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
NMNT	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} $K_{i_{NAD}}$: 2.1μM	[7]	Competitive inhibition
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

[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

Amount of enzymes and import rates

The total enzyme concentration was set to 10 times the scaling factor, for all enzymes except NamPT and NMNAT, for which the concentration was set to 100 times the scaling factor. As enzyme concentrations here have an arbitrary unit a scaling factor of 0.1μM was applied to all enzymatic reactions to achieve consumption rates that are in the range of reported values [12]. Concentration of potential co-substrates were assumed to be constant and not-limiting for the reaction. Thus being implicitly represented by maximal velocities consiting of total enzyme concentration times tunrover rates. Nam import rates for import into the system was set to 0.1 μM/s for all simulations, being in the range meassured for Nam uptake in mammalian cells [13]. For the two compartment simulation compartmentsize was equal to ... for both compartments. The Nam import rates were set to 100/s for both compartments. The amount of NADA present was set to 100. Thus equal to the amount of NamPT used.

Kinetic Rate Laws

Product Inhibition

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

Competitive Inhibition

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

Henry-Michaelis Menten for irreversible reactions (HMM)

$$v = \frac{E_T \cdot k_{cat} \cdot S}{K_M + S} \tag{3}$$

Substrate Competition at NMNAT

$$v = E_T \cdot \frac{\frac{k_{cat_A} \cdot A \cdot B}{K_{M_A}} - \frac{k_{cat_P} \cdot P \cdot Q}{K_{M_P}}}{1 + \frac{A}{K_{M_A}} + \frac{B}{K_{M_B}} + \frac{P}{K_{M_P}} + \frac{Q}{K_{M_Q}}} \tag{4}$$

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