Longevity, Aging & Body Health

Huberman Lab Keypoints

Episodes in this pack: 21

How Your Immune System Works & How to Improve It | Dr. Max Krummel

Guest: Max Krummel
Date: 2026-08-03 · Duration: 2:27:41
URL: https://www.youtube.com/watch?v=s_tkMm5U9aY

KEYPOINTS

1. The immune system's core job is telling self from non-self
Krummel retells a 1970s immunologist's analogy. WWII submarines carried two books of engine sounds, one for friendly subs (don't fire) and one for enemy subs. The immune system works the same way, and Krummel says the self/non-self question has turned out far richer than immunologists thought in the 1990s and 2000s. He calls today's view a 'new immunity.' It isn't a single fuel gauge running low for self and high for viruses.

2. Your body becomes a genetic mosaic as you age
Skin cells may pick up roughly 10,000–30,000 DNA mutations per cell per day from basic sun exposure, more than many other organs, which is one reason for sunscreen. Over years, neighboring cells stop being identical. Part of the immune system's role is surveillance: checking that cells are still 'the right thing' and acting when something is out of range, as with emerging cancers.

3. Kids get sick often because everything is new to them
A child's body has never seen flu or most other pathogens, so nearly every virus causes some illness. But young immune systems react strongly and clear infections quickly. Some childhood vaccines aren't given until about six months or later for developmental reasons. In late life, susceptibility rises again.

4. The thymus trains T cells, then shrinks
T cells are named for the thymus, where developing cells with an enormous range of possible receptors, on the order of 10^11, are screened. Cells too reactive to your own tissues, which might attack your pancreas or 'your big toe,' are weeded out to maintain tolerance. With age the thymus involutes and becomes tiny in older people, so it stops putting out new T cells. That's why there's interest in revitalizing it, for example to supply fresh tumor-specific T cells in cancer.

5. Unapproved thymic peptides are hype for now
Huberman notes that some people are already injecting non-FDA-approved thymus-derived peptides and says he doesn't recommend it. Krummel's general warning is that an idea that makes intuitive sense often fails. If an experiment has a 10% chance of working, you need at least ten tries, and probably more, to expect a result. Self-experimenters also generate anecdotes that get mistaken for data.

6. Sleep loss likely hurts immunity partly through 'plumbing'
Bags under the eyes and glassy eyes after poor sleep are well-established lymph-clearance problems that resolve after a night or two of good sleep. Krummel doesn't think lymph alone explains why one bad night makes you catch a cold, though. His speculative model is that cleanup processes, like macrophages clearing debris in the eye, work best when you aren't generating new metabolic 'grime.' It's like washing a windshield when you're not driving into flies.

7. The brain can store and replay immune states
In a mouse study Krummel describes, inflammatory bowel injury was induced with a sugar that damages the gut. Neurons firing in the insular cortex during that period were tagged. Re-activating those neurons after recovery made the gut immune system set itself up again as if newly injured. The implication is that memories, and possibly cues like smells, carry immune states. Krummel says it makes the idea that meditation can shift you toward less inflammatory states 'less and less wacky,' while warning that intuitive stories can mislead.

8. Acute stress helps immunity; chronic stress harms it
Huberman argues, and Krummel agrees, that the immune-enhancing effects of acute cortisol and stress have been overlooked next to the well-known harms of chronically high cortisol.

9. Some autoimmunity may be a trade-off
Genes that make the immune system overactive may persist because they help during pandemics. Huberman raises reports that mild psoriasis, which involves interleukin-17 and responds to anti-IL-17 drugs, may come with better resistance to infection. They present this as an intriguing reason why autoimmunity might be adaptive, not settled fact.

EXAMPLES

1. Jacques Miller's thymus experiment
Children who had the thymus removed during exploratory heart surgery often died later of opportunistic infections. Jacques Miller, then in England, removed the thymus from newborn mice. They grew up okay but succumbed to bacterial infections, and a few developed tumors, a cancer link noted then forgotten. Krummel thinks the discovery deserved a Nobel Prize.

2. Krummel's own vaccine choices
He vaccinated his kids, calling it a reasonable 'no-brainer' after weighing the risks and benefits. He also asked to go off the standard schedule at one point. His reasoning is that schedules are often built on a single study plus convenience, and his mouse work shows slightly different timing can still give the same protection.

