

# ROS networks: designs, aging, Parkinson's disease and precision therapies

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*Motivation and Aim:* How the network around ROS (Reactive Oxygen Species) protects against oxidative stress and Parkinson's disease (PD), and how processes at the minutes time scale cause disease and aging after decades, remains enigmatic. Challenging whether the ROS network is as complex as it seems, we built a fairly comprehensive version thereof which we disentangled into a hierarchy of simpler subnetworks each delivering one type of robustness.

*Methods and Algorithms:* Our comprehensive model has 63 substances, 61 reactions, and more than 100 parameter values. The basis for substances and for the processes between them is the networks of ROS management known from the scientific literature. Model diagrams were generated using CellDesigner, a graphical front-end for creating process diagrams of biochemical networks in Systems Biology Markup Language. CellDesigner-generated models were transferred to COPASI ([www.copasi.org](http://www.copasi.org)), which is another Systems Biology Markup Language-compliant programme, but with a wider variety of analysis options. The comprehensive dynamic model described *in vitro* data sets from two independent laboratories. The model and its description is available at FAIRDOMHub [1].

*Results:* Our model exhibited a relatively sudden breakdown, after some 80 years of virtually steady performance: it predicted aging. PD related conditions such as lack of DJ-1 protein or increased  $\alpha$ -synuclein accelerated the collapse, whilst antioxidants or caffeine retarded it. Introducing a new concept (aging-time-control coefficient), we found that as many as 25 out of 57 molecular processes controlling aging.

*Conclusion:* We have built a partly validated dynamic model that is able to (i) address aging and PD as results of networked molecular processes going awry, (ii) elucidate the corresponding time warp, and (iii) enable analyses towards individualized medicinal and nutritional therapies [2].

## References

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