

## Rate Equations

The following kinetic expressions were used:

$$v_{\text{GLT}} = \frac{V_m \left( \text{GLCo} - \frac{\text{GLCi}}{K_{\text{eq}}} \right)}{K_m \left( \frac{\text{GLCi}}{K_m} + \frac{\text{GLCo}}{K_m} + \frac{\text{GLCi GLCo } K_i}{K_m^2} + 1 \right)} \quad (1)$$

$$v_{\text{HXK}} = \frac{\text{HXK}_{\text{cor}} V_m \left( \text{ATP GLCi} - \frac{\text{ADP G6P}}{K_{\text{eq}}} \right)}{K_{m,\text{glc}} K_{m,\text{atp}} \left( \frac{\text{ADP}}{K_{m,\text{adp}}} + \frac{\text{ATP}}{K_{m,\text{atp}}} + 1 \right) \left( \frac{\text{G6P}}{K_{m,\text{g6p}}} + \frac{\text{GLCi}}{K_{m,\text{glc}}} + \frac{\text{T6P}}{K_{i,\text{t6p}}} + 1 \right)} \quad (2)$$

$$v_{\text{PGM1}} = \frac{V_m \left( \text{G1P} - \frac{\text{G6P}}{K_{\text{eq}}} \right)}{K_{m,\text{G1P}} \left( \frac{\text{G1P}}{K_{m,\text{G1P}}} + \frac{\text{G6P}}{K_{m,\text{G6P}}} + 1 \right)} \quad (3)$$

$$v_{\text{TPS1}} = \frac{\text{F6P G6P UDPGLC } V_m}{K_{m,\text{G6P}} K_{m,\text{UDPGLC}} \left( \frac{\text{G6P}}{K_{m,\text{G6P}}} + 1 \right) \left( \frac{\text{PI}}{K_{i,\text{PI}}} + 1 \right) \left( \frac{\text{UDPGLC}}{K_{m,\text{UDPGLC}}} + 1 \right) (\text{F6P} + K_{m,\text{F6P}})} \quad (4)$$

$$v_{\text{TPS2}} = \frac{\text{PI T6P } V_m}{\text{PI} (K_{m,\text{T6P}} + \text{T6P}) + K_{i,\text{PI}} K_{m,\text{T6P}}} \quad (5)$$

$$v_{\text{NTH1}} = \frac{\text{TRE } V_m}{K_{m,\text{TRE}} \left( \frac{\text{TRE}}{K_{m,\text{TRE}}} + 1 \right)} \quad (6)$$

$$v_{\text{PGI}} = \frac{\text{PGI}_{\text{cor}} V_m \left( \text{G6P} - \frac{\text{F6P}}{K_{\text{eq}}} \right)}{K_{m,\text{g6p}} \left( \frac{\text{F6P}}{K_{m,\text{f6p}}} + \frac{\text{G6P}}{K_{m,\text{g6p}}} + 1 \right)} \quad (7)$$

$$v_{\text{PFK}} = \frac{\text{PFK}_{\text{cor}} R g_R \text{ lam}_1 \text{ lam}_2 V_m}{R^2 + L T^2} \quad (8)$$

$$\text{lam}_1 = \frac{\text{F6P}}{K_{R,\text{F6P}}} \quad (9)$$

$$\text{lam}_2 = \frac{\text{ATP}}{K_{R,\text{ATP}}} \quad (10)$$

$$R = \text{lam}_1 \text{ lam}_2 + g_R \text{ lam}_1 \text{ lam}_2 + 1 \quad (11)$$

$$T = c_{\text{ATP}} \text{ lam}_2 + 1 \quad (12)$$

$$L = \frac{L_0 \left( \frac{\text{AMP } c_{i,\text{AMP}}}{K_{\text{AMP}}} + 1 \right)^2 \left( \frac{\text{ATP } c_{i,\text{ATP}}}{K_{\text{ATP}}} + 1 \right)^2 \left( \frac{\text{F26bP } c_{i,\text{F26bP}}}{K_{\text{F26bP}}} + \frac{\text{FBP } c_{i,\text{FBP}}}{K_{\text{FBP}}} + 1 \right)}{\left( \frac{\text{AMP}}{K_{\text{AMP}}} + 1 \right)^2 \left( \frac{\text{ATP}}{K_{\text{ATP}}} + 1 \right)^2 \left( \frac{\text{F26bP}}{K_{\text{F26bP}}} + \frac{\text{FBP}}{K_{\text{FBP}}} + 1 \right)} \quad (13)$$