3. Why no test predicts checkpoint-drug response
In melanoma, checkpoint drugs cure about 50% of patients, up from essentially zero before. But since nobody can tell in advance who will respond, everyone takes them. A predictive test would cut the drug's market in half, so companies have no incentive to build one.

4. Cord-blood banking: unproven value

Huberman asks whether anyone is alive today because they banked umbilical cord blood. Krummel says he doesn't know. Banked stem cells can in principle rebuild blood after the bone marrow is wiped out by radiation, as works in mice. He suggests thymic-cell banking is also speculative.

5. 'I've already successfully reproduced'

Huberman recalls collaborator David Feldheim, of UC Santa Cruz, handling carbocyanine dyes without gloves years ago. When asked about gloves, Feldheim quipped that he had already reproduced. They use the story to discuss the 'grandparent effect': genes favoring older people may persist because elders help raise and teach the young.

OTHER RELEVANT

1. Prioritize sleep when exposure is high

After one bad night, the coworker coughing across the room is more likely to get you sick. A couple of good nights clears the visible lymph backlog and, by both speakers' experience, restores resilience.

2. Use acute stressors, but avoid chronic stress

Short stress spikes appear immune-boosting, while sustained high cortisol impairs immunity.

3. Be skeptical of immune hacks

Peptides, thymic banking and other self-experiments may work, but most plausible ideas fail. Wait for real data rather than internet anecdotes.

4. Talk with your doctor about vaccine timing

Krummel supports vaccination and notes that schedules have some flexibility. Discuss any change from the standard schedule with your doctor rather than skipping vaccines.

The Best Vitality & Health Protocols | Dr. Rhonda Patrick

Guest: Dr. Rhonda Patrick
Date: 2026-03-23 · Duration: 3:31:07
URL: https://www.youtube.com/watch?v=C0DMdUqF73Q

KEYPOINTS

1. Exercise is non-negotiable hygiene: vigorous cardio plus heavy lifting
Crediting cardiologist Ben Levine with the 'hygiene' idea, Patrick trains 5–6 hours a week. Twice weekly she does 30 minutes of heavy, low-rep lifting (deadlifts, squats, cleans; about 2 minutes' rest) then 30 minutes of intervals, plus two longer HIIT sessions, 4–6 miles of running and family hikes. On busy days she does back-to-back Tabatas or 10 minutes of air squats and jumping jacks. She now works into triples and singles and still dreads them.

2. Vigorous exercise sharpens the brain in the short term
She cites findings that 10 minutes of vigorous exercise improves executive function about 14%, and a study where only HIIT (not walking or easy jogging) raised plasma serotonin, which tracked with better impulse control.

3. Train harder, worry less about protein
Patrick eats about 1.2–1.6 g of protein per kilogram of body weight, averaging around 1.3–1.4, below the popular 1 g per pound. Pushing protein higher added calories and weight for her at 47 and in perimenopause. Her view is that people should be 'more obsessed with training and less obsessed with protein,' because training drives the adaptation and protein complements it.

4. Meals briefly open the gut barrier and let bacterial LPS into the blood
The gut holds about a gram of lipopolysaccharide (LPS) from gram-negative bacteria. Tight junctions open briefly with each meal, and more so with refined sugar plus saturated fat, ultra-processed meals, big meals, or fat without a fiber matrix like butter. In human studies, gut-level doses of LPS raised TNF-alpha by up to about 50% and caused depressive feelings and social withdrawal. Patrick believes this immune activation contributes to post-meal lethargy.

5. How LPS links gut health to heart disease
LPS binds the apoB protein on LDL particles. As these particles shrink into small, dense LDL, the masked apoB can't be cleared by liver receptors, so they lodge in artery walls. Macrophages attack them as if they were bacteria and become foam cells, the start of atherosclerosis. She adds that people who don't respond to SSRIs often have high CRP, which hints at an inflammation-driven subtype of depression.

6. Stop eating three hours before bed
A recent study tracked blood pressure continuously from afternoon through the night. People who stopped eating three hours before bed had deeper nighttime drops in blood pressure and heart rate, which Patrick says translates to roughly 20% lower cardiovascular event risk. Insulin sensitivity is also lowest in the evening because rising melatonin quiets the pancreas, and Courtney Peterson's early time-restricted eating work showed blood pressure drops of about 10 mmHg.

