Supplementary Table 2

Overview of kinetic constants used for the construction of the model.

Enzyme	EC number	Kinetic parameter	References	Rate Law
NADA	3.5.1.19	K_M:9.6μM K_{iP}:120μM k_{cat}:0.65s^{-1}	[1]	Product inhibition
NADS	6.3.5.1	K_M:190μM k_{cat}:21s^{-1}	[2]	HMM
NMNAT	2.7.7.1/2.7.7.18	$K_{M_{NaMN}}$:67.7μM $k_{cat_{NaMN}}$:42.9s^{-1} $K_{M_{NMN}}$:22.3μM $k_{cat_{NMN}}$:53.8s^{-1} $K_{M_{NMN}}$:59μM $k_{cat_{NAD}}$:129.1s^{-1} $K_{M_{NaAD}}$:502μM $k_{cat_{NaAD}}$:103.8s^{-1}	[3][1] [4][2] [4][3]	Substrate Competition
NNMT	2.1.1.1	K_M:400μM K_{iP}:60μM k_{cat}:8.1s^{-1}	[5] [6]	Product inhibition
NamPT	6.3.5.1	K_M:5nM k_{cat}:0.0077s^{-1}	[7]	HMM
NAPRT	2.4.2.11	K_M:1.5μM k_{cat}:3.3s^{-1}	[7]	HMM
SIRT1	3.5.1.-	K_M:29μM K_{iP}:60μM k_{cat}:0.67s^{-1}	[8]	Product inhibition
NT5	3.1.3.5	$K_{M_{NaMN}}$:3.5mM $k_{cat_{NaMN}}$:2.8s^{-1} $K_{M_{NMN}}$: 5mM $k_{cat_{NMN}}$:0.5s^{-1}	[9]	HMM
PNP	2.4.2.1	K_M:1.48mM k_{cat}:40s^{-1}	[10]	HMM
NRK	2.7.1.173	K_M:3.4μM k_{cat}:0.23s^{-1}	[11]	HMM

The total enzyme concentration was set to 10 for all enzymes except NamPT and NMNAT, for which the concentration was set to 100. Concentration of potential co-substrate was assumed to be constant and not-limiting for the reaction. Thus they were implicitly represented by the maximal velocities given in the table.

[1] Values for NMNAT1 used
[2] Keq used for calculation of turnover rate of reverse reaction
[3] Equilibrium constant used for calculation of turnover rate of reverse reaction

Kinetic Rate Laws

Product Inhibition

$$v = \frac{E_T \cdot k_{cat} \cdot S}{K_M + S + \frac{K_M \cdot P}{K_{iP}}} \tag{1}$$

Henry-Michaelis Menten for irreversible reactions (HMM)

$$v = \frac{E_T \cdot k_{cat} \cdot S}{K_M + S} \tag{2}$$

Substrate Competition at NMNAT

$$v = E_T \cdot \frac{\frac{k_{cat_A} \cdot A \cdot B}{K_{M_A}} - \frac{k_{cat_P} \cdot P \cdot Q}{K_{M_P}}}{1 + \frac{A}{K_{M_A}} + \frac{B}{K_{M_B}} + \frac{P}{K_{M_P}} + \frac{Q}{K_{M_Q}}} \tag{3}$$

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