casp9.IAP}]))$$
$$+((\mathrm{k1}_{(8)}[\text{apop.(casp9)2}] - \mathrm{k2}_{(8)}[\text{apop.casp9}][\text{casp9}])) \tag{16}$$
$$+((\mathrm{k1}_{(9)}[\text{apop.casp9}] - \mathrm{k2}_{(9)}[\text{apop}][\text{casp9}]))$$
$$-((\mathrm{k1}_{(10)}[\text{casp9}][\text{pro3}] - \mathrm{k2}_{(10)}[\text{casp9.pro3}]))$$

$$\frac{\mathrm{d}([\text{apop.casp9}]V_{\text{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(13)}[\text{apop.casp9}][\text{IAP}] - \mathrm{k2}_{(13)}[\text{apop.casp9.IAP}]))$$
$$+((\mathrm{k1}_{(8)}[\text{apop.(casp9)2}] - \mathrm{k2}_{(8)}[\text{apop.casp9}][\text{casp9}]))$$
$$-((\mathrm{k1}_{(9)}[\text{apop.casp9}] - \mathrm{k2}_{(9)}[\text{apop}][\text{casp9}])) \tag{17}$$

$$\frac{\mathrm{d}([\text{casp9.pro3}]V_{\text{Cyto}})}{\mathrm{d}t} = -(\mathrm{k1}_{(11)}[\text{casp9.pro3}]) \tag{18}$$
$$+((\mathrm{k1}_{(10)}[\text{casp9}][\text{pro3}] - \mathrm{k2}_{(10)}[\text{casp9.pro3}]))$$

$$\frac{\mathrm{d}([\text{pro3}]V_{\text{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(16)}[\text{apop.(casp9)2}][\text{pro3}] - \mathrm{k2}_{(16)}[\text{apop.(casp9)2.pro3}]))$$
$$-((\mathrm{k1}_{(10)}[\text{casp9}][\text{pro3}] - \mathrm{k2}_{(10)}[\text{casp9.pro3}])) \tag{19}$$

$$\frac{\mathrm{d}([\mathrm{casp3}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(11)}[\mathrm{casp9.pro3}])$$
$$-((\mathrm{k1}_{(15)}[\mathrm{casp3}][\mathrm{IAP}] - \mathrm{k2}_{(15)}[\mathrm{casp3.IAP}]))$$
$$+(\mathrm{k1}_{(17)}[\mathrm{apop.(casp9)2.pro3}])$$
$$-((\mathrm{k1}_{(18)}[\mathrm{casp3}][\mathrm{Bid}] - \mathrm{k2}_{(18)}[\mathrm{casp3.Bid}])) \quad (20)$$
$$+(\mathrm{k1}_{(19)}[\mathrm{casp3.Bid}])$$
$$-((\mathrm{k1}_{(29)}[\mathrm{casp3}][\mathrm{Bcl-xLCyto}] - \mathrm{k2}_{(29)}[\mathrm{casp3.Bcl-xL}]))$$
$$+(\mathrm{k1}_{(30)}[\mathrm{casp3.Bcl-xL}])$$

$$\frac{\mathrm{d}([\mathrm{IAP}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = -((\mathrm{k1}_{(12)}[\mathrm{casp9}][\mathrm{IAP}] - \mathrm{k2}_{(12)}[\mathrm{casp9.IAP}]))$$
$$-((\mathrm{k1}_{(13)}[\mathrm{apop.casp9}][\mathrm{IAP}] - \mathrm{k2}_{(13)}[\mathrm{apop.casp9.IAP}])) \quad (21)$$
$$-((\mathrm{k1}_{(14)}[\mathrm{apop.(casp9)2}][\mathrm{IAP}] - \mathrm{k2}_{(14)}[\mathrm{apop.(casp9)2.IAP}]))$$
$$-((\mathrm{k1}_{(15)}[\mathrm{casp3}][\mathrm{IAP}] - \mathrm{k2}_{(15)}[\mathrm{casp3.IAP}]))$$

$$\frac{\mathrm{d}([\mathrm{casp9.IAP}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(12)}[\mathrm{casp9}][\mathrm{IAP}] - \mathrm{k2}_{(12)}[\mathrm{casp9.IAP}])) \quad (22)$$

$$\frac{\mathrm{d}([\mathrm{apop.casp9.IAP}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(13)}[\mathrm{apop.casp9}][\mathrm{IAP}] - \mathrm{k2}_{(13)}[\mathrm{apop.casp9.IAP}])) \quad (23)$$

$$\frac{\mathrm{d}([\mathrm{apop.(casp9)2.IAP}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(14)}[\mathrm{apop.(casp9)2}][\mathrm{IAP}] - \mathrm{k2}_{(14)}[\mathrm{apop.(casp9)2.IAP}])) \quad (24)$$

$$\frac{\mathrm{d}([\mathrm{casp3.Bid}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(18)}[\mathrm{casp3}][\mathrm{Bid}] - \mathrm{k2}_{(18)}[\mathrm{casp3.Bid}])) \quad (25)$$
$$-(\mathrm{k1}_{(19)}[\mathrm{casp3.Bid}])$$

$$\frac{\mathrm{d}([\mathrm{apop.(casp9)2.pro3}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(16)}[\mathrm{apop.(casp9)2}][\mathrm{pro3}] - \mathrm{k2}_{(16)}[\mathrm{apop.(casp9)2.pro3}]))$$
$$-(\mathrm{k1}_{(17)}[\mathrm{apop.(casp9)2.pro3}]) \quad (26)$$