7. Short cortisol spikes are healthy; chronic low-level elevation is the problem
Cortisol, acting through glucocorticoid and mineralocorticoid receptors, regulates about 20% of the genome. Exercise, fasting and probably cold exposure create sharp spikes that switch off. Chronic stress and sleep loss create a 'slow drip' that shifts receptor balance and causes cortisol resistance. Huberman adds that cold exposure lowers cortisol in the data, and that 'women shouldn't train fasted' distorted Stacy Sims's 'do what works for you.'

8. Visceral fat is the dangerous fat, and you can gain it without gaining weight
Waist circumference of 35 inches or more in women and 40 or more in men suggests high visceral fat. About 70% of women and 50% of men over 50 have it, and falling estrogen in perimenopause shifts fat storage toward the abdomen. Visceral fat ignores insulin's signal to stop releasing fatty acids, feeding them straight to the liver and driving insulin resistance. Patrick cites double the risk of early death and 44% higher cancer risk. In one study, five days of 1,200–1,500 extra junk-food calories made young men's brains insulin resistant and added visceral and liver fat without weight gain.

9. Aim for one 'metabolic switch' a day, through fasting or exercise
After about 11–12 hours, liver glycogen runs low and the body shifts to fat and ketones, a concept coined by Mark Mattson. Patrick fasts until about 11 a.m., often training fasted around 8:30, and stops eating around 7 p.m. She values the morning mental clarity and links it to ketones balancing glutamate with GABA. She cites Mattson's recent 5:2 study showing about 20% better cognitive test scores. Weight loss still comes down to calorie deficit, and resistance training protects muscle.

10. Ten minutes of 'exercise snacks' a day add up
In accelerometer studies of short bursts of vigorous everyday activity (VILPA), three 1–3 minute bursts a day, about 9 minutes total, were associated with 40% lower all-cause and cancer mortality and 50% lower cardiovascular mortality, even in people who don't exercise. Ten bodyweight squats every 45 minutes over a 7.5-hour workday controlled glucose better than a 30-minute walk.

EXAMPLES

1. Creatine for muscle and stressed brains
Patrick takes 10 g a day in two morning doses, up from 5 g. She points to a small German MRI study in which brain creatine rose only at about 10 g, and to studies where roughly 0.35 g/kg (about 20–25 g) restored or improved cognition during sleep deprivation and in mild cognitive impairment. She calls this early data, notes diarrhea in some people at high doses, and gives her son 2.5 g a day, citing pediatric safety and agility data.

2. Omega-3, vitamin D and lifting in a Swiss trial

Omega-3 alone slowed epigenetic aging clocks and lowered pre-frailty by about 16%. Combined with vitamin D and resistance training, aging slowed by about 3.8 months and invasive cancer risk fell 66%, though 88% of participants were already active. About 2 g a day of omega-3 usually moves a low omega-3 index to high. Huberman uses prescription Lovaza, and both take about 5,000 IU of vitamin D.

3. COSMOS multivitamin trials

In three large randomized trials, adults 65 and older taking a basic Centrum Silver showed about 2.1 years less global brain aging and 4.9 years less episodic-memory aging. Patrick takes a multivitamin and also uses a glucoraphanin (sulforaphane precursor) supplement backed by 13 studies.

4. Glutamine and NAC for run-down periods

Endurance athletes taking high-dose glutamine (around 30 g) had fewer respiratory infections. Patrick takes 5 g a day, rising to 15–20 g in 5 g doses during exposure, and admits placebo is possible. She'd avoid it with a known colon or liver tumor. She takes NAC only when sick or exposed, and away from workouts, because strong antioxidants like high-dose vitamin E and C can blunt training adaptations.

OTHER RELEVANT

1. Exercise after a bad night, but don't make it a habit

One to three nights of poor sleep can cause short-term insulin resistance. Patrick saw prediabetic glucose readings on a continuous glucose monitor as a new mother, and twice-weekly HIIT largely reversed them.

2. Pick magnesium by goal

Glycinate or bisglycinate, taken a couple of hours before bed, suits sleep. Threonate may cross into the brain better for cognition, but the evidence is mostly animal data and a small study funded by Magtein. Athletes may need up to 20% more magnesium.

3. Be cautious with BPC-157 and NAD boosters

BPC-157 has many animal studies but almost no human data, and its angiogenic effects raise a theoretical cancer concern. Huberman notices faster hair and nail growth on NMN and wonders what else it speeds up. Patrick cites a mouse study in which NMN accelerated pancreatic cancer growth.

