



Glycine supplementation could reverse aging

Aging means dysfunctional mitochondria

One of the hallmarks of aging is dysfunction in mitochondria, the powerhouses of the cell. Mitochondria have their own DNA, and the mitochondrial theory of aging posits that increased mutations in mitochondrial DNA cause this dysfunction.

A very neat piece of scientific research, [published in Nature Scientific Reports](#), has now found that the respiratory defects in mitochondria are due not to mutations in mitochondrial DNA, but to epigenetic regulation, in other words, due to changes in gene expression.

The Japanese scientists doing the study found that reversing the epigenetic changes caused the mitochondria in cells from very old people, aged 80 to 97, basically to become like brand new mitochondria, with the functional capability of mitochondria from fetal cells. That's a very good thing.

In searching for the genes that controlled mitochondrial respiration, they found two, and these two control glycine production in mitochondria. Glycine

is a non-essential amino acid, also available as a cheap over-the-counter supplement.

When glycine was added to culture media containing cells from the 97-year-old, the mitochondria in these cells became like new.

This study suggests a number of things.

Aging may be programmed

One, it suggests that aging is programmed. Mitochondrial dysfunction with aging appears not to be a matter of accumulating mutations that the organism has no control over, but rather a controlled difference in gene expression, controlled by the organism itself. In other words, aging is not accumulation of random damage, but a programmed function.

This lends some evidence to [my recent assertion that nature wants you to die](#), and that you must outwit nature to increase maximum lifespan.

Glycine supplementation increases lifespan in rats

Two, it suggests that glycine supplementation can fight aging, and indeed, in the experiment, it did, albeit in cell culture, not *in vivo*. It's too early to say what the proper dose of glycine might be, but we can speculate that it would be enough to bring glycine levels up to those seen in young people. (Indeed, in infants.)

Very interestingly, we already know that, in rats, [glycine supplementation increases lifespan, through increased clearance of methionine](#). (Glycine here acts as a methionine restriction mimetic.) The amount of glycine fed to those rats with increased lifespan was approximately 3 to 6 times the amount fed to controls, which is, I would say, a very doable proposition. A few grams of glycine daily might do the trick.

Worthy of note, increasing lifespan in rats is a much better indication of what might work in humans than increasing lifespan in *C. elegans*. Far fewer things work in increasing rodent lifespan than they do in nematodes.

Could the mechanism of the increased dietary glycine that caused greater lifespan be that it made the rats' mitochondria more youthful? Yes, it very well could be. [Methionine restriction causes much better mitochondrial function](#), so that's probably what the glycine is doing, since increased glycine is a methionine restriction mimetic.

Three, and this is my own insight/speculation, glycine is probably increasing levels of glutathione in mitochondria, and since glutathione is the cells' and the mitochondria's main internal antioxidant, this protects them from oxidative damage and keeps them in a youthful state. Glutathione is made from three amino acids, one of which is glycine, and if glycine is in short supply inside the mitochondria, then there will be less glutathione there. Methionine restriction also increases mitochondrial glutathione levels.

Four, also my own (informed) speculation, one of the chief roles of autophagy

is to turn over defective mitochondria, to allow the cell to replace them with new ones. So this study reaffirms the role of declining autophagy in aging.

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By the way, the authors of the paper themselves do not shy away from suggesting that glycine supplementation could decrease or reverse aging.

This is an exciting study and, although much more work will be needed, appears to open up a new avenue in potential anti-aging and life extension treatments. Best of all, glycine is cheap and likely very safe, since it's an amino acid the body produces itself.

P.S.: My new book, Stop the Clock: The Optimal Anti-Aging Strategy will be out soon.