

In cellular medicine, we learn that our cells need cleaning.

Our bodies perform cellular housekeeping through a process known as **autophagy**.

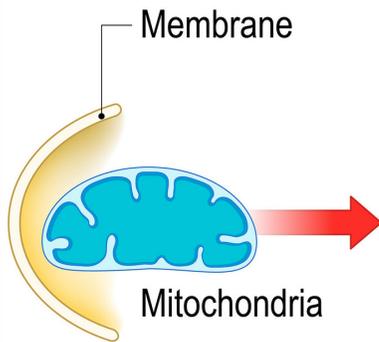
Autophagy means "self-eating." It is the way our cells clean out and recycle unwanted cellular debris.

As we age, autophagy is dysregulated, leading to increase in damaged cells that can cause aging and disease. Improving autophagy is critical to healthy aging.

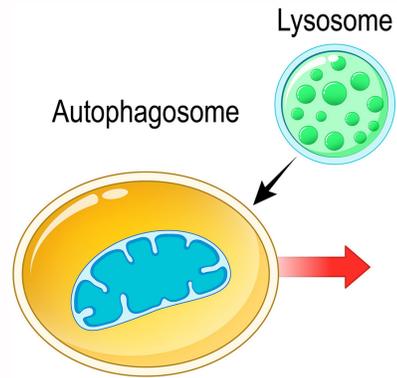


PROCESS OF AUTOPHAGY

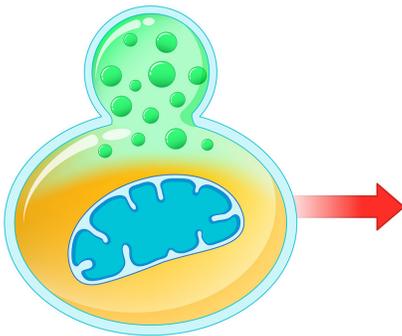
A membrane forms around cellular components



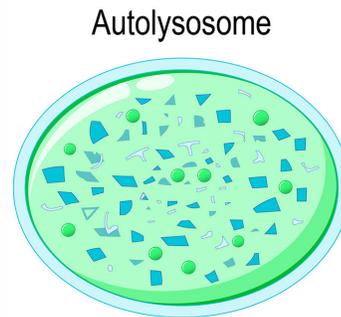
This forms the autophagosome



The autophagosome fuses with a lysosome



Released enzymes degrade the cell waste inside the autophagosome



2 KEY WAYS TO INCREASE AUTOPHAGY



Intermittent Fasting



Polyamines

- Being in a calorie restricted state for a longer period of time triggers a stress response and cues your cells to enter autophagy
- There are different methods of intermittent fasting, but research suggests a minimum of 12 hours is needed to begin to see health impacts.

- Polyamines decrease with age.
- Spermine, Spermidine, and Putrescine are polyamines that have been well researched for anti-aging benefits.
- Polyamines induce autophagy by inhibiting a key nutrient sensing pathway and "tricking" your body into thinking its at a calorie deficit.



Overview of Intermittent Fasting

In the distant past, food was scarce. Much like most animals, reliant on hunt or seasonal harvest for their nutrients, humans too evolved to survive during long periods of hunger and stress. Today, despite our brains knowing that our next meal is not days away, our bodies haven't evolved at the same pace. So what does fasting really mean in our modern, food-accessible world?

Intermittent fasting (IF), also known as time restricted eating, refers to going extended periods of time between meals. Fasting challenges the body, engaging stress response pathways to increase chance of survival. When you go into a calorie restricted state for a longer period of time, you put your body in one of these stressful states and cue your body to enter autophagy. Autophagy, or programmed cell death, is very important to overall health. Through autophagy, our bodies get rid of unneeded, "bad cells," helping us to age in a healthy fashion and fend off diseases and cancers.



Intermittent Fasting Research Findings

Contrary to the many cereal box commercials we watched as kids, breakfast is NOT the most important meal of the day.

The word breakfast quite literally means “to break your fast,” subtly alluding to the idea that fasting itself is a powerful practice. Though there is still some debate around this, studies have shown that breakfast-eaters are more likely to be heavier and at higher risk for metabolic diseases compared to breakfast skippers. [R1, R2] By skipping breakfast, you are extending your overnight fast, likely leading to many of the benefits of autophagy.

