

$$\begin{aligned} \frac{d\left([cL_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(q1 \cdot L \cdot [cP] \cdot gml + \frac{n1 \cdot g1^2}{g1^2 + ([cP9] + [cP7] + [cP5] + [cT])^2} \cdot gml - (m1 \cdot L + m2 \cdot (1 - L)) \cdot [cL_m] \right) \\ \frac{d\left([cL] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{(p2 + p1 \cdot L) \cdot [cL_m]}{gml} - m3 \cdot [cL] - \frac{p3 \cdot [cL]^2}{[cL]^2 + g3^2} \right) \\ \frac{d\left([cLmod] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p3 \cdot [cL]^2}{[cL]^2 + g3^2} - m3 \cdot [cLmod] \right) \\ \frac{d\left([cP] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p7 \cdot (1 - L) \cdot (1 - [cP]) - m11 \cdot [cP] \cdot L) \\ \frac{d\left([cP9_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(q3t \cdot L \cdot [cP] \cdot gm9 + \frac{\frac{\frac{nt1 \cdot (g1t + at1 \cdot [cLmod])}{g1t + [cLmod]} \cdot g2t^2}{g2t^2 + [cL]^2} \cdot g3t}{g3t + [cEC]} \cdot g4t^2 \cdot gm9 - m1t \cdot [cP9_m] \right) \\ \frac{d\left([cP9] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p1t \cdot [cP9_m]}{gm9} - mp1t \cdot [cP9] \right) \\ \frac{d\left([cP7_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{\frac{\frac{nt2 \cdot g5t^2}{g5t^2 + [cL]^2} \cdot g6t}{g6t + [cEC]} \cdot g7t^2}{g7t^2 + ([cP5] + [cT])^2} \cdot gm7 - m2t \cdot [cP7_m] \right) \\ \frac{d\left([cP7] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p2t \cdot [cP7_m]}{gm7} - (mp2t + mp3t \cdot (1 - L)) \cdot [cP7] \right) \\ \frac{d\left([cP5_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{\frac{\frac{\frac{nt3 \cdot (g8t + at2 \cdot [cLmod])}{g8t + [cLmod]} \cdot g9t^2}{g9t^2 + [cL]^2} \cdot g10t}{g10t + [cEC]} \cdot g11t^2}{g11t^2 + [cT]^2} \cdot gm5 - m3t \cdot [cP5_m] \right) \\ \frac{d\left([cP5] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p3t \cdot [cP5_m]}{gm5} - (mp4t + mp5t \cdot (1 - L)) \cdot [cP5] \right) \\ \frac{d\left([cT_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{\frac{\frac{\frac{nt4 \cdot (g12t + at3 \cdot [cLmod])}{g12t + [cLmod]} \cdot g13t^2}{g13t^2 + [cL]^2} \cdot g14t}{g14t + [cEC]} \cdot g15t^2}{g15t^2 + [cT]^2} \cdot gmt - m4t \cdot [cT_m] \right) \\ \frac{d\left([cT] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p4t \cdot [cT_m]}{gmt} - (mp6t + mp7t \cdot (1 - L)) \cdot [cT] \cdot (p5t \cdot [cZTL] + [cZG]) - mp8t \cdot [cT] \right) \\ \frac{d\left([cE4_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{\frac{n13 \cdot g2}{g2 + [cEC]} \cdot g6^2}{g6^2 + [cL]^2} \cdot gm4 - m34 \cdot [cE4_m] \right) \\ \frac{d\left([cE4] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p23 \cdot [cE4_m]}{gm4} - m35 \cdot [cE4] - p25 \cdot [cE4] \cdot [cE3n] + p21 \cdot [cE34] \right) \\ \frac{d\left([cE3_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{n3 \cdot g16^2}{g16^2 + [cL]^2} \cdot gm3 - m26 \cdot [cE3_m] \right) \\ \frac{d\left([cE3c] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p16 \cdot [cE3_m]}{gm3} - m9 \cdot [cE3c] \cdot [cCOP1c] - p17 \cdot [cE3c] \cdot [cGc] - p19 \cdot [cE3c] + p20 \cdot [cE3n] \right) \\ \frac{d\left([cE3n] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p19 \cdot [cE3c] - p20 \cdot [cE3n] - p17 \cdot [cE3n] \cdot [cGn] - m30 \cdot [cE3n] \cdot [cCOP1d] - m29 \cdot [cE3n] \cdot [cCOP1n] + p21 \cdot [cE34] - p25 \cdot [cE4] \cdot [cE3n]) \\ \frac{d\left([cLUX_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{\frac{n13 \cdot g2}{g2 + [cEC]} \cdot g6^2}{g6^2 + [cL]^2} \cdot gm4 - m34 \cdot [cLUX_m] \right) \\ \frac{d\left([cLUX] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p27 \cdot [cLUX_m]}{gm4} - m39 \cdot [cLUX] - p26 \cdot [cLUX] \cdot [cE34] \right) \\ \frac{d\left([cCOP1c] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (n5 - p6 \cdot [cCOP1c] - m27 \cdot [cCOP1c] \cdot (1 + p15 \cdot L)) \\ \frac{d\left([cCOP1n] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p6 \cdot [cCOP1c] - n6 \cdot L \cdot [cP] \cdot [cCOP1n] - n14 \cdot [cCOP1n] - m27 \cdot [cCOP1n] \cdot (1 + p15 \cdot L)) \\ \frac{d\left([cCOP1d] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (n14 \cdot [cCOP1n] + n6 \cdot L \cdot [cP] \cdot [cCOP1n] - m31 \cdot (1 + m33 \cdot (1 - L)) \cdot [cCOP1d]) \\ \frac{d\left([cEGc] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p17 \cdot [cE3c] \cdot [cGc] - m9 \cdot [cEGc] \cdot [cCOP1c] - p18 \cdot [cEGc] + p31 \cdot [cEGn]) \\ \frac{d\left([cEC] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(p26 \cdot [cLUX] \cdot [cE34] - m36 \cdot [cEC] \cdot [cCOP1n] - m37 \cdot [cEC] \cdot [cCOP1d] - m32 \cdot [cEC] \cdot \left(1 + \frac{p24 \cdot L \cdot cGn_tot^2}{g7^2 + cGn_tot^2} \right) \right) \\ \frac{d\left([cZTL] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p14 - p12 \cdot L \cdot [cZTL] \cdot [cGc] + p13 \cdot [cZG] \cdot (1 - L) - m20 \cdot [cZTL]) \\ \frac{d\left([cZG] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p12 \cdot L \cdot [cZTL] \cdot [cGc] - p13 \cdot [cZG] \cdot (1 - L) - m21 \cdot [cZG]) \\ \frac{d\left([cG_m] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(L \cdot q2 \cdot [cP] \cdot gmg + \frac{n12 \cdot g14}{g14 + [cEC]} \cdot g15^2 \cdot gmg - m18 \cdot [cG_m] \right) \\ \frac{d\left([cGc] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot \left(\frac{p11 \cdot [cG_m]}{gmg} - p12 \cdot L \cdot [cZTL] \cdot [cGc] + p13 \cdot [cZG] \cdot (1 - L) - m19 \cdot [cGc] - p17 \cdot [cE3c] \cdot [cGc] - p28 \cdot [cGc] + p29 \cdot [cGn] \right) \\ \frac{d\left([cGn] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p28 \cdot [cGc] - (p29 + m19 + p17 \cdot [cE3n]) \cdot [cGn]) \\ \frac{d\left([cEGn] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p18 \cdot [cEGc] + p17 \cdot [cE3n] \cdot [cGn] - (m9 \cdot [cCOP1n] + m10 \cdot [cCOP1d] + p31) \cdot [cEGn]) \\ \frac{d\left([cE34] \cdot V_{cell}\right)}{d\,t} &= +V_{cell} \cdot (p25 \cdot [cE4] \cdot [cE3n] - (p26 \cdot [cLUX] + p21 + m37 \cdot [cCOP1d] + m36 \cdot [cCOP1n]) \cdot [cE34]) \\ cGn_tot &= [cGn] + [cEGn] \end{aligned}$$