Many Health Potentials of Sauna and Cold dip

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The following is a guest article by Rhonda Perciavalle Patrick, Ph.D. (RP), who works with Dr. Bruce Ames of the Ames carcinogenicity test, the 23rd most-cited scientist in all fields between 1973 and 1984. Dr. Patrick also conducts clinical trials, performed aging research at Salk Institute for Biological Studies, and did graduate research at St. Jude Children's Research Hospital, where she focused on cancer, mitochondrial metabolism, and apoptosis.

The massive indoor climate control systems and pleasantly chilled water fountains found in most gyms speak to this fact. There are some exceptions — Bikram yoga, for example — but they're few and far between.

But here's the surprise: increasing your core temperature for short bursts is not only healthful; it can also dramatically improve performance.

This is true whether it's done in conjunction with your existing workout or as an entirely separate activity. I'm going to explain how heat acclimation through sauna use (and likely any other non-aerobic activity that increases core body temperature) can promote physiological adaptations that result in increased endurance, easier acquisition of muscle mass, and a general increased capacity for stress tolerance. I will refer to this concept of deliberately acclimating yourself to heat, independent of working out, as "hyperthermic conditioning."

I'm also going to explain the positive effects of heat acclimation on the brain, including the growth of new brain cells, improvement in focus, learning and memory, and ameliorating depression and anxiety. In addition, you'll learn how modulation of core temperature might even be largely responsible for "runner's high" via an interaction between the dynorphin / beta-endorphin opioid systems.

1. **The Effects of Heat Acclimation on Endurance (RP)**

If you've ever run long distances or exercised for endurance, it's intuitive that increased body temperature will ultimately induce strain, attenuate your endurance performance, and accelerating exhaustion. What might not be as intuitive is this: acclimating yourself to heat independent of aerobic physical activity through sauna use induces adaptations that **reduce** the later strain of your primary aerobic activity.

Hyperthermic conditioning improves your performance during endurance training activities by causing adaptations, such as improved cardiovascular and thermoregulatory mechanisms (I will explain what these mean) that reduce the negative effects associated with elevations in core body temperature. This helps optimize your body for subsequent exposures to heat (from metabolic activities) during your next big race or even your next workout.

Just a few of the physiological adaptations that occur are:

- Improved cardiovascular mechanisms and lower heart rate.[1]
- Lower core body temperature during workload (surprise!)
- Higher sweat rate and sweat sensitivity as a function of increased thermoregulatory control.[2]
- Increased blood flow to skeletal muscle (known as muscle perfusion) and other tissues.[2]
- Reduced rate of glycogen depletion due to improved muscle perfusion.[3]
- Increased red blood cell count (likely via erythropoietin).[4]
- Increased efficiency of oxygen transport to muscles.[4]

2. Hyperthermic conditioning optimizes blood flow to the heart, skeletal muscles, skin, and other tissues because it **increases plasma volume**. This leads to endurance enhancements in your next workout or race, when your core body temperature is once again elevated.

*Being heat acclimated **enhances endurance** by the following mechanisms…*

1. It increases plasma volume and blood flow to the heart (stroke volume).[2,5] This results in reduced cardiovascular strain and lowers the heart rate for the same given workload.[2] These cardiovascular improvements have been shown to enhance endurance in both highly trained and untrained athletes.[2,5,6]

2. It increases blood flow to the skeletal muscles, keeping them fueled with glucose, esterified fatty acids, and oxygen while removing by-products of the metabolic process such as lactic acid. The increased delivery of nutrients to muscles reduces their dependence on glycogen stores. Endurance athletes often hit a "wall" (or "bonk") when they have depleted their muscle glycogen stores. Hyperthermic conditioning has been shown to reduce muscle glycogen use by 40%-50% compared to before heat acclimation.[3,7] This is presumably due to the increased blood flow to the muscles.[3] In addition, lactate accumulation in blood and muscle during exercise is reduced after heat acclimation.[5]
3. It improves thermoregulatory control, which operates by activating the sympathetic nervous system and increasing the blood flow to the skin and, thus the sweat rate. This dissipates some of the core body heat. After acclimation, sweating occurs at a lower core temperature and the sweat rate is maintained for a longer period.[2]

So what sort of gains can you anticipate?

One study demonstrated that a **30-minute sauna session two times a week for three weeks POST-workout increased the time that it took for study participants to run until exhaustion by 32% compared to baseline.**[4]

The 32% increase in running endurance found in this particular study was accompanied by a 7.1% increase in plasma volume and 3.5% increase in red blood cell (RBC) count.[4] This increased red blood cell count accompanying these performance gains feed right back into those more general mechanisms we talked about earlier, the most obvious of which being: more red blood cells increase oxygen delivery to muscles. It is thought that heat acclimation boosts the RBC count through erythropoietin (EPO) because the body is trying to compensate for the corresponding rise in plasma volume.[4]

[Note from Tim: If "EPO" sounds familiar, it's because it's commonly injected by Tour de France competitors. More on that here.]

In other words, hyperthermia conditioning through sauna use doesn't just make you better at dealing with heat; it makes you better, period. I do want to mention that while these gains were made with a small sample size (N=6) some of the later studies that I point out reinforce this conclusion.

