MitoMap: an aesthetic, multi-layered mitochondrial biochemical network map

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Mitochondria, are the main energy producers in human cells. Therefore, mitochondrial dysfunction is associated with numerous diseases, especially when the affected cells have a high metabolic rate. In order to understand how the dysfunction of individual pathways can influence the overall energy production capabilities of a mitochondria, it is indispensable to computationally predict the state of normal and diseased mitochondrial metabolic networks. Here, we present MitoMap, an innovative tool for multi-scale visualistion of mitochondrial biochemical pathway function. The mitochondrial component of an existing manually drawn map (ReconMap, http://vmh.uni.lu/#reconmap) was extracted and complemented with mitochondrial reactions from the latest version of the human metabolic reconstruction, Recon 3D. The map accounts for $\sim$1000 mitochondrial reactions, each of which can carry a non-zero steady state flux. By implementing a multi-layered approach to pathway visualisation within NaviCell (https://navicell.curie.fr/) semantic zooming in enabled order to selectively visualise successive layers of information in the correct network contex. By connecting computational predictions from The Constraint-based Reconstruction and Analysis Toolbox (COBRA Toolbox) to the MitoMap one can visualise steady state fluxes through the different mitochondrial reactions. An example is illustrated from ongoing work in the context of the SysMedPD project (http://sysmedpd.eu/) where the aim is to computationally predict mitochondrial drug targets to rescue mitochondrial dysfunction in Parkinson's Disease patients.