SUPPLEMENTAL MATERIAL

The complete differential equations system introduced into the MATLAB mathematical package is the following:

$$\frac{d[NADPH]}{dt} = -V_{GR} - k_N[NADPH] + k_{12}[NADP^+] \tag{S1}$$

$$\frac{d[NADP^+]}{dt} = V_{GR} + k_N[NADPH] - k_{12}[NADP^+] \tag{S2}$$

$$\frac{d[GSH]}{dt} = 2(V_{GR} - V_{DHAR} - k_7[O_2^-][GSH] - k_4[DHA][GSH]) \tag{S3}$$

$$\frac{d[GSSG]}{dt} = -V_{GR} + V_{DHAR} + k_7[O_2^-][GSH] + k_4[DHA][GSH] \tag{S4}$$

$$\frac{d[ASC]}{dt} = V_{DHAR} + k_3[MDA]^2 + k_4[DHA][GSH] + k_{13}[MDA] - k_2^{APX}[ASC][CoI] - \\ -k_3^{APX}[ASC][CoII] - k_6[O_2^-][ASC] - 2k_8[H_2O_2][ASC] \tag{S5}$$

$$\frac{d[DHA]}{dt} = -V_{DHAR} + k_3[MDA]^2 - k_4[DHA][GSH] \tag{S6}$$

$$\frac{d[MDA]}{dt} = k_2^{APX}[ASC][CoI] + k_3^{APX}[ASC][CoII] - 2k_3[MDA]^2 + k_6[O_2^-][ASC] + \\ +2k_8[H_2O_2][ASC] - k_{13}[MDA] \tag{S7}$$

$$\frac{d[H_2O_2]}{dt} = V_{SOD} - k_1^{APX}[H_2O_2][APX] - k_4^{APX}[H_2O_2][CoI] + k_5[O_2^-]^2 + \\ +k_6[O_2^-][ASC] + k_7[O_2^-][GSH] - k_8[H_2O_2][ASC] \tag{S8}$$

$$\frac{d[APX]}{dt} = -k_1^{APX}[H_2O_2][APX] + k_3^{APX}[ASC][CoII] + \\ +k_5^{APX}\left([APX]_0 - [APX] - [CoI] - [CoII]\right) \tag{S9}$$

$$\frac{d[CoI]}{dt} = k_1^{APX}[H_2O_2][APX] - k_2^{APX}[ASC][CoI] - k_4^{APX}[H_2O_2][CoI] \tag{S10}$$

$$\frac{d[CoII]}{dt} = k_2^{APX}[ASC][CoI] - k_3^{APX}[ASC][CoII] \tag{S11}$$

$$\frac{d[APX_i]}{dt} = k_4^{APX}[H_2O_2[[CoI] \tag{S12}$$

$$\frac{d[O_2^-]}{dt} = -2V_{SOD} + F_I - 2k_{12}[NADP^+] - k_{13}[MDA] - 2k_5[O_2^-]^2 - k_6[O_2^-][ASC] - \\ -k_7[O_2^-][GSH] \tag{S13}$$

Note that the sums NADPH + $NADP^+$, GSH + 2 GSSG and ASC + DHA + MDA are constants in the present model since the sum of their corresponding differential equations is zero. This ODE set is very stiff, which means there are components of the solution that are varying on such widely different time scales that the size of the step needed to obtain accurate numerical solutions is unacceptably small, so it just takes classical numerical integration methods an imposibly long time to achieve reasonable accuracy. For these cases, ode15s solver is advised for the supplier. By this reason we decided to use this function, obtaining numerical solutions in the range of a few seconds or less. This fact has the advantage that it will allow us to extend the model adding more steps.