3. The Effects of Hyperthermia Conditioning on Muscle Hypertrophy (Growth) (RP)

Exercise can induce muscular hypertrophy. Heat induces muscular hypertrophy. Both of these together synergize to induce hyper-hypertrophy.

Here are a few of the basics of how muscle hypertrophy works: muscle hypertrophy involves both the increase in the size of muscle cells and, perhaps unsurprisingly, an accompanying increase in strength. Skeletal muscle cells do contain stem cells that are able to increase the number of muscle cells [TIM: called "hyperplasia"] but hypertrophy instead generally involves an increase in size rather than number.

So what determines whether your muscle cells are growing or shrinking (atrophying)?

A shift in the protein synthesis-to-degradation ratio…and an applied workload on the muscle tissue (of course). That's it.

At any given time your muscles are performing a balancing act between NEW protein synthesis and degradation of existing proteins. The important thing is your net protein synthesis, and not strictly the amount of new protein synthesis occurring. Protein degradation occurs both during muscle use and disuse. This is where hyperthermic conditioning shines: **heat acclimation reduces the amount of protein degradation** occurring and as a result it increases net protein synthesis and, thus muscle hypertrophy. Hyperthermic conditioning is known to increase muscle hypertrophy by increasing net protein synthesis through three important mechanisms:

- Induction of heat shock proteins.[8,9]
- Robust induction of growth hormone.[1]
- Improved insulin sensitivity.[10]

Exercise induces both protein synthesis and degradation in skeletal muscles but, again, it is the net protein synthesis that causes the actual hypertrophy. When you exercise, you are increasing the workload on the skeletal muscle and, thus, the energetic needs of your muscle cells. The mitochondria found in each of these cells kick into gear in order to help meet this demand and start sucking in the oxygen found in your blood in order to produce new energy in the form of ATP. This

process is called oxidative phosphorylation. A by-product of this process, however, is the generation of oxygen free radicals like superoxide and hydrogen peroxide, which is more generally referred to simply as “oxidative stress”.

4. Heat Stress Triggers Heat Shock Proteins That Prevent Protein Degradation (RP)

Oxidative stress is a major source of protein degradation.

For this reason, any means of preventing exercise-induced oxidative protein damage and/or repairing damaged proteins, while keeping the exercise induced protein synthesis, will ultimately cause a net increase of protein synthesis and therefore will be anabolic.

Heat shock proteins (or HSPs), as the name implies, are induced by heat and are a prime example of hormesis. Intermittent exposure to heat induces a hormetic response (a protective stress response), which promotes the expression of a gene called heat shock factor 1 and subsequently HSPs involved in stress resistance.

- HSPs can prevent damage by directly scavenging free radicals and also by supporting cellular antioxidant capacity through its effects on maintaining glutathione.[8,9]
- HSPs can repair misfolded, damaged proteins thereby ensuring proteins have their proper structure and function.[8,9]

Okay, let’s take a step back from the underlying mechanisms and look at the big picture of heat acclimation in the context of increasing muscle hypertrophy:

It has been shown that a 30-minute intermittent hyperthermic treatment at 41°C (105.8°F) in rats induced a robust expression of heat shock proteins (including HSP32, HSP25, and HSP72) in muscle and, importantly, this correlated with **30% more muscle regrowth than a control group during the seven days subsequent to a week of immobilization.**[8] This HSP induction from a 30-minute intermittent hyperthermic exposure can persist for up to 48 hours after heat shock.[8,9] Heat acclimation actually causes a higher basal (such as when not exercising) expression of HSPs and a more robust induction upon elevation in core body temperature (such as during exercise).[11,12,13] This is a great example of how a person can theoretically use hyperthermic conditioning to increase their own heat shock proteins and thereby reap the rewards.

5. Heat Stress Triggers A Massive Release of Growth Hormone (RP)

Another way in which hyperthermic conditioning can be used to increase anabolism is through a massive induction of growth hormone.[14,15,1] Many of the anabolic effects of growth hormone are primarily mediated by IGF-1, which is synthesized (mainly in the liver but also in skeletal muscle and other tissues) in response to growth hormone. There are two important mechanisms by which IGF-1 promotes the growth of skeletal muscle:

1. It Increases protein synthesis via activation of the mTOR pathway.[16]
2. It decreases protein degradation via inhibition of the FOXO pathway.[16]

Mice that have been engineered to express high levels of IGF-1 in their muscle develop skeletal muscle hypertrophy, can combat age-related muscle atrophy, and retained the same regenerative capacity as young muscle.[17,18] In humans, it has been shown that the major anabolic effects of growth hormone in skeletal muscle may be due to inhibition of muscle protein degradation (anti-catabolic), thereby increasing net protein synthesis.[16] In fact, growth hormone administration to endurance athletes for four weeks has been shown to decrease muscle protein oxidation (a biomarker for oxidative stress) and degradation by 50%.[19]

My point is good news. You don’t need to take exogenous growth hormone. Sauna use can cause a robust release in growth hormone, which varies according to time, temperature, and frequency.[1,15]