4. Reduce microplastic exposure where you can

Washing synthetic clothing is a major microplastic source and dryer vents can blow them indoors; washing-machine filters can trap them. For heat, Patrick usually does a 20-minute sauna at about 180°F or a hot tub, five nights a week.

Restore Youthfulness & Vitality to the Aging Brain & Body | Dr. Tony Wyss-Coray

Guest: Dr. Tony Wyss-Coray
Date: 2026-02-23 · Duration: 1:59:13
URL: https://www.youtube.com/watch?v=Ew0-Lg_Evj0

KEYPOINTS

1. Young blood can rejuvenate old tissues in mice
Wyss-Coray, a Stanford neurology professor, describes parabiosis, in which an old and a young mouse are surgically joined so their blood mixes. His colleague Tom Rando showed that young circulation restored old muscle's ability to regenerate. In their joint brain studies, old mice exposed to young blood reactivated brain stem cells, had less inflammation, showed more neural activity and, most importantly, had better memory.

2. Blood is a window into how old you are
While searching for blood signatures of Alzheimer's disease, his lab found the biggest differences in blood proteins were between young and old people. Labs can now measure about 11,000 proteins in a drop of blood, and some come from specific organs. Joining these protein measurements with large cohorts followed for decades lets researchers build 'clocks' for individual organs.

3. Organs age at different rates, and the gap predicts disease
For most people, organ ages roughly match their actual age. When one organ's estimated age runs ahead of the person's age (an 'age gap'), it strongly predicts disease in that organ. A fast-aging heart predicts heart disease, kidney predicts kidney disease and brain predicts Alzheimer's. He co-founded Vero Biosciences to offer this kind of profiling, combined with clinical and wearable data, so that fast-aging organs can be caught early.

4. Old blood both adds harmful factors and loses helpful ones
With age, inflammatory proteins rise. Knocking them out or neutralizing them improved cognition in old mice. Young blood also supplies pro-growth factors, such as GDF11, IGF-1 and Klotho, that help maintain stem cells. The challenge is finding the smallest set of factors that matters; Wyss-Coray thinks a drug might emerge in 5–10 years.

5. Exercise benefits travel through the blood
Blood from exercised young mice improved the brains of sedentary mice. His former trainee Saul Villeda found that exercised blood had an even stronger effect in old mice. Both labs traced part of the effect to factors released by the liver. Wyss-Coray's lab identified clusterin (apolipoprotein J), a complement-pathway protein, and found that injecting a synthetic version mimicked some of the benefits.

6. Plasma-based treatments look promising but aren't proven
His company Alkahest showed that young human blood had similar effects in mice, then worked with plasma maker Grifols to test fractions of pooled donor plasma in small Alzheimer's and Parkinson's trials, with promising results. A blinded, placebo-controlled Grifols trial in about 500 Alzheimer's patients that removed their plasma and replaced it with albumin showed significant benefits. A large definitive trial is still needed for FDA approval.

7. No supplement has been shown to extend human lifespan
Asked about NAD boosters like NMN, Wyss-Coray says no intervention has been validated to extend human lifespan; only exercise and diet have proven benefits. NMN supplements do raise blood levels. A Singapore researcher testing 10 NMN products found many didn't contain what the label said. Huberman takes NMN for a perceived energy boost but doesn't expect it to lengthen his life.

8. Fasting evidence in humans is weak
Calorie restriction extends life in worms and mice, partly by lowering inflammation and oxidative damage and improving energy use and cellular cleanup. But there's no agreed definition of intermittent fasting, the field is 'a mess,' some monkey studies suggest harm (such as worse kidney function), and no clinical study shows a clear benefit in humans.

EXAMPLES

1. Young spinal fluid boosted old brains
A fellow in his lab infused cerebrospinal fluid from young mice into old mice over a month. Their brains regenerated and cognition improved, and oligodendrocytes, the cells that insulate neural wiring, responded most strongly.

2. A spinal fluid ratio predicts cognitive resilience
In spinal fluid from about 3,000 people, the proteins most linked to cognition were mostly synaptic. A ratio of the top rising and top falling protein strongly separated people likely to stay sharp from those likely to decline. The ratio worsens steadily from early adulthood, independent of Alzheimer's pathology.

3. Unregulated stem cell injections can be dangerous
Huberman recounts a doctor who received stem cells injected into a spinal disc at a clinic in Mexico and developed an egg-sized infection that left him paralyzed. Wyss-Coray adds that PRP (platelet-rich plasma) concentrates wound-healing growth factors from your own blood, while exosomes are still mainly a research and diagnostic tool.