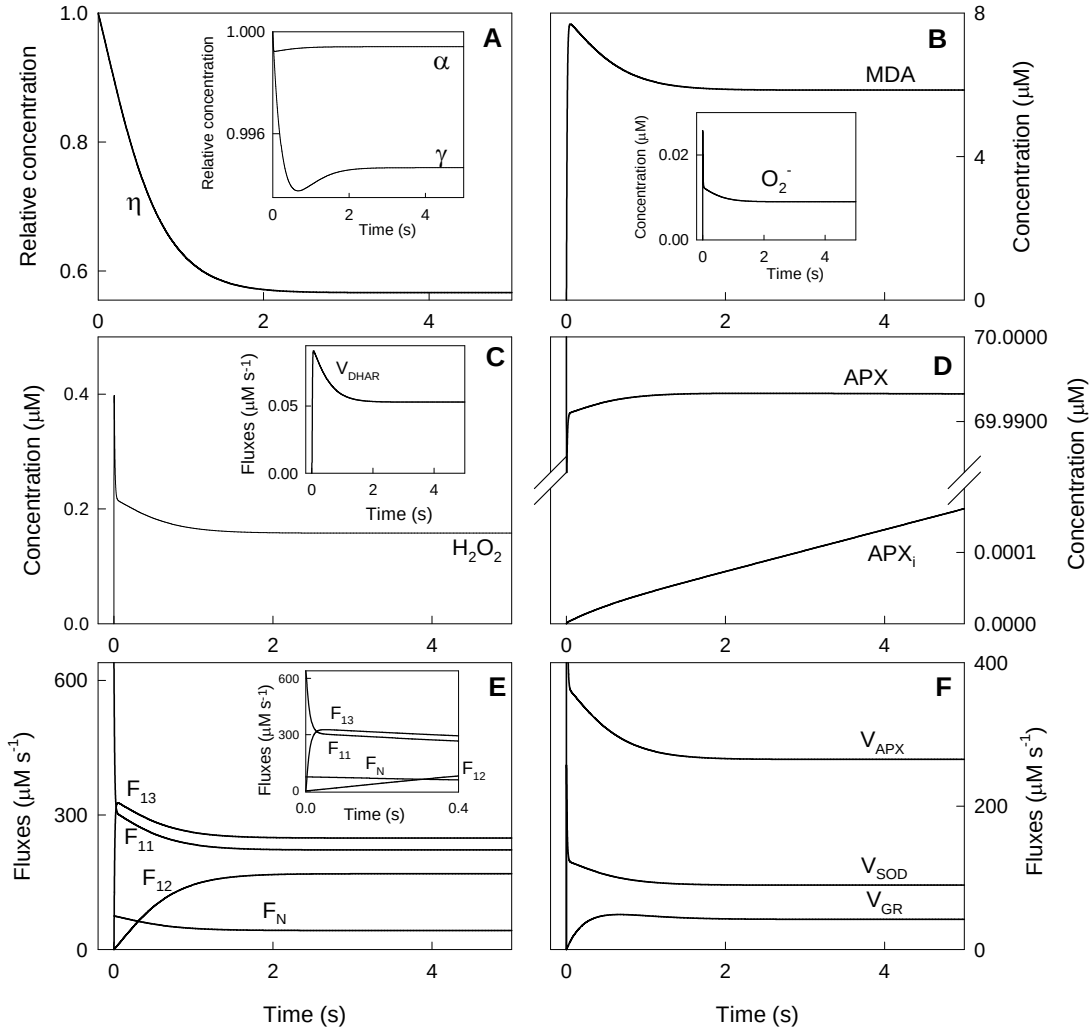

Figure S1. Simulated progress curves corresponding to the species involved in the mechanism shown in Scheme 1. The values of the rate constants and initial conditions used were those shown in Tables II and III. The inset in panel E shows an amplification of the data in that panel near the coordinate origin for greater clarity.