For example, two 20-minute sauna sessions at 80°C (176°F) separated by a 30-minute cooling period elevated growth hormone levels two-fold over baseline.[1,15] Whereas, two 15-minute sauna sessions at 100°C (212°F) dry heat separated by a 30-minute cooling period resulted in a five-fold increase in growth hormone.[1,15] However, what’s perhaps more amazing is that repeated exposure to whole-body, intermittent hyperthermia (hyperthermic conditioning) through sauna use has an even more profound effect on boosting growth hormone immediately afterward: **two one-hour sauna sessions a day at 80°C (176°F) dry heat (okay, this is a bit extreme) for 7 days was shown to increase growth hormone by 16-fold on the third day.**[14] The growth hormone effects generally persist for a couple of hours post-sauna.[1] It is also important to note that when hyperthermia and exercise are combined, they induce a synergistic increase in growth hormone.[20]

6. Increased Insulin Sensitivity (RP)

Insulin is an endocrine hormone that primarily regulates glucose homeostasis, particularly by promoting the uptake of glucose into muscle and adipose tissue. In addition, insulin also plays a role in protein metabolism, albeit to a lesser degree than IGF-1. Insulin regulates protein metabolism in skeletal muscle by the two following mechanisms:

1. It increases protein synthesis by stimulating the uptake of amino acids (particularly BCAAs) into skeletal muscle.[21]
2. It decreases protein degradation through inhibition of the proteasome, which is a protein complex inside cells that is largely responsible for the degradation of most cellular proteins.[22]

In humans, there is more evidence indicating that the major anabolic effects of insulin on skeletal muscle are due to its inhibitory action on protein degradation.

For example, insulin infusion in healthy humans, which increased insulin to normal physiological postprandial (after a meal) levels, suppressed muscle protein breakdown without significant affecting muscle protein synthesis.[23, 21] In contrast, insulin deficiency (such as in type 1 diabetes mellitus) and insulin resistance (to a lesser extent) are both associated with increased skeletal muscle breakdown.[22,24]

For this reason, hyperthermic conditioning may also lend itself to promoting muscle growth by improving insulin sensitivity and decreasing muscle protein catabolism. Intermittent hyperthermia has been demonstrated to reduce insulin resistance in an obese diabetic mouse model. Insulin resistant diabetic mice were subjected to 30 minutes of hyperthermic treatment, three times a week for twelve weeks. **This resulted in a 31% decrease in insulin levels and a significant reduction in blood glucose levels, suggesting re-sensitization to insulin.[10]** The hyperthermic treatment specifically targeted the skeletal muscle by increasing the expression of a type of transporter known as GLUT 4, which is responsible for the transporting of glucose into skeletal muscle from the bloodstream. Decreased glucose uptake by skeletal muscle is one of the mechanisms that leads to insulin resistance.

[TIM: For more fun with GLUT 4 transporters, read the "Damage Control" chapter in The 4-Hour Body, which covers how to minimize (or eliminate) fat gain from cheat meals or cheat days.]

7. Relevance for Muscle Injury (RP)

Animal studies using rats have shown that a 30-minute and 60-minute hyperthermic treatment at 41°C (105.8°F) attenuates hindlimb muscle atrophy during disuse by 20% and 32%, respectively.[9,25] In order to return to a hypertrophic state after injury, muscle regrowth (“reloading”) must occur. Muscle reloading, while important for hypertrophy, induces oxidative stress particularly after periods of disuse, which slows the rate of muscle regrowth. A 30-minute hyperthermic treatment at 41°C (105.8°F) increased soleus muscle regrowth by 30% after reloading as compared to non-hyperthermic treatment in rats.[8] The effects of whole body hyperthermia on preventing muscle atrophy and increasing muscle regrowth after immobilization were shown to occur as a consequence of elevated HSP levels.[8,9,25]

During injury, you may be immobilized but you don’t have to be very mobile to sit in the sauna a few times a week to boost your HSPs! This is a clear win in the injury and recovery department. Remember, hyperthermic conditioning (from sauna use) results in an elevation in HSP levels under normal conditions and leads to an even greater boost during exercise (or when core body temperature is elevated).[11-13]

8. Relevance for Rhabdomyolysis (RP)

Hyperthermic conditioning may also be able to protect against rhabdomyolysis (muscle breakdown due to severe muscle overuse) through the induction of HSP32 also known as heme oxygenase 1.[26,27]

Rhabdomyolysis releases myoglobin, a byproduct from broken down muscle tissue, into the bloodstream, which can cause kidney failure. [TIM: CrossFitters, watch your CPK levels after glute-ham ab work. If you can't do long planks with your feet *against* a wall, don't do hyper-extended ROM, ballistic ab work.]

Since myoglobin is a heme-containing protein, HSP32 (heme oxygenase 1) can rapidly degrade myoglobin before it has toxic effects on the kidney.[26,27] In fact, induction of HSP32 in rats has been shown to protect against rhabdomyolysis in rats.[26] This function of HSP32 is very different than the classical role of HSPs in preventing protein degradation. Again, heat acclimation causes a higher basal expression of HSPs and a more robust expression upon heat stress.[11-13] The more

heat acclimated your body is (the pre-conditioning is the key here), the higher your HSP32 expression will be during physical activity and this will protect your kidneys from the toxic myoglobin breakdown product.

