NADH to Oxygen steady state expression, MatLab program.
This is an research program and also calculates the concentrations of intermediates of cytochrome c oxidase.

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Ke = 6.4 * 10^11;
k1 = 5*10^10;
k1r = 5*10^8;
k2 = 3.5*10^8;
k2r = 1*10^1;
K3 = 2*10^6;
K5 = 1*10^25;
k4a = 2.4*10^8;
k4b = 8*10^7;
a3t = 1*10^-6;                  % cytochrome a3 concentration
ct = 2*10^-6;                   % cytochrome c concentration (2 x cyt a3t)
NADt =  2 * 10^-5;              % total concentration of NAD (NADH + NAD+)
x = (1:100)';                   % used to generate levels for energy state Q
for q = 1:6;                    % used to set oxygen concentration
   W = 7.1;                     % W = pH of the medium
   H = 10^-W;                   % H = hydrogen ion concentration
   N = 0.1;                     % N = intramitochondrial [NAD+]/[NADH]
   Q = 0.270 + x.*0.0005;       % energy state in volts
   O = q.*1.*10.^-5;            % O is the oxygen concentration
   G = Q .* 46.183;             % Gibb's free energy in kcal for 2 electron transfer
   S = Q./0.059;                % coupling value for energy conservation
   z = 10.^S;                   % used to couple rate and equilibrium constants to the energy state
   kf1 = k1 ./z.^0.5;           % couples k1 to energy state
   kr1 = k1r .*z.^0.5;          % couples k1r to energy state
   D = N.^0.5 .*z.^2 .*(H./Ke).^0.5;  % expression D in steady state
   co = D.*ct./(1 + D);         % co is oxidized cytochrome c
   cr = ct - co;                % cr is reduced cytochrome c
   A = (k2r + k4a.*cr + k4b.*cr.* K3.*H)./(k2.*O);      % calculates value of expression A
   B = (k2.*O.*A + kr1.*co.* A -k2r)./(kf1 .* cr);      % calculates value of expression B
   C = K5.^-1 .* (1/H)^2.*(co./cr).^2 .* z.^2 .* B;     % calculates value of expression C
   III = a3t./(1 + K3.*H + A + B + C);          % concentration of intermediate III
   I = B .* III;                % concentration of intermediate I
   II = A .* III;               % concentration of intermediate II
   IV = K3 .*H.* III;           % concentration of intermediate IV
   V = C.*III;                  % concentration of intermediate V
   y(q,x) = (k4a.*cr + k4b.*cr.*K3.*H) .* III .*4./ct;     % rate as cyt c TN
end
 plot (x,y)                     % plots cyt c TN (y) vs x value
 axis([0 100 0 40])             % sets graph x and y axis limits
```