Targeting cellular powerhouses to mitigate age-related chronic conditions

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Abstract
Current evidence points to mitochondrial dysfunction as an overarching mechanism of aging and age-related diseases. Mitochondria are the primary source of energy in most tissues and are particularly important for tissues with high energy demand such as skeletal muscle, heart, brain and retina. Mitochondrial dysfunction results in cellular energy deficiency, triggers the production of reactive oxygen species, and initiates various cell death and inflammatory pathways. Repairing age-related mitochondrial damage may provide a universal approach for delaying aging and mitigating chronic conditions such as frailty, heart failure, age-related macular degeneration, and neurodegeneration.

We have designed a series of cell-permeable tetrapeptides (SS peptides) that selectively target mitochondria to enhance mitochondrial bioenergetics and reduce mitochondrial oxidative stress. They have a unique and novel mechanism of action. Rather than target a single protein, these peptides target cardiolipin on the inner mitochondrial membrane to induce structural change in the membrane and modify the spatial organization of multiple electron transport chain proteins to optimize electron transfer and ATP production. These peptides have been shown to repair damaged mitochondria, promote cellular repair, prevent chronic inflammation and tissue remodeling, and restore organ function.

Treatment of aged mice with SS-31 repairs age-related mitochondrial damage and restores skeletal muscle, cardiac, renal, visual and cognitive function. These studies confirm the fundamental importance of mitochondrial bioenergetics in promoting health and preventing chronic diseases. SS-31 (elamipretide) is currently in clinical trials for rare mitochondrial diseases as well as age-associated chronic diseases including age-related muscle weakness, macular degeneration, and heart failure.

Recent publications