9. Longevity (RP)

In flies and worms, a brief exposure to heat treatment has been shown to increase their lifespan by up to 15% and it's been shown that this effect is specifically mediated by HSPs.[28,29,30]

While studying the effects of something like hyperthermic conditioning on longevity is inherently hard in humans (obviously), there have been some preliminary positive associations with variations in the HSP70 gene associated with increased expression and longevity.[31]

10. Effects of Heat Stress on The Brain (RP)

One of the ways that the brain responds to injury on the cellular level is increased HSP production.

This includes ischemic injury (i.e. stroke), traumatic injury, and excitotoxicity (epileptic).[32] What complicates things, however, in the context of "hyperthermic conditioning" (or deliberate heat acclimation) is that while on the one hand hyperthermia has been shown to reduce the frequency of seizures and the damage they cause post-conditioning, hyperthermia can actually increase the damage caused by seizures if they occur during a period of heat stress. In other words, the stress and its damaging effects are additive.[33,34]

That (and it's implicit warning) being said, sauna-induced hyperthermia has been shown to induce a robust activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis.

One study demonstrated that men that stayed in the sauna that was heated to 80°C (176°F) until subjective exhaustion increased norepinephrine by 310%, had a 10-fold increase in prolactin, and actually modestly decreased cortisol.[1,15] Similarly, in another study, women that spent 20-minute sessions in a dry sauna twice a week had a 86% increase in norepinephrine and a 510% increase in prolactin after the session.[35]

Norepinephrine helps with focus and attention while prolactin promotes myelin growth, which makes your brain function faster, which is key in repairing nerve cell damage.[36,37]

In addition to increasing norepinephrine, heat acclimation has actually been shown to increase biological capacity to store norepinephrine for later release.[38] In light of the fact that the norepinephrine response to exercise has been demonstrated to be blunted in children with ADHD and that norepinephrine reuptake inhibitors (NRI) are frequently prescribed to treat ADHD (among other things), use of heat stress and subsequent acclimation should be tested for it's effectiveness as an interesting alternative therapeutic approach.[39]

11. Neurogenesis (RP)

Heat stress has been shown to increase the expression of brain-derived neurotrophic factor (BDNF) more than exercise alone when used in conjunction with exercise.[40]

This is important because BDNF increases the growth of new brain cells as well as the survival of existing neurons. An increase in neurogenesis is thought to be responsible for enhancing learning.[41] BDNF's role in the brain is also to modulate neuronal plasticity and long-term memory, while also having been shown to ameliorate anxiety and depression from early-life stressful events.[42] In addition to the function BDNF plays in the brain when it's released as a consequence of exercise, BDNF is also secreted by muscle where it plays a role in muscle repair and the growth of new muscle cells.[43]

While BDNF has specifically been shown to play some role in relieving depression from stressful early-life events, whole-body hyperthermia has also been demonstrated to improve depression in cancer patients.[44] In this particular study, however, it was speculated that beta-endorphin (which is also induced by hyperthermia), not BDNF, may have been the agent responsible for this effect. As an aside, one of the reasons whole-body hyperthermia is sometimes used with cancer patients is because it can enhance the effects of chemotherapeutic agents.[45]

12. The Runner's High and The Role of Dynorphin (RP)

Ever wonder what is responsible for the "runner's high" or post-exercise highs, in general? You've probably heard that it's due to endorphins, but that's not the whole story.

Beta-endorphins are endogenous (natural) opioids that are a part of the body's natural painkiller system, known as the mu opioid system, which block pain messages from spreading from the body to the brain in a process called antinociception. What is lesser known is that the body also produces a peptide known as dynorphin (a "kappa opioid"), which is generally responsible for the sensation of dysphoria. The discomfort experienced during intense exercise, exposure to extreme heat (such as in a sauna), or eating spicy food (capsaicin) is due to the release of dynorphin. The release of dynorphin causes an upregulation and sensitization of mu opioid receptors, which interact with beta-endorphin.[46] This process is what underlies the "runner's high" and is directly precipitated by the discomfort of physical exercise. Translation: the greater the discomfort experienced during your workout or sauna, the better the endorphin high will be afterward. Now you understand the underlying biological mechanism that explains this.

13. **How is this relevant to hyper thermic conditioning and sauna use? (RP)**

Heat stress from heat exposure in a dry sauna has been demonstrated to cause a potent increase in beta-endorphin levels, even more than exercise alone.[1,15]

A study in rats explains this somewhat: dynorphin delivered directly into a part of the hypothalamus in the brains of rats triggers a drop in their body temperature, while blocking dynorphin with an antagonist was shown to prevent this same response. Similarly, mu receptor agonists have been shown to induce increases in body temperature in rats.[47] What this seems to imply is that perhaps, by deliberately manipulating your body temperature you are actually directly engaging the mu (endorphin) and kappa opioid (dynorphin) systems since they clearly play a role in temperature regulation in general.

