**Andrew Huberman Lab Podcast #19 Supercharge Exercise Performance & Recovery with Cooling:**

4 Steps for optimal learning -a protocol that leverages adrenaline:

* Be calm and focused while trying to acquire or learn the skill
* Immediately after learning the skill/practicing have an adrenaline spike using cold or breathing techniques
* Have a non-sleep deep rest period for 20min
* Optimize sleep later in that night.

Why temperature is the dominant variable controlling physical performance (endurance and strength, suppleness and flexibility) and recovery:

Preface:

Heat is bad for tissue health because it causes cell death and tissue damage. Getting too hot causes neuron death. Cells contain enzymes (things that end in ‘ase’ like lipase), the enzymes structure is modified when heat is applied and damages the capability and function of the enzymes. This effects cells ability to metabolize fuel and produce neurotransmitters/hormones etc…

The human body has many functions to control temperature homeostasis. Heat shock protiens are created, vasoconstriction happens to draw blood into the core to insulate our key organs when cold. Vasodilation happens when we get hot and blood flows to the periphery of our body, water is drawn out of the blood to cause sweat. Relative humidity and temperature controls the rate of evaporation of sweat off of our skin which in turn effects the rates which we can move heat energy from our body to the surrounding environment.

If a person gets too hot the body’s ability to contract muscles is reduced because the range that ATP function is between 39-40 degC (102.2-104 F) and the rate of synthesis drops off on both sides of that temperature range. If your temperature is outside of this range then your willpower and biological potential to do work is drastically reduced because the muscles ability to contract is handicapped.

Correctly applied cooling has allowed professional and college athletes to increase their # of sets and total work done by 3 times after one week of application of the methods.

The theory:

3 main compartments in the body for regulating temperature:

* Core organs –heart lungs pancreas liver
* Periphery –arms legs feet hands
* Face, Palms of your hands, Bottom of your feet. (MOST IMPORTANT)

The face, palms, and bottom of your feet is composed of glabrous skin which has a special arrangement of vasculature in these portions of our body. Blood moves from arteries to capillaries then to veins, and then the heart. In our hands face and feet we have a special vasculature called AVA’s –noted in the greys anatomy textbook. AVAs are arteriovenous anastomoses which are direct connections from small arteries to small veins and have where the capillaries are bypassed. These short vessel segments have a large inner diameter and have a thick muscular wall. also have input from agernergic neurons that release epinephrine or norepinephrine to control vasodilation and constriction.

Mass flow rate is proportional to the volumetric flow rate over specific volume. And ‘volumetric flow rate’ is proportional to the diameter of the pipe that flow is occurring in. Hence more blood flow = more potential to heat or cool the surrounding area.

Why do we shut down when we get hot:

Universities and DARPA studied people who exert themselves and found that by cooling peoples palms people could double their amount of work done.

Muscle Pyruvate Kinase is an enzyme that is deformed into an inactive state by heat at around a muscle temperature of 104 degF which effects ATP usage in muscle tissues. This is a rate limiting enzyme for metabolic functions that is temperature sensitive. Its function is to limit overexertion on a cellular level to prevent thermogenesis from causing cell death.

The key take away is that a lower temperature allows you to do more work per unit time regardless if you feel overheated or not.

The device (a cold water pipe that people held on to) used to cool the person down in these tests was at a temperature that was cold enough to cool the blood without causing vasoconstriction and the goal was to cool blood down –not muscle tissue- that flows into the core. As vasoconstriction would harm physical performance. In the tests people would use this cooling device between sets of pull ups and after one week found an 80% increase in performance which outpaced steroid usage gains of 1% per week.

Applying cooling to the palms of the hands protects the brain from hyperthermia, nerve death, overheating, coma, and heat stroke death.

The applied methodology during performance:

Best temperature: slightly cooler than resting body temperature before exertion –may need some play in temp to see optimal effect “+/- to taste”

<https://www.rtxcorecontrol.com.au/>, bike handles that cool the hands.

DO NOT cool the core directly with ice packs or ice baths. This is actually detrimental to performance. However, using ice packs on the face or a cool facemask for short durations can improve performance.

Self-directed method: use cool water and dip hands into it for 10-30 seconds.

If you are someone that tends to get cold outside, warming your face is the most effective measure for maintaining core body temperature.

The applied methodology for improved recovery:

Best seen in combat sports with icepacks and towels during time outs. However, the application is usually to the body and back of the neck which is inefficient and causes vasoconstriction. Cold showers and baths also cause vasoconstriction. Vasoconstriction will block inflammation that occurs from exertion. Vasoconstriction also blocks mTOR (mammalian target of rapamycin) which induces hypertrophy and the muscle growth response.

The best practice is to use a cool water towel to absorb heat from the hands and face after training. Or get into a COOL bath –not a cold bath. Cold baths are effective to deliberately increase brown fat thermogenesis and also practice and train mental resilience.

Thermoregulation and Human Performance: Physiological and Biological aspects- F.E Marino

The faster you can cool the body back to its resting temperature –before any exertion- the faster the body will begin recovery and heal the muscles and tendons. This allows a person to maximize the amount of time a person can perform weight training.

Foods that effect physiological performance:

Caffeine/pre-workout increases body temperature and reduces the amount of work you can do. Caffeine for non-caffeine adapted people will have a vasoconstriction effect. While caffeine adapted people will experience vasodilation during usage and vasoconstriction when it wears off. In general no caffeine usage will be ideal however for caffeine addicted people may experience a 3-week adaptation period where one will experience withdraw.

Ephedrine increases core thermogenesis and reduces performance

Alcohol is a vasodilator which cools the body down (could be a good tool to cool down after an exercise)

NSAIDs reduce body temperature –can be a pharmacological tool for endurance athletes to lower body temperature over time. However, water and salt balance are necessary to maintain and NSAIDs have an effect on the liver and kidneys. Therefore, caution is required

Eating does increase thermogenesis however the effects are marginal at best and shouldn’t be considered unless there are extraneous circumstances at play.

Clenbuterol and Epinephrine heat the body up and can cause heat stroke deaths if used to increase physical performance, however they do increase fat loss. But with the usage there is an inherent danger. A note about sports TBIs; hyperthermia and dehydration help contribute to brain injuries as much as physical traumatic injuries.

Losing fat/building muscle – is it worth taking something that energizes you to work out or is it better to perform longer.

Is your performance enhancing dietary choices a hindrance to recovery time and optimization?