4. Growth hormone trades vitality for longevity
Hormones like growth hormone can make people feel and look younger. In general, though, higher growth hormone and IGF-1 are linked to a shorter life, a trade-off each person has to weigh.

OTHER RELEVANT

1. Lifestyle still carries the most weight

Smoking, excessive alcohol, low education, childhood obesity and poverty all raise dementia risk, and addressing them sharply lowers it. Wyss-Coray avoids drinking hot liquids from plastic. Centenarians are almost always socially connected, which may explain much of wine's reputation. Huberman's view is that zero alcohol is best, with two drinks a week as an upper limit.

2. Choose exercise you enjoy

Huberman describes a study in which a mouse forced to run whenever a partner ran developed higher blood pressure, stress markers and memory deficits, while the voluntary runner benefited. Sunlight is also linked to longer life in a large Swedish study, though outdoor activity is a confounder.

3. Aging speeds up in bursts

Aging is not linear. The conversation covers phases when it speeds up, including puberty (the fastest change of a lifetime, often within about two years), the early 40s and the early 60s, after which it slows again. That makes these periods worth watching with organ-age tracking.

4. Breathing, circulation and the aging brain

Huberman notes that practices like qigong and tai chi combine deliberate breathing with movement to improve circulation. He also points to limited data showing that people tend to become mouth breathers as their cognition declines. Whether that is a cause or a symptom is unknown.

How A Doctor Cured His Own Terminal Disease | Dr. David Fajgenbaum

Guest: Dr. David Fajgenbaum
Date: 2025-11-03 · Duration: 1:58:54
URL: https://www.youtube.com/watch?v=PCbD3hFyfCk

KEYPOINTS

1. Many treatments may already be sitting on pharmacy shelves
Dr. David Fajgenbaum, a physician at the University of Pennsylvania and co-founder of the nonprofit Every Cure, notes there are about 4,000 FDA-approved drugs for roughly 4,000 diseases, while about 14,000 diseases have no approved treatment. Since a typical small-molecule drug binds 20 to 30 different proteins, many drugs likely have uses beyond their label. The system, he says, is not set up to find new uses for old medicines.

2. Generic drugs lose their champions
About 80% of approved drugs are generic. Once a patent expires, many manufacturers sell the same drug for pennies, so no one funds trials, pushes new uses into guidelines or educates doctors. Companies near a patent cliff usually tweak dose or formulation for the same disease rather than pursue a new one. Fajgenbaum stresses this is not a conspiracy; the incentives simply are not there.

3. Cheap drugs with striking new evidence
Aspirin has been shown to reduce colon cancer recurrence, particularly in tumors with a mutation in the mTOR pathway, yet many eligible patients do not take it. A trial in India of about 1,600 women with localized breast cancer, published in the Journal of Clinical Oncology, found lidocaine injected around the tumor shortly before surgery was associated with 29% lower five-year mortality. Every Cure is still reviewing the mechanism and evidence before advocating for it.

4. The same mechanism can harm and heal
Thalidomide caused devastating birth defects by blocking blood vessel growth. That same anti-angiogenic effect later earned approval for leprosy and multiple myeloma, saving thousands of lives. Sildenafil (Viagra) went from heart disease to erectile dysfunction to a rare pediatric lung disease. Colchicine, an ancient gout remedy, won approval at an adjusted dose to reduce heart attack risk in people who had already had one, particularly those with diabetes.

5. Knowledge exists somewhere but fails to spread
In DADA2, a genetic condition causing dozens of strokes from birth, a doctor around 20 years ago tried a leftover TNF inhibitor in one child and the strokes stopped. The finding spread slowly for about a decade until Chip Chambers, a physician whose two children were born with DADA2, helped gather data and guidelines. Fajgenbaum calls it a travesty: someone knew, but the world did not.

6. How to advocate for yourself with a serious illness
First, connect with the disease organization for your condition, such as the ALS Association or the Michael J. Fox Foundation, which often hear what is being tried worldwide. Second, find the world's leading expert and travel to them if you can. Third, keep asking questions, including whether anything else is being used elsewhere. Doctors read the literature in piecemeal ways and cannot keep up with millions of papers.