14. **Effect of Sauna for the Social potential (Veli-Jussi Jalkanen, VJJ)**

When people bathe together in safe, relaxed and caring atmosphere, it makes people approach automatically each other, even become friends. Social atmosphere in a mixed group also supports various hormone production in each member.

15. **Effect of self - esteem and body awareness in nude bathing (VJJ)**

The most healthy and natural way of having sauna is to bathe nude. Nude body is physically more relaxed and feels better all stimulants of from the water, heat, herbs and treatments. Also bathing nude in a safe company (same sex or mixed group) increases own body approval and quickly makes people take human body as natural without (culture combined) fears and shames. Usually people are surprized how quickly they relax in a mix group and become liberated in this sense. Also doing all sorts of treats like mud or clay coating, herbal oils etc. cannot be done well with any clothes on. Bathing nude also gives people an experience of comfortable and healthy nudeness, when nothing is pressing or limiting movements or the freedome of the skin and sweating. Cooling swimming nude in the pool after each sauna heat session, gives people an experience of very enjoyable water "touch" which also has some of the same effect as lymphatic massage generated by the water turbulence on the skin.

16. **Health and relaxation treats in Sauna (VJJ)**

Sauna is excellent place to feed many kind of reviving natural biochemical into the body in sauna because the skin is open and receptive. Such things are sauna birch "whip" treatment, herbal oil treatment, mud (treatment peat actually) and clay coating, herbal juice (numerous choices) treatments etc. There is maybe no better place to do these treatments than sauna and this way maximize the whole effect by getting these vitalizing biochemical in the body when it is very active anyway.

17. **Important Quality of Air (VJJ)**

If sauna is heated with traditional normal electricity stove, the quality of air is not too good. the glowing steel in the stove destroys the negative ions from the air. This is why sauna experts, who have experienced better saunas, do not like e-saunas. The difference is that its easy to bathe and enjoys in sauna with good air for hours but most of us come out from e-saunas after minutes. Wood heated saunas are so better in this respect. The best is if sauna is heated with the steam that comes out from the burning process. This is so called traditional Finnish smoke sauna. New Finnish wood pellet burning technology is offering here a way to burn wood totally smoke free (only CO_2 and H_2O come out) and thus avoid all bad sides traditional wood stove heating.

Other important issue is also **ventilation.** Sauna must be well ventilated to get safely the health benefits. Many materials, people etc. evaporate gasses when they heat up and they need to be ventilated out and fresh oxygen in. this is often neglected.

18. **Powerful Welfare Treatments by Touching (VJJ)**

When we touch the other person or get safely touched in a relaxing and safe way, the person we touch, produces "happy hormones" like dopamine, serotonin and oxytocin. These important health, happy feeling and relaxing hormones are known to degrease loneliness, depression, and increases relaxation and happiness. Particular thing is that also the person who touches, also produces these hormones in his/her body. In sauna massages, back/body wash, yoga, pair stretching etc. offer natural and fluent way to benefit also this powerful tool for health, stress relief and relaxation.

19. Ice dipping after Sauna Heat Sessions (VJJ)

Heat regulation and hormonal stimulation is greatly accelerated if cooling down after sauna sessions happens in the snow or cold water. People know by experience that after going to icy water the body produces so much heat that it stays warm 5- 15 minutes wet and nude even in frosty air (but not much wind there). The wonderful feeling of warmth that takes over the body after ice dipping is a sign of powerful hormonal process for the balancing, heat production and adaptation. This is a maybe a superior way to produce the healthy brown fat (BAT) that turns into energy when a person enters into cold conditions. I am exited to support having sauna in a social group when it´s easy even for a beginner to go into the cold water. If one needs to walk on ice, special ice dipping shoes are handy (but not necessary if you are experienced) to keep the toes from getting cold. Bathing clothes are uncomfortable because they hold the icy water from leaving the skin after coming out. It takes 2-4 times to get comfortably used to this "shocking" treatment. Many people, who have practical possibility, also adopt this super healthy habit to them and do it daily even without sauna. They have a common feature: they seldom have flue. Surely this cold shock also has strong hormonal impacts and it's a good way to train ones micro circulation effectively.

20. About Useful and Practical Sauna Habits and Performance that Enforce Sauna Health Impacts (VJJ)

In some cultures (Germany) there is often very strict order of doing things according to the instructions of the sauna "master". Our bodies however are very different and so the heat level (how high on the benches you are if there is a choice), how much you add water/snow on the stones to produce steam, and how long you can comfortably stay in the heat, are details, which are very individual.
Likely the best practice is that everybody listens to her/his own body and decide the length of the stay inside, drinking water, number of heats and cool downs (outside, shower, snow or in the water) as they feel best and most suitable to themselves. With more experience and with the hints of more experiences sauna enthusiasts all learn to make the sauna more and more fitting to her/his body and get more and more health benefits out from it.
Alcohol is not a good drink in sauna. We need to drink a lot of liquid there if we sweat a lot as we should. If it is alcohol, many health-, social and accident dangers increase and safety and comfort of the neighbours likely diminish.