$$v_{\text{ALD}} = \frac{\text{FBA}_{\text{cor}} V_m \left( \text{FBP} - \frac{\text{DHAP GAP}}{K_{\text{eq}}} \right)}{K_{m,\text{FBP}} \left( \frac{\text{FBP}}{K_{m,\text{FBP}}} + \left( \frac{\text{DHAP}}{K_{m,\text{dhap}}} + 1 \right) \left( \frac{\text{GAP}}{K_{m,\text{gap}}} + 1 \right) \right)} \quad (14)$$

$$v_{\text{TPI}} = \frac{\text{TPI}_{\text{cor}} V_m \left( \text{DHAP} - \frac{\text{GAP}}{K_{\text{eq}}} \right)}{K_{m,\text{dhap}} \left( \frac{\text{DHAP}}{K_{m,\text{dhap}}} + \frac{\text{GAP}}{K_{m,\text{gap}}} + 1 \right)} \quad (15)$$

$$v_{\text{GPD}} = \frac{V_m \left( \text{DHAP NADH} - \frac{\text{G3P NAD}}{K_{\text{eq}}} \right)}{K_{m,\text{NADH}} K_{m,\text{DHAP}} \left( \frac{\text{NAD}}{K_{m,\text{NAD}}} + \frac{\text{NADH}}{K_{m,\text{NADH}}} + 1 \right) \left( \frac{\text{DHAP}}{K_{m,\text{DHAP}}} + \frac{\text{G3P}}{K_{m,\text{G3P}}} + 1 \right) \left( \frac{\text{ADP}}{K_{i,\text{ADP}}} + \frac{\text{ATP}}{K_{i,\text{ATP}}} + \frac{\text{FBP}}{K_{i,\text{FBP}}} + 1 \right)} \quad (16)$$

$$v_{\text{HOR2}} = \frac{\text{G3P } V_m}{K_{m,\text{G3P}} \left( \frac{\text{G3P}}{K_{m,\text{G3P}}} + 1 \right) \left( \frac{\text{PI}}{K_{i,\text{PI}}} + 1 \right)} \quad (17)$$

$$v_{\text{GLYct}} = K_{\text{GLYct}} (\text{GLYC} - \text{GLYCe}) \quad (18)$$

$$v_{\text{GAPDH}} = \frac{\text{GAPDH}_{\text{cor}} V_m \left( \text{GAP NAD PI} - \frac{\text{BPG NADH}}{K_{\text{eq}}} \right)}{K_{m,\pi} K_{m,\text{nad}} K_{m,\text{gap}} \left( \left( \frac{\text{BPG}}{K_{m,\text{bpg}}} + 1 \right) \left( \frac{\text{NADH}}{K_{m,\text{nadh}}} + 1 \right) + \left( \frac{\text{GAP}}{K_{m,\text{gap}}} + 1 \right) \left( \frac{\text{NAD}}{K_{m,\text{nad}}} + 1 \right) \left( \frac{\text{PI}}{K_{m,\pi}} + 1 \right) - 1 \right)} \quad (19)$$

$$v_{\text{PGK}} = \frac{\text{PGK}_{\text{cor}} V_m (\text{ADP BPG } K_{\text{eq}} - \text{ATP P3G})}{K_{m,\text{P3G}} K_{m,\text{ATP}} \left( \frac{\text{BPG}}{K_{m,\text{BPG}}} + \frac{\text{P3G}}{K_{m,\text{P3G}}} + 1 \right) \left( \frac{\text{ADP}}{K_{m,\text{ADP}}} + \frac{\text{ATP}}{K_{m,\text{ATP}}} + 1 \right)} \quad (20)$$

$$v_{\text{PGM}} = \frac{\text{PGM}_{\text{cor}} V_m \left( \text{P3G} - \frac{\text{P2G}}{K_{\text{eq}}} \right)}{K_{m,\text{P3G}} \left( \frac{\text{P2G}}{K_{m,\text{P2G}}} + \frac{\text{P3G}}{K_{m,\text{P3G}}} + 1 \right)} \quad (21)$$

$$v_{\text{ENO}} = \frac{\text{ENO}_{\text{cor}} V_m \left( \text{P2G} - \frac{\text{PEP}}{K_{\text{eq}}} \right)}{K_{m,\text{P2G}} \left( \frac{\text{P2G}}{K_{m,\text{P2G}}} + \frac{\text{PEP}}{K_{m,\text{PEP}}} + 1 \right)} \quad (22)$$