7. He found his own treatment through repurposing
As a third-year medical student, Fajgenbaum developed idiopathic multicentric Castleman disease, a cytokine storm that shut down his liver, kidneys and bone marrow. He nearly died five times. Seven-drug chemotherapy repeatedly saved him but did not hold. Testing his own blood and lymph node tissue, he found the mTOR pathway in overdrive and proposed sirolimus (rapamycin), a transplant drug never used for Castleman. He has been in remission for nearly 12 years.

8. Breadcrumbs in published research can save lives
In 2016 a man with metastatic angiosarcoma had been told he was out of options. A PubMed search turned up a 2013 paper showing four of five tumors expressed PD-L1. Treated with a PD-1 inhibitor, he has been in remission for nine years; the approach now helps about 18% of patients with a cancer once fatal within a year.

9. Every Cure uses AI to rank drug-disease matches
His lab's work has found 14 drugs for diseases they were not designed for. Every Cure scans all drugs against all diseases. Its top-ranked option for Castleman, the TNF inhibitor adalimumab, helped a patient who had failed other treatments; the case was published in the New England Journal of Medicine. A physician and patient must still make each treatment decision.

EXAMPLES

1. Tocilizumab's long road
Kazuyoshi Yoshizaki developed tocilizumab for Castleman disease in Japan, reportedly receiving the first dose himself. It was later approved in the US for rheumatoid arthritis, yet Fajgenbaum's doctors did not think to try it. It works in about a third of patients and did not work for him.

2. More Castleman patients helped
Sirolimus helped other patients, including a boy named Joey, now in college at Temple. A girl named Kayla who did not respond to sirolimus improved on ruxolitinib, a myelofibrosis drug, and is now studying nursing at Marquette.

3. POEMS syndrome
A man about to be taken off life support was treated with three multiple myeloma drugs, based on the close similarity between the conditions. He has been in remission more than a year and a half.

4. DFMO for Bachmann-Bupp syndrome
Children with this rare syndrome have excess ODC1 activity and are often tube-fed and bed-bound. DFMO, developed for

African sleeping sickness, binds the enzyme; started early, some children come off feeding tubes and can sit up.

OTHER RELEVANT

1. Sleep loss and the immune system

Fajgenbaum cites a mouse study in which severe sleep deprivation killed animals through a cytokine storm involving interleukin-6, and blocking cytokines extended survival. In people with autoimmune disease, stress is strongly linked to flares.

2. Be skeptical of rapamycin for longevity

He takes a transplant-level dose for his disease but says lifespan gains in caged lab animals may not translate to people exposed to pathogens, given the drug's potent immunosuppression.

3. Hope, action, impact

Taking action creates impact, which fuels hope and more action. Huberman links this to Josef Parvizi's finding that stimulating the anterior midcingulate cortex makes patients want to lean into a challenge.

4. Preventive uses need rigor too

On GLP-1 drugs and emerging links to Parkinson's, Alzheimer's and breast cancer risk, and on nicotine or lithium for brain health, Fajgenbaum urges caution: individual anecdotes cannot show cause.

Improve Your Lymphatic System for Overall Health & Appearance

Date: 2025-10-27 · Duration: 1:39:47
URL: https://www.youtube.com/watch?v=KBkl3I645c8

KEYPOINTS

1. The lymphatic system is the body's second circulation and waste-removal route
Blood delivers oxygen and nutrients, but some fluid leaks into the interstitial space between cells along with waste such as proteins, ammonia and carbon dioxide. Lymphatic vessels collect roughly 3–4 liters of this excess fluid and return it to the blood. Huberman opens with three conclusions: the system is essential to short- and long-term health, it's under-appreciated next to the heart, brain and microbiome, and it gets a 'woo' reputation from practices like rebounding that actually have a sound basis.

2. Lymph drains back into the blood near the collarbones
Superficial lymphatic capillaries sit just under the skin. Deeper vessels run with the fascia around muscles, so ordinary movement like walking pushes lymph upward against gravity. The fluid eventually re-enters the venous blood through two ducts, the right lymphatic duct and the thoracic duct, near where the neck meets the chest. That's why so many drainage protocols focus on the clavicle region.

3. Lymph nodes are immune checkpoints, so don't squeeze them
Nodes under the jaw, in the armpits and in the groin are where T cells, B cells and other white blood cells inspect lymph for bacteria and viruses. Swollen or sore nodes, when not explained by a hard workout or short sleep, can mean you're fighting something or about to get sick. A sore node in one armpit doesn't necessarily mean a problem in that arm. Massage professionals told Huberman that pressing directly on nodes is generally a bad idea, since lymph needs time there to be surveilled.