21. Cultural differences (VJJ)

Germany may be the leader in public saunas. There are several spas with pool area where people ware bathers and sauna areas where all are nude but one must have a towel under their butts and feet while sitting on the benches. The atmosphere is relaxed, social, calm and safe.

In Finland, The original and traditional sauna country of the North, the bathing in the saunas used to be for the whole farm staff together. Even villages had village saunas with all people bathing together without bathers etc. Such practices where common 1600 – 1900.

Unfortunately this traditional and valuable culture has somewhat degenerated due to unfortunate Anglican heritage of puritan (…"pure") and inhibited values which has also spread out from UK to British colonies and to US and through their entertainment media to other countries too.

In Arabic and catholic culture people in the same sex do not show the bodies to each other. In Asian cultures men and women bathe also separately. Still in some traditional and famous spas in Japan, all people are told to bath nude and mixed in the thermal spas, which is like exception in their culture. In Asia the word sauna, unfortunately, is often linked with prostitution.

22. How to Avoid Getting Tired in Sauna (VJJ)

Many people have experience that they get tired in sauna. Some things are wrong their bathing. In high quality bathing one should be energized and relaxed after sauna. The most common reasons to get tired in sauna are

a) Not drinking water enough (alcohol dries up the body, sugar or carbon drinks not good at all)
b) Overheating the body that is insufficient cooling between the heats periods

c) Lack of oxygen / poor ventilation.
d) Poor quality of air. Glowing steel wires abolish the negative ions from the air. This happens in electric saunas if the wires are not covered with ceramics coating. Forest after rain with its super rich air is good example of air full with negative ions. Wood burning stoves (varies between the brands) save better the negative ions in the air.

If these 4 mistakes are avoided, sauna enjoyment / treatment / therapy can last up to 3-4 hours in all.

Similarities between heat shock (sauna) and cold shock (ice dipping) (RP):

- Both are thermal stresses on the body and both can induce heat shock proteins (HSPs). This is because cold shock is also a hermetic stress that induces the expression of genes involved in stress response. However, the cold shock does not induce as robust of an increase in HSPs.
- Cold shock causes a massive release of norepinephrine (heat can also induce) from the locus cerulean, which helps with focus and attention. A burst of NE also makes you feel really good... norepinephrine-reuptake inhibitors are also a class of drugs used to treat ADHD.
- This increase in norepinephrine from cold shock regulates thermogenesis through the expression of uncoupling protein 1. The function of ucp1 is to uncouple the mitochondria---explain this and how it ramps up mitochondrial metabolism and stimulates lipolysis. Also, repeated norepinephrine release has been shown to cause white adipose tissue to express UCP1 and become more like brown adipose tissue.
- Some of the other effects (like dimorphic release and the effects on the opioid system) aren't the same for cold shock, however.

In Conclusion (RP)

To recap and drive the point home: acclimating your body to heat stress by intermittent whole-body hyperthermia via sauna use ("hyper thermic conditioning") has been shown to:

Enhance endurance by: (RP)

- Increasing nutrient delivery to muscles thereby reducing the depletion of glycogen stores.
- Reducing heart rate and reducing core temperature during workload.

Increase muscle hypertrophy by preventing protein degradation through the following three means: (RP)

1. Induction of heat shock proteins and a hermetic response (which has also been shown to increase longevity in lower organisms).
2. Cause a massive release of growth hormone.
3. Improving insulin sensitivity.

Hyperthermia conditioning also has robust positive effects on the brain: (RP)

- Increases the storage and release of norepinephrine, which improves attention and focus.
- Increases prolactin, which causes your brain to function faster by enhancing myelination and helps to repair damaged neurons.
- Increases BDNF, which causes the growth of new brain cells, improves the ability for you to retain new information, and ameliorates certain types of depression and anxiety.
- Causes a robust increase in dynorphin, which results in your body becoming more sensitive to the ensuing endorphins.

Life is stressful. When you exercise, you are forcing your body to become more resilient to stress (somewhat paradoxically) through stress itself.

Hyperthermia conditioning is a novel and possibly effective tool that can improve your resistance to the sort of stress associated with fitness pursuits as well as some that are not traditionally associated with fitness such as the protective effects of HSPs on various types of stress. That being said, **deliberately applied physical stress, whether heat stress or ordinary exercise, is something that requires caution.**

You shouldn't avoid it altogether, but you should use good common sense, not overwhelm yourself, and make sure to know your limits. (NOTE: you should not drink alcohol before or during sauna use as it increases the risk of death).[48]

Personal variation probably comes into play when finding your own sweet spot for building thermal tolerance while avoiding over-extending yourself.

I believe that hyper thermic conditioning in general may be worth a closer look as a tool in the toolbox of athletes. Perhaps it can be used for much more than just relaxation? RP.

Many Health Benefits of cold exposure (Cryotherapy) By Dr. Mercola (M)

While living in a climate-controlled environment has its benefits in terms of keeping us comfortable, it can actually have surprising impacts on health. There's a compelling body of evidence showing exposure to harsh conditions can be highly beneficial. In fact, extreme temperature variations appear to help optimize many biological functions.