Forget your trainer’s advice. Eating small meals throughout the day is not a good way to lose weight or boost metabolism.

Every time you eat, you not only spike cortisol (stress hormone) and glucose (blood sugar), but you also release insulin in response to these triggers. Insulin cues your body to store fat. As a result, If you are releasing insulin throughout the day with every small meal or snack you eat, you are actually more likely to store fat and gain weight. Additionally, we don’t tend to see a change in metabolism with small meals throughout the day. Rather, the total calories consumed plays a larger role, and often, people practicing a multiple, small meals a day diet eat more calories than those eating the traditional three meals a day. [R1, R2]

Recently, researchers have even identified intermittent fasting as a potential defense against Covid-19. [R]

“Autophagy may induce innate immunity by delivering viral nucleic acids to endosomes containing Toll-like receptor 7 (TLR7), which stimulates the production of type 1 interferons (IFN) that, in turn, attract immune cells to the site of infection.” Or in other words, by activating autophagy through fasting, we prime our immune systems and boost immunity.



Intermittent Fasting Methods

There's different methods of intermittent fasting. Some of the most common are:

- 16:8 Fasting Plan means you eat during an 8 hour window (ie noon to 8pm) and fast the remaining part of the day
- 24-Hour Fast means you go one full day without eating. Typically practiced one or twice per week.
- Extended Fast in which you go 2 or more days with zero caloric intake.
- Fast Mimicking Diet involves a week long fast in which you eat low-calorie meals intentionally composed of ingredients that do not raise blood sugar to significant levels.

Whether you are practicing some form of intermittent fasting or not, one of the best things you can do for your overall health is eat consistently at around the same time every day. This helps to reset your body's internal clock, or circadian rhythm. If you are curious to learn more about our body's internal clock and its impact on our health, check out our content on Circadian Rhythm.



Overview of Polyamines

Polyamines decrease with age and have been linked to many aging related diseases. The first polyamine, spermine (yes...found in semen) was discovered over 300 years ago, and other polyamines spermidine and putrescine have been well researched for their wide range of anti-aging benefits. Polyamines induce autophagy by working to inhibit a key nutrient sensing pathway and "tricking" your body that you are in a calorie deficit.

The polyamine lifecycle involves the cyclical conversion of ornithine to putrescine to spermidine to spermine. This ongoing interconversion regulates homeostasis within the cell. We can get polyamines from our food, with different plant and animal products containing different levels of various polyamines. One of our earliest sources of polyamines is through breast milk, exemplifying its evolutionary importance!



Polyamines Research Findings

Polyamines are present in virtually all cells, prokaryotic or eukaryotic, and they are known to be crucial to cellular viability and function.

Polyamines have a wide range of impacts on overall health. They are essential to "cell growth and proliferation, the stabilization of negative charges of DNA, RNA transcription, protein synthesis, the regulation of the immune response, apoptosis, the regulation of ion channels, particularly by blocking potassium channels, and as antioxidants" [R].

Research on polyamine biology and metabolism illuminates opportunities for treating disease.

Polyamines are essential for cell growth, and they play a critical role in metabolism regulation. Polyamine metabolism is frequently dysregulated in cancer and other diseases, and therapies targeted at polyamine metabolism pathways may yield promising in cancer treatments. [R]

Polyamines are found in a wide range of different plant and animal products.

Spermidine, present in all plant-derived foods, is generally the predominant polyamine. Cereals, legumes and soy derivatives, particularly wheat germ and soybeans, contain high levels of spermidine and spermine. Mushrooms, peas, hazelnuts, pistachios, spinach, broccoli, cauliflower and green beans also contain significant amounts of both polyamines. The lowest levels are found in the fruit category. Putrescine is also found in many plant, including fruits and vegetables, notably citrus fruits and green peppers, as well as wheat germ and soybean sprouts. In animals, meats such as chicken, beef, pork, etc tend to have more polyamines than fish, but fish and meats are much higher than animal derivatives like eggs, milk, and cheese (with the exception of blue cheese). [R]