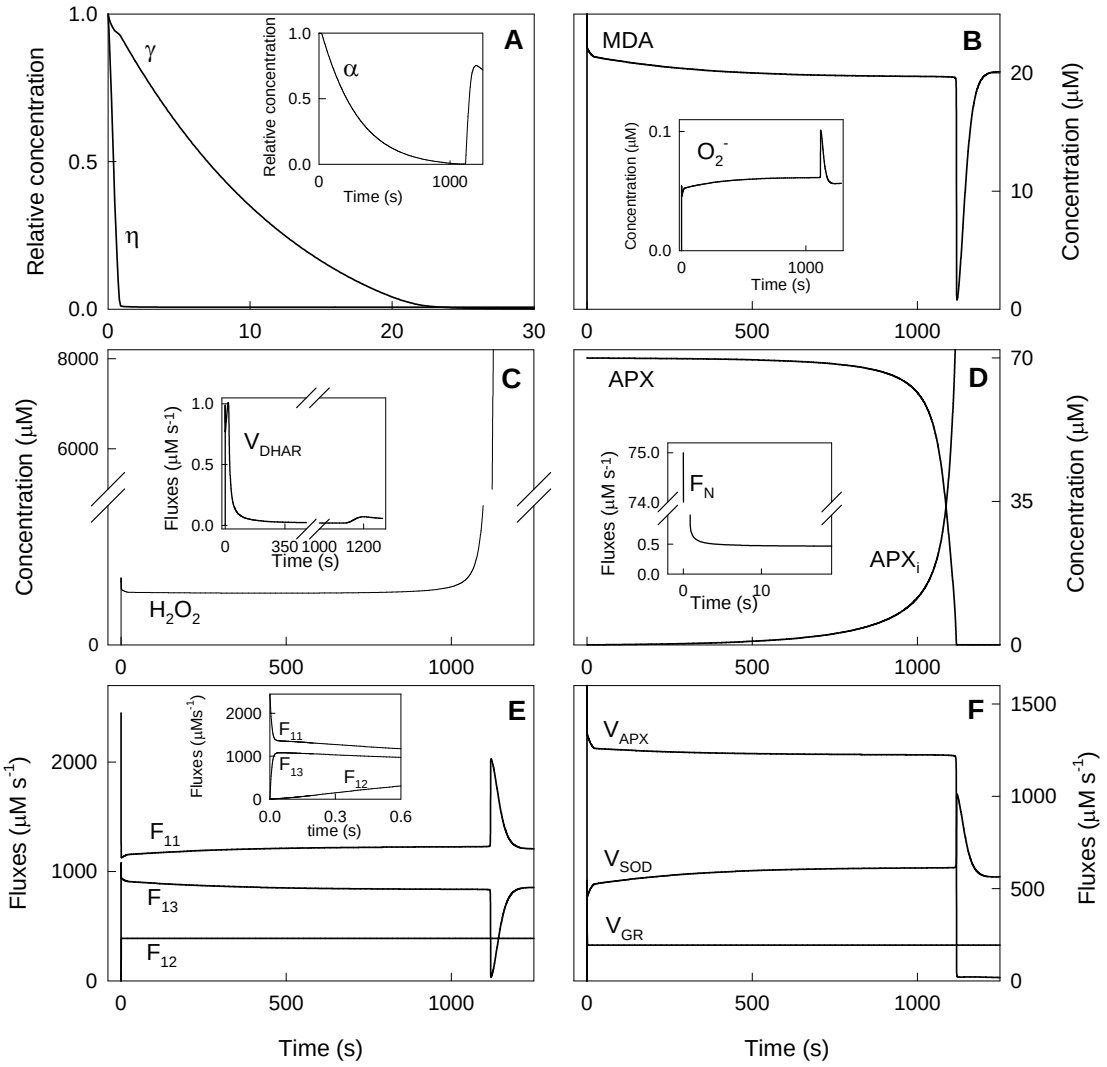

Figure S2. Simulated progress curves corresponding to the species involved in the mechanism shown in Scheme 1. The values of the rate constants and initial conditions used were those shown in Tables II and III, except that F_1 = 2450 μM s^{-1}. Note that under these conditions the system cannot attain a steady-state. Once APX has been inactivated, data have no physical meaning because [H_2O_2] calculated by the model are very high. The model takes into account a limited number of reactions involving H_2O_2, but other pernicious effects of H_2O_2 in the cell have not been included. The inset in panel E shows an amplification of the data in that panel near the coordinate origin for greater clarity.