$$v_{\text{PYK}} = \frac{\text{ADP PEP PYK}_{\text{cor}} V_m \left( \frac{\text{PEP}}{K_{m,\text{pep}}} + 1 \right)^{\text{hill}}}{K_{m,\text{adp}} K_{m,\text{pep}} \left( \left( \frac{\text{PEP}}{K_{m,\text{pep}}} + 1 \right)^{\text{hill}} + L \left( \frac{\frac{\text{ATP}}{K_{i,\text{ATP}}} + 1}{\frac{\text{FBP}}{K_{a,\text{FBP}}} + 1} \right)^{\text{hill}} \right) \left( \frac{\text{ADP}}{K_{m,\text{adp}}} + 1 \right) \left( \frac{\text{PEP}}{K_{m,\text{pep}}} + 1 \right)} \quad (23)$$

$$v_{\text{PDC}} = \frac{\text{PDC}_{\text{cor}} V_m \left( \frac{\text{PYR}}{K_{m,\text{PYR}}} \right)^{\text{hill}}}{\left( \frac{\text{PYR}}{K_{m,\text{PYR}}} \right)^{\text{hill}} + 1} \quad (24)$$

$$v_{\text{ADH}} = - \frac{\text{ADH}_{\text{cor}} V_m \left( \text{ETOH NAD} - \frac{\text{ACENADH}}{K_{\text{eq}}} \right)}{K_{i,\text{NAD}} K_{m,\text{ETOH}} \left( \frac{\text{NAD}}{K_{i,\text{NAD}}} + \frac{\text{NADH}}{K_{i,\text{NADH}}} + \frac{\text{ACE } K_{m,\text{NADH}}}{K_{i,\text{NADH}} K_{m,\text{ACE}}} + \frac{\text{ACENADH}}{K_{i,\text{NADH}} K_{m,\text{ACE}}} + \frac{\text{ETOH } K_{m,\text{NAD}}}{K_{i,\text{NAD}} K_{m,\text{ETOH}}} + \frac{\text{ETOH NAD}}{K_{i,\text{NAD}} K_{m,\text{ETOH}}} + \frac{\text{ACE ETOH NAD}}{K_{i,\text{ACE}} K_{i,\text{NAD}} K_{m,\text{ETOH}}} \right)} \quad (25)$$

$$V_{\text{ETOHt}} = K_{\text{ETOHt}} (\text{ETOH} - \text{ETOHe}) \quad (26)$$

$$V_{\text{mito}} = \frac{\text{ADP PI } V_m}{(\text{ADP} + K_{m,\text{ADP}}) (K_{m,\text{PI}} + \text{PI})} \quad (27)$$

$$V_{\text{ATPase}} = \frac{\text{ATP } K}{\text{ADP}} \quad (28)$$

$$V_{ADK} = K \left( ADP^2 - \frac{AMP ATP}{K_{eq}} \right) \quad (29)$$

$$V_{vacPi} = -K (PI - PI_{vac}) \quad (30)$$

$$V_{Amd1} = \frac{AMP V_{Amd1}}{AMP + K_{m,AMP} \left( \frac{PI}{K_{m,PI}} + 1 \right)} \quad (31)$$

$$V_{Ade13Ade12} = IMP K \quad (32)$$

$$V_{Isn1} = IMP K \quad (33)$$

$$V_{Pnp1} = INO K \quad (34)$$

$$V_{Hpt1} = HYP K \quad (35)$$

$$V_{mitoNADH} = \frac{NADH V_m}{K_m + NADH} \quad (36)$$

$$V_{sinkG6P} = \frac{G6P V_m}{G6P + K_m} \quad (37)$$

$$V_{sinkF6P} = \frac{F6P V_m}{F6P + K_m} \quad (38)$$

$$V_{sinkGAP} = \frac{GAP V_m}{GAP + K_m} \quad (39)$$

$$V_{\text{sinkP3G}} = \frac{\text{P3G } V_m}{K_m + \text{P3G}} \quad (40)$$

$$V_{\text{sinkPEP}} = \frac{\text{PEP } V_m}{K_m + \text{PEP}} \quad (41)$$

$$V_{\text{sinkPYR}} = \frac{\text{PYR } V_m}{K_m + \text{PYR}} \quad (42)$$

$$V_{\text{sinkACE}} = \frac{\text{ACE } V_m}{\text{ACE} + K_m} \quad (43)$$