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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\frac{\mathrm{d}([\mathrm{Bax2}]V_{\mathrm{Mito}})}{\mathrm{d}t} = +(\mathrm{k1}_{(22)}[\mathrm{tBid.Bax}][\mathrm{Bax}_{\mathrm{Mito}}]) \tag{38}$$

$$\frac{\mathrm{d}([\mathrm{Bak2}]V_{\mathrm{Mito}})}{\mathrm{d}t} = +(\mathrm{k1}_{(26)}[\mathrm{tBid.Bak}][\mathrm{Bak}]) \tag{39}$$

$$\begin{aligned}\frac{\mathrm{d}([\mathrm{casp3.Bcl-xL}]V_{\mathrm{Mito}})}{\mathrm{d}t} &= +((\mathrm{k1}_{(29)}[\mathrm{casp3}][\mathrm{Bcl-xLCyto}] - \mathrm{k2}_{(29)}[\mathrm{casp3.Bcl-xL}])) \\ &\quad -(\mathrm{k1}_{(30)}[\mathrm{casp3.Bcl-xL}])\end{aligned} \tag{40}$$

$$\frac{\mathrm{d}([\mathrm{Bcl-xL.Inactive}]V_{\mathrm{Cyto}})}{\mathrm{d}t} = +(\mathrm{k1}_{(30)}[\mathrm{casp3.Bcl-xL}]) \tag{41}$$