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Recharging mitochondrial batteries in old eyes. Near infra-red increases ATP.

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Abstract

Progressive accumulation of age related mitochondrial DNA mutations reduce ATP production and increase reactive oxygen species output, leading to oxidative stress, inflammation and degradation. The pace of this is linked to metabolic demand. The retina has the greatest metabolic demand and mitochondrial density in the body and displays progressive age related inflammation and marked cell loss. Near infra-red (670 nm) is thought to be absorbed by cytochrome c oxidase (COX), a key element in mitochondrial respiration and it has been demonstrated that it improves mitochondrial membrane potentials in aged eyes. It also significantly reduces the impact of experimental pathology and ameliorates age related retinal inflammation. We show ATP decline with ageing in mouse retina and brain. Also, in these tissues that ATP is significantly increased by 670 nm exposure in old mice. In the retina this was associated with increased COX and reduced acrolein expression. Acrolein, being a free radical marker of retinal oxidative stress, is up regulated in Alzheimer's and retinal degeneration. This is the first demonstration of ATP manipulation in vivo and may provide a simple non-invasive route to combating age related tissue decline.

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