Any of us can take full advantage of the many magnificent benefits that regular cold exposure can have to improve your health. One of the mechanisms by which cold exposure or cold thermogenesis aids weight loss and reduces your risk of diabetes and other chronic disease is by inducing brown adipose tissue (BAT) = brown fat.

BAT, which is incredibly mitochondrial-dense, helps improve your mitochondrial function. One of the physiological functions of body fat is to be used as fuel to heat your body if you have active BAT metabolism. This is accomplished by uncoupling the mitochondria from producing ATP and actually producing heat instead. By regularly exposing yourself to cold, you build up a mitochondria-rich tissue in brown fat and help your body generate heat, which actually lowers your blood sugar and decreases insulin resistance.

Beige fat is a derivative of brown fat and is recruited through your white fat, which can then be used to heat your body and maintain a more active-passive metabolism. Indeed, the conclusion I reached after many decades of studying health is that burning fat as your primary fuel is a key to preserving and maintaining your health. There are a number of ways to reach this goal. You can do it through diet, and in my new book, "Fat for Fuel," I explain how to do that. But there's also a tremendous synergy with cold thermogenesis.

Cold Exposure Increases Whole-Body Metabolic Rate (M)

A recent study[1] in Bioscience Reports looked at the impact of cryotherapy — exposure to cold — on the mitochondrial structure in BAT and skeletal muscle, both of which are thermogenic sites. As explained in this study:

"Mitochondria are very dynamic organelles that undergo dramatic remodeling in response to increase in local energy demand within a cell. The mitochondrial architecture (including cristae density, compactness, length, shape, and size) is a reflection of their level of activity, and thus it is also an indicator of cellular energy status. It is believed that organs involved in thermogenesis within the mammalian body elevate their metabolism in response to cold adaptation."

While BAT and muscle both generate heat, they do so using different mechanisms. In BAT, heat generation is based on mitochondrial metabolism. In muscle, mitochondrial metabolism plays only a secondary role by supplying energy to the muscle. In other words, mitochondrial metabolism is directly responsible for BAT-based thermogenesis, but only indirectly linked to thermogenesis in skeletal muscle.

Together, these differing thermogenic processes allow your body to maintain a constant core body temperature. As your body adapts to increasingly colder temperatures, several things happen, which together results in an increase in your overall metabolic rate:

Oxygen consumption increases

Fibroblast growth factor 21, IL1α, peptide YY, tumor necrosis factor α and interleukin 6 are induced, and appear to play an important role in coordinating the various physiological adaptations to cold, and in the cross-communication that occurs between BAT and muscle

BAT becomes browner

Enzymatic activity in the mitochondria of your muscle is upregulated

Insulin and leptin are downregulated

The number of mitochondria increases

Health Benefits of Cryotherapy (M)

The fact that cold thermogenesis increases the number of mitochondria and improves their overall function accounts for many of the health benefits associated with cryotherapy. For example, cold thermogenesis has been shown to:[2,3,4]

Strengthen joint tissue

Support weight loss efforts by increasing metabolism

Increase blood circulation	Reduce symptoms of depression and anxiety by at least 50 percent[5]
Speed rate of recovery following joint or muscle injury[6]	Provide temporary relief lasting about 90 minutes from pain associated with arthritis[7]
Reduce pain and swelling following injury	Reduce your risk of developing cognitive decline and dementia by reducing inflammation and oxidative stress[8]
Reduce inflammation	Improve symptoms of eczema[9]
Enhance benefits of physical therapy	Reduce pain associated with migraines when applied to the back of the neck for about 30 minutes[10]
Improve muscle function and strength	Boost mental focus and attention by increasing production of norepinephrine in your brain. Norepinephrine can be increased twofold just by getting into 40 degree F water for 20 seconds, or 57 degree water for a few minutes[11]

In addition to increasing norepinephrine, cold thermogenesis also forces your body to produce cold shock protein, known as the RNA-binding motif 3 or RBM3, in your brain. Interestingly, when you're exposed to cold, you actually degrade synapses (the connections between neurons), but RBM3 completely regenerates them. This has been shown in hibernating animals like bears and squirrels, and research shows that by increasing RBM3, Alzheimer's onset can be significantly delayed — at least in rodents.[12]

Studies have also been done on human cells, showing that RBM3 does get activated when your brain cells are exposed to cold, and that the temperature change needed is only about 1.5 degrees Fahrenheit. More research needs to be done, but preliminary work such as this suggests cold thermogenesis could have a neuroprotective effect.

Common Cryotherapy Methods (M)

There are a number of different cold thermogenesis methods available. Some high-end spas and gyms will have cryotherapy booths, along with saunas. But you can also take advantage of cold thermogenesis at home by:

Applying an ice pack or cold gel pack	Applying an iced towel (simply wet a towel and freeze it) or massaging the area with ice cubes
Taking a cold shower or alternating between cold and hot in your shower	Taking an ice bath
Exercising in cold weather wearing few articles of clothing	Jumping into an unheated pool following sauna or exercise
Bathing in any nature water when temperatures are low	Turning down the thermostat in your house in the winter to about 60 F

Keep in mind that cold thermogenesis treatment should not last for more than a few minutes, to 10 or 20 minutes after you have acclimated, and is contraindicated for pregnant women, young children, those with high blood pressure and/or a heart condition. Cold causes acute vasoconstriction, which can be potentially dangerous if you have high blood pressure or heart failure. A quick cold shower would probably be OK, but avoid ice baths or other extreme cold water immersion techniques.

