HEALTH

# Cell Health and Aging: Leveling up Your Longevity

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This is the year we deploy some 20/20 vision in order to focus on healthy aging. To do so, we are going to train the microscope of our mind's eye on that basic unit of life: the cell.

A lot of longevity and life extension research and bio-hacks focus on cellular health for good reason: the cell is the building block our tissues and organs are made from and the starting point of all health and disease. Improving cellular health may help increase our life span and our **healthspan**, leading to better energy, mood, fitness, and overall quality of life.

First, let's lay out some key terms and topics covering biological processes that govern our energy levels and cellular health and then later see how they fit together to support healthy cell function and healthy aging.

**Methylation:** You may have heard this term when it comes to B vitamins, like the form of B12 known as methylcobalamin. Methylation is a massively wide-reaching

process in the body. It is the transfer of methyl groups to drive various chemical reactions and create or breakdown molecules and compounds in the body. This means it plays a major role in the following processes:

- stress (fight-or-flight) response
- production and recycling of glutathione (the body's master antioxidant)
- detoxification in the liver
- the inflammatory response
- genetic expression (epigenetics) and the repair of DNA
- creation of neurotransmitters and the balancing of brain chemistry
- energy production
- restoration of cells damaged by free radicals
- the immune response
- synthesis of creatine, protein, and phosphatidylcholine

"Methyl donors" drive these reactions and we can get some from our diet: betaine from red beets, choline from nuts, eggs, meat and fish, folate from leafy greens, the amino acid methionine from eggs, meat, fish, shellfish and some nuts like Brazil nuts and supplemental MSM (methylsulfonylmethane) are a few examples. Some people, due to genetics, are not able or can only poorly perform methylation and it is thought to **decrease in activity with age.**

**Sirtuins:** These are a family of proteins that regulate cell health, activity, and epigenomic function. They help regulate aging, cell death, DNA repair, stress resistance of cells, ROS (a form of free radical) detox, energy metabolism, and gene expression. They require a co-enzyme called NAD+ to function and are also activated and upregulated by many flavonoids in our diet: resveratrol, **grape seed proanthocyanidins**, quercetin, and luteolin, to name a few. There's even a "Sirtfood Diet" high in kale, red wine, berries, dark chocolate, green tea, turmeric, and coffee. Some of my favorite things!

**NAD+:** This is nicotinamide adenine dinucleotide, a critical co-enzyme for all cells. It's necessary for cell metabolism, energy production, and repair. Sirtuins require and consume NAD+ to function, and NAD+ production is thought to **decline by up to 50% between ages 40-60**. Various forms of vitamin B3 (niacin, niacinamide) and the amino acid tryptophan can be used by the body to make NAD+, but these require multiple conversion steps.

Remember methylation? Niacinamide requires methylation to be converted to NAD+. Nicotinamide riboside (NR, also called niagen) seems to be the easiest, closest pre-cursor one can take orally to make NAD+, but its supplemental form is expensive, and only a few foods have trace amounts. Thankfully, both aerobic and resistance exercise **have been shown** to reverse the age-related decline in NAD+ levels in the body. Lastly, the flavonoids apigenin (found in herbs like chamomile,

celery, parsley watercress, and sheep sorrel) and quercetin (found in apples, red clover, and black or green tea) have also **been shown** to prevent the loss of NAD+ due to aging (at least in animal studies so far).

**Telomeres:** These are like caps at the end of each DNA strand that shorten as cells divide. Think of them as the tips on shoelaces that keep them from fraying. They are one of several markers of aging and the biological age of your cells. When telomeres become too short, the cell becomes senescent or dies. Telomeres allow cells to divide without losing genetic information. The enzyme telomerase keeps telomeres from wearing down, and this is one-way cancer cells escape death and continue to divide (by abnormally creating more telomerase). Smoking, obesity, stress, and environmental pollution **are linked** to decreases in telomere length while antioxidants, fiber, omega-3s, and exercise are associated with maintaining telomere length.

**mTOR:** A protein kinase and meta regulator of metabolism and cell growth in response to insulin, growth factors, amino acids, and other nutrients and protein synthesis. It's a key regulator of metabolic homeostasis that senses nutrient levels, oxygen, and energy levels. It is anabolic in nature and so aids muscle growth. Overactivation of mTOR pathways may decrease longevity.