$$\frac{\mathrm{d}([\mathrm{casp3.IAP}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +((\mathrm{k1}_{(15)}[\mathrm{casp3}][\mathrm{IAP}] - \mathrm{k2}_{(15)}[\mathrm{casp3.IAP}])) \tag{27}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{tBid}_{\mathrm{Mito}}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= +(\mathrm{k1}_{(20)}[\mathrm{tBid}_{\mathrm{Cyto}}]) \\ -(\mathrm{k1}_{(21)}[\mathrm{tBid}_{\mathrm{Mito}}][\mathrm{Bax}_{\mathrm{Mito}}])&+(\mathrm{k1}_{(22)}[\mathrm{tBid.Bax}][\mathrm{Bax}_{\mathrm{Mito}}]) \\ -(\mathrm{k1}_{(25)}[\mathrm{Bak}][\mathrm{tBid}_{\mathrm{Mito}}])&+(\mathrm{k1}_{(26)}[\mathrm{tBid.Bak}][\mathrm{Bak}])\end{aligned} \tag{28}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{Bax}_{\mathrm{Mito}}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= -(\mathrm{k1}_{(21)}[\mathrm{tBid}_{\mathrm{Mito}}][\mathrm{Bax}_{\mathrm{Mito}}]) \\ &\quad -(\mathrm{k1}_{(22)}[\mathrm{tBid.Bax}][\mathrm{Bax}_{\mathrm{Mito}}]) \\ &\quad -(\mathrm{k1}_{(24)}[\mathrm{Bax}_{\mathrm{Mito}}][\mathrm{Bcl} - \mathrm{xLMito}])\end{aligned} \tag{29}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{tBid.Bax}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= +(\mathrm{k1}_{(21)}[\mathrm{tBid}_{\mathrm{Mito}}][\mathrm{Bax}_{\mathrm{Mito}}]) \\ &\quad -(\mathrm{k1}_{(22)}[\mathrm{tBid.Bax}][\mathrm{Bax}_{\mathrm{Mito}}])\end{aligned} \tag{30}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{cyc}_{\mathrm{Mito}}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= -(\mathrm{k1}_{(23)}[\mathrm{Bax2}][\mathrm{cyc}_{\mathrm{Mito}}]) \\ &\quad -(\mathrm{k1}_{(28)}[\mathrm{Bak2}][\mathrm{cyc}_{\mathrm{Mito}}])\end{aligned} \tag{31}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{Bax.Bcl} - \mathrm{xL}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= +(\mathrm{k1}_{(24)}[\mathrm{Bax}_{\mathrm{Mito}}][\mathrm{Bcl} - \mathrm{xLMito}]) \\ &\quad -(\mathrm{k1}_{(27)}[\mathrm{Bax.Bcl} - \mathrm{xL}])\end{aligned} \tag{32}$$

$$\frac{\mathrm{d}([\mathrm{Bcl} - \mathrm{xLMito}]V_{\mathrm{Mito}})}{\mathrm{d}t} = -(\mathrm{k1}_{(24)}[\mathrm{Bax}_{\mathrm{Mito}}][\mathrm{Bcl} - \mathrm{xLMito}]) \tag{33}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{Bak}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= -(\mathrm{k1}_{(25)}[\mathrm{Bak}][\mathrm{tBid}_{\mathrm{Mito}}]) \\ &\quad -(\mathrm{k1}_{(26)}[\mathrm{tBid.Bak}][\mathrm{Bak}])\end{aligned} \tag{34}$$

$$\frac{\mathrm{d}([\mathrm{Bak.tBid}]V_{\mathrm{Mito}})}{\mathrm{d}t} = +(\mathrm{k1}_{(25)}[\mathrm{Bak}][\mathrm{tBid}_{\mathrm{Mito}}]) \tag{35}$$

$$\frac{\mathrm{d}([\mathrm{tBid.Bak}]V_{\mathrm{Mito}})}{\mathrm{d}t} = -(\mathrm{k1}_{(26)}[\mathrm{tBid.Bak}][\mathrm{Bak}]) \tag{36}$$

$$\frac{\mathrm{d}([\mathrm{BaxCyto}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(27)}[\mathrm{Bax.Bcl-xL}]) \tag{37}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{Bcl-xLCyto}]V_{\mathrm{Cyto}})}{\mathrm{d}t} &= +(\mathrm{k1}_{(27)}[\mathrm{Bax.Bcl-xL}]) \\ -((\mathrm{k1}_{(29)}[\mathrm{casp3}][\mathrm{Bcl-xLCyto}] &- \mathrm{k2}_{(29)}[\mathrm{casp3.Bcl-xL}]))\end{aligned} \tag{38}$$

$$\frac{\mathrm{d}([\mathrm{Bax2}]V_{\mathrm{Mito}})}{\mathrm{d}t} = +(\mathrm{k1}_{(22)}[\mathrm{tBid.Bax}][\mathrm{Bax}_{\mathrm{Mito}}]) \tag{39}$$

$$\frac{\mathrm{d}([\mathrm{Bak2}]V_{\mathrm{Mito}})}{\mathrm{d}t} = +(\mathrm{k1}_{(26)}[\mathrm{tBid.Bak}][\mathrm{Bak}]) \tag{40}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{casp3.Bcl-xL}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= +((\mathrm{k1}_{(29)}[\mathrm{casp3}][\mathrm{Bcl-xLCyto}] - \mathrm{k2}_{(29)}[\mathrm{casp3.Bcl-xL}])) \\ &\quad -(\mathrm{k1}_{(30)}[\mathrm{casp3.Bcl-xL}])\end{aligned} \tag{41}$$

$$\frac{\mathrm{d}([\mathrm{Bcl-xL.Inactive}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(30)}[\mathrm{casp3.Bcl-xL}]) \tag{42}$$