

ABSTRACT

With the recent explosion of Cryotherapy into mainstream industry and media, many sources have been quick to either claim the modality as effective or ineffective. This article summarizes a 20 page report conducted by Dr. Rhonda Patrick, Ph.D, expert in the field of aging, cancer and nutrition, and serves to shed light upon the century-old, proven science of the effects that cold exposure has on the body.

CRYOTHERAPY INCREASES NOREPINEPHRINE

Cold exposure has been proven in several anecdotal studies to improve mood and even be a viable option for the treatment of depression and other mood disorders. One of the most important response mechanisms of the human body is centralized around the regulation of the crucial hormone and neurotransmitter **Norepinephrine (NE)**. In regards to the body's sympathetic nervous system, NE is increased when the body's fight-or-flight response is activated. As for the brain, presence of NE in the bloodstream have profound effects on vigilance, attention span and mood, while the absence of NE results in inattention, poor mood and decreased energy. Not only does NE act as a neurotransmitter in these instances, but it also acts as a hormone, and when present in the blood stream cause vasoconstriction. The role that NE plays in the human body is essential for how the body responds to cold temperatures: by increasing NE in the blood, resulting in constriction of blood vessels and retention of bodily heat (decreased loss of heat to the environment).



Dr. Rhonda Patrick

Ph.D, Biomedical Science - Expert in fields of Aging, Cancer & Nutrition

For more information on Dr. Rhonda Patrick, Ph.D, visit her website at <http://www.foundmyfitness.com>

COLD IS GOOD. BUT HOW MUCH COLD IS NEEDED?

The answer: It's gotta be COOOLLDDDD. Dr. Rhonda's site's a few different studies in her report:

“Cold water immersion at 68°F (20°C) for 1 hour does not appear to activate norepinephrine release... A long term study in humans directly compared people that immersed themselves in cold water at 40°F (4.4°C) for 20 seconds to those that did whole body cryotherapy for 2 minutes at -166°F (-110°C) three times a week for 12 weeks and found that in both cases, plasma norepinephrine increased 2 to 3 fold (200 to 300%)”

So...although standing outside on a cold winter day may not be enough to trigger your body to release NE, the temperatures involved in cryotherapy will!

COLD SHOCK PROTEINS: THE BRAIN REPAIRMEN

Synapses are gaps between neurons in the brain. These synapses are responsible for cell communication and forming memories. Different things can cause degeneration or breakdown of synapses including disease & environmental factors. When exposed to cold, synapses between neurons break down. But, not to worry! Synapses do regenerate with the help of Cold Shock Proteins. One protein in specific, RBM3 has been shown to be elevated up to 3 days after exposure to cold! Why is this significant? Degeneration or breakdown of synapses occur from normal brain aging and is greatly increased by diseases like Alzheimer's disease, Parkinson's disease or after traumatic brain injury. When these Cold Shock Proteins are present, neurodegeneration or the breakdown of these synapses is decreased! Although most studies conducted thus far have taken place in a laboratory setting and much is still unknown about the effect of RBM3 in humans, the link between synapse regeneration, cold exposure and Cold Shock Proteins may pose as significant puzzle pieces into combatting cellular degeneration and aging.

CRYOTHERAPY DECREASES INFLAMMATION

Inflammation is the body's way of eliminating the cause of cell injury, ridding the body of dead cells and initiating cell & tissue repair mechanisms. Inflammation has been proven to not only be a key cause for the aging process, but to also be behind at least 80% of all disease.

Now, let's get back to our friend Norepinephrine. We know that NE acts as both a neurotransmitter and hormone, but NE also has key inflammation reducing properties. NE acts to inhibit the inflammatory pathway by decreasing TNF-alpha, a molecule that increases inflammation, as well as reducing other inflammatory cytokines that are key players in causing inflammatory diseases such as arthritis. Because inflammation is major cause of pain, NE has also been known to decrease pain.

CRYOTHERAPY IMPROVES IMMUNE FUNCTION

You may be asking 'why does my body house such self-harming substances such as TNF-alpha or the harmful cytokines mentioned above? The reason for this is because these molecules are what compose your body's immune

system and help to rid the body of any harmful materials. Having a large amount of these immune cells is typically a good thing, as long as they remain in a dormant state and are not overactive.

So how does the cold effect these immune cells? It increases them! Regular cold exposure has been shown to increase white blood cell count, increase cytotoxic T lymphocytes (active in killing cancer cells) and increase other beneficial immune cells as well.

CRYOTHERAPY INCREASES METABOLISM

When the body is exposed to cold, its response is to produce heat. It does this by increasing its metabolism, not to produce ATP (your body's fuel for energy), but to produce heat to warm the body back up. This process is called thermogenesis. Thermogenesis happens in one of two ways. The first is through muscle contractions which result in shivering — this produces heat. The second is non-shivering thermogenesis, which involves the body transferring white adipose tissue cells into the more mitochondria-dense & more metabolically active brown adipose tissue cells. The more Brown Adipose Tissue your body has, the more fat your body will burn.

CRYOTHERAPY INCREASES ANTIOXIDANT ACTIVITY

Another one of those pesky, self-harming substances that your body produces during several processes including metabolism is Reactive Oxygen Species (ROS). ROS are great for damaging any and all kind of cells in the body, including DNA. As stated previously, ROS will always be present in the body; this is normal. The important factor is how the body responds to the damage cause by ROS. ROS are key players in the aging process and preventing damage from ROS not only means extending cell and DNA lifespan but also means staying cancer free.

So how can we keep these nasty ROS from wreaking too much havoc? You guessed it, cryotherapy. Cold exposure has been shown to activate invaluable naturally occurring genetic anti-oxidizing systems (these are much more powerful than supplemental antioxidants).

One important thing to note here is that in regards to anti-oxidizing enzyme activity, it was shown to take multiple sessions of whole body cryotherapy to activate these enzymes. AKA the more cryotherapy sessions done, the more activation of these beneficial enzymes.

CONCLUSION

The science behind cryotherapy and cold exposure is not new science. It has been proven in studies time and time again. Cryotherapy allows the controlled elicitation of the body's natural cell repairing, pain & inflammation reducing and metabolic processes. Do understand that many of the studies detailed in Dr. Rhonda's report include extended, *regular* exposure of cryotherapy and cold exposure. The use of coldness as a 'good stressor' on the body can help to trigger several beneficial responses within the human body.