As a general rule, listen to your body. Individual tolerance for hot and cold temperatures vary widely, and if you push it too far you can do yourself harm. That said, over time you will become acclimated to the cold, which will allow you to withstand colder temperatures for longer periods of time.

Wim Hof, aka "The Iceman," is a perfect example of this. He's exposed himself to cold on a daily basis for decades. As a result, he's now able to withstand the cold for much longer periods than one might consider normal, because his body can generate more heat.

Again, the ability to generate more heat is a direct result of increased BAT and, secondarily, improved thermogenesis in your skeletal muscle. The more mitochondria you have in your fat tissue, the more fat you're able to burn and the more heat your body can generate, which translates into an increased ability to withstand cold for longer periods of time.

One of the simplest ways to improve your BAT metabolism is taking cold showers, which you can do on a daily or near-daily basis. The initial tensing you experience is part of your body's attempts to heat itself back up. Try to suppress this initial instinct and relax instead. Just how long it takes to build up BAT is still unknown, but we do know that BAT is generally a seasonal tissue.

In the winter, your body generates more of it as a way to boost its ability to stay warm. In the summer, you have less. A primary issue is, how often do you activate it? Without environmental stimuli, meaning exposure to various temperature extremes, your body will not create this metabolically or energy-rich tissue since it has no reason to do so. Taking an ice-cold rinse each day, year-round is a simple way to consistently activate your BAT metabolism.

When to Avoid Cryotherapy (M)

There is one important caveat worth mentioning. When you're doing strength training, the oxidative stress generates reactive oxygen species (ROS) that actually help increase muscle mass. If you expose yourself to cold within the first hour after strength training, you suppress that beneficial process, so avoid doing cold immersion (such as a really cold shower or ice bath) immediately after strength training.

On the other hand, spending some time in the sauna after exercise may actually help increase muscle mass. It'll also help with detoxification, allowing you to sweat out toxins that can wreak havoc on mitochondrial function in general. As explained by Rhonda Patrick, Ph.D., in a previous interview:

"This is what's important to understand: Exercise is a stress on the body. You're making ROS. You're generating inflammation. But that's a good thing because it's a short burst, and you want it … There's a one hour timeframe from the time you stop exercising [in which inflammation peaks].

That is the stressful period. But then as soon as an hour hits, the stress response kicks in and you start to have a potent anti-inflammatory [response]. You start having an antioxidant response from activating all these good genes that stay activate for a long time.

What happens is that because the cold also is causing an anti-inflammatory response, it's important that you don't get that anti-inflammatory response too soon, because you need some of that exercise-induced inflammation. You want that inflammation to happen to get the anti-inflammatory response. That's important for the strength training.

The inflammation you generate during the strength training is part of the mechanism for making more proteins in the skeletal muscle. If you blunt that, then you're going to blunt the effects of the strength training. The question is then can you do it an hour or two hours later? Studies have shown, yes, you can do cold exposure, cold water immersion and actually get some performance enhancements even from doing [that]."

Cold Thermogenesis Is a Simple Way to Optimize Your Health (M)

When it comes to improving your health, many of the simplest strategies can have a significant impact. Regularly exposing yourself to cold temperatures can catalyse a wide variety of beneficial changes in your biology that can go a long way toward optimizing your health.

One of the things I do regularly, nearly every day when I am home, is to take a 30-minute 170 degree far-infrared sauna and then jump in an unheated pool and swim five laps. In the summer the water is in the 80s but it can go down to the 40s in the winter. It is absolutely amazing how good you feel after coming out of the pool when it's winter. It's incredibly invigorating.

Regularly exposing yourself to these kinds of extreme temperature variations will help improve your mitochondrial function, which we have now come to realize is a foundational aspect of good health, disease prevention and longevity.

Remember, mitochondria are the energy generators in your cells, and if they are not functioning well, or if damaged ones are not efficiently replaced by new, healthy mitochondria, any number of health problems are sure to ensue. Cryotherapy is one effective form of mitochondrial therapy.

Additions (sections 14 -22) by sauna and preventive health expert Veli-Jussi Jalkanen, Finland

You can find more video and writing from Dr. Rhonda Patrick at her website, FoundMyFitness.com.

- The Tim Ferriss Show, Episode 12: Dr. Rhonda Patrick on Life Extension, Performance, and Much More
- Soylent: What Happened When I Stopped Eating For 2 Weeks
- "Productivity" Tricks for the Neurotic, Manic-Depressive, and Crazy (Like Me)
- How to Cure Anxiety — One Workaholic's Story, Six Techniques That Work
- One Month with No Phone — How to Go Phoneless in a Major US City

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