**Autophagy:** This is a regulated mechanism throughout the body to clean cells of debris and waste. When initiated, autophagy helps recycle cell components and cells themselves. It's an adaptive response to stress, disease, and fasting that balances cell survival and cell death. It also, *I sense a theme here*, declines with age and is inhibited by mTOR activation.

**Mitochondrial Biogenesis:** This refers to an increase in the number and size of mitochondria in our cells. The job of the mitochondria is to turn nutrients (like glucose) into energy, so having more of them and larger ones, allows more energy to be available for our muscles. It's our bodies' way of adapting and meeting the challenge of increased energy needs in response to some sort of physical stress, e.g., exercise. It also decreases with age and disease and loss of telomeres. If you want to counter this loss due to aging, look for ways to enhance autophagy (which helps the recycling of damaged mitochondria), which include increasing exercise and trying cold therapy. For supplements and diet, CoQ10, PQQ, rosemary, turmeric, **red beet juice**, and polyphenols from plants **may help** increase the size and density of mitochondria in cells as well.

**Free Radicals:** These are unstable molecules that cause cell damage and are associated with aging and disease. Unless they are "quenched" or neutralized by antioxidants, free radicals can cause oxidative damage to cells, leading to decreased ATP (the form of energy our cells use) production. An increase in free radicals inhibits the mTOR pathway and upregulates autophagy (the cleaners are called in to deal with the cell damage).

**Intermittent Fasting:** This is an umbrella term for a variety of ways to restrict calories for specific periods of time; it's also known by the term' time-restricted eating.' For example, 14 hours of no eating with a 10-hour window in which you can eat your 2 or 3 meals for the day. The idea is to give your body a longer break with no food to deal with, and its popularity has skyrocketed due to claims of weight loss, improvements in metabolic health, and maybe even an increased lifespan (at least according to **animal studies**). **Some research** has found it decreases the mTOR pathway, reduces inflammation, **increases sirtuin activity and lowers insulin levels**, and increases autophagy and antioxidant levels.

**Cryo-Therapy:** Cold therapy, or intentional exposure to cold temperatures (as in an ice bath or prolonged cold shower), helps to increase mitochondrial-rich brown fat and thermogenesis. **Research shows** this increases mitochondrial biogenesis, encourages fat burning genes to reduce obesity, and has a positive effect on glucose and insulin balance. Aerobic activity also helps to increase brown fat.

Now here's how these all fit together:

**mTOR:** Anabolic ↑ Aging ↑ Autophagy ↓

**NAD+:** Sirtuins ↑ ATP Production ↑

**Aging:** Sirtuins ↓ Mitochondrial Biogenesis ↓ Autophagy ↓

**Autophagy:** Mitochondrial Biogenesis ↓ Catabolic ↑

**Cold Therapy:** Mitochondrial Biogenesis ↑

**Free Radicals:** mTOR ↓ Autophagy ↑ ATP Production ↓

**Intermittent Fasting:** mTOR ↓ Sirtuins ↑ Autophagy ↑ Endogenous Antioxidants ↑

**Antioxidants/Polyphenols:** Telomeres ↑ Mitochondrial Biogenesis ↑ Sirtuins ↑ NAD+ ↑

**Exercise:** Mitochondrial Biogenesis ↑ Telomeres ↑ mTOR ↑ NAD+ ↑

So, what are the takeaways from all this in terms of supporting cell health? What's the summary?

1. Exercise: specifically, at least three, 60-minute sessions of "zone 2" exercise per week where you're at about 60-70% of your lung capacity and exertion. This maximizes fat burning and helps to increase mitochondrial biogenesis.

2. Try out some form of **intermittent fasting** for at least a couple weeks to test it out.

3. Analyze your diet and supplements. Ensure you've got cellular health essentials like B vitamins, CoQ10, **polyphenols** like quercetin, apigenin and luteolin, **grapeseed extract**, omega-3 (especially **DHA/EPA**), **turmeric,** dark chocolate, green tea, choline, **red beets**, and a **complete amino acid** protein source covered.

4. Enjoy your increased life and health span! (hopefully!)

Disclaimer: This information is for educational purposes only and should not be construed as specific health advice. Please consult your doctor before beginning an exercise program.

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