4. Diaphragmatic breathing pumps lymph
Belly breathing, where the diaphragm descends and the belly moves out, creates pressure changes that move lymph from vessels back into the blood. Huberman suggests two or three deep belly breaths on waking, again in the afternoon or evening, and whenever you remember. This is especially useful when stuck at a desk or on a plane, where the usual muscle-pump effect is missing.

5. Bouncing, treading water and swimming work, for mechanical reasons
Huberman jumps on a small trampoline in the mornings. Jumping might seem to push fluid downward, but he compares it to tamping down a slurpee: clearing space in vessels lets fluid from elsewhere move in. Swimming and treading water are among the best options because water creates a rippling shear along the skin that squeezes the superficial lymph capillaries.

6. Lymphedema ranges from invisible to permanent
Lymphedema is common after cancer treatment, when lymph nodes are removed or destroyed to limit metastasis. It's staged one to four. Stage 1 has abnormal flow without visible swelling. In stage 2, swelling such as puffy ankles resolves after 20–30 minutes with the legs elevated. Stages 3 and 4 involve more permanent buildup. For milder leg heaviness or soreness, light swimming, treading water, walking, leg elevation or pneumatic compression boots help move fluid.

7. The brain has a glymphatic system that runs mainly during sleep
Until 2012, scientists believed the brain lacked lymphatic clearance. Then Maiken Nedergaard, who studies glial cells, showed that during sleep the perivascular spaces around brain blood vessels expand by about 60%, letting cerebrospinal fluid flush waste away. Poor glymphatic clearance helps explain brain fog and morning facial puffiness. Huberman cites a mouse study of Alzheimer's disease in which aerobic exercise improved lymphatic clearance of amyloid beta.

8. Side sleeping and slight elevation may aid nighttime clearance
All mammals put their heads down to sleep. Though systematic human studies are limited, side sleeping appears best for lymphatic drainage, and left versus right doesn't seem to matter. Some sleep studies have people wear a pack on their back to prevent rolling over. Huberman also suggests elevating the feet about 5–10 degrees with a pillow, using a pillow that keeps the head from tilting down, and keeping the room cool. He has started making an effort to sleep on his side himself.

9. Cardio grows lymphatic vessels in the heart
Heart cells work constantly and generate a lot of waste, and clearance declines with age. Cardiovascular exercise drives lymphangiogenesis, the growth of new lymphatic vessels serving the heart. Huberman calls this a major reason aerobic exercise supports heart and brain health and longevity.

EXAMPLES

1. The scientist who was dismissed
Before 2012, a researcher saw injected dye travel along brain perivascular spaces. Two larger, famous groups failed to replicate her finding because they left a hole in the skull while imaging, which released the pressure lymph needs to move. She left the field, later funded work at the NIH that helped confirm brain lymphatics, and illustrates Huberman's point that a failure to observe something doesn't prove it isn't there.

2. Puffiness after deep-tissue massage
Deep-tissue massage can push lymph through the nodes earlier than normal and trigger a minor inflammatory response, which shows up as facial puffiness. It usually resolves within a couple of hours of walking around.

3. Fascial and lymphatic face massage
Huberman points to Instagram creator Anastasia Beauty Fascia (no financial ties) for non-surgical face routines, with striking before-and-after photos over 2–60 days. He says the order and pressure matter because the lymph capillaries around the

eyes are tiny and easy to pinch shut. Dermatologists told him under-eye patches likely work simply by applying gentle pressure that moves lymph out of the area; the added peptides and collagen are unnecessary.

4. Morning face versus a few hours later

Many people wake with bags under their eyes and look older, then look fresh a couple of hours later without any cosmetics. Huberman attributes this to lymph and glymphatic fluid clearing once they're upright and moving, and notes it's worse after poor sleep.

OTHER RELEVANT

1. Daily lymph routine

Move throughout the day, take a few deep belly breaths several times a day, and add rebounding, swimming or treading water when possible. Get regular cardio, timed early enough not to disrupt sleep.

2. Hydrate

Lymph is fluid-based, which gives another reason to stay well hydrated alongside regular cardio and resistance training.

3. Use long-wavelength light

Red, near-infrared and infrared light (roughly 620–1,000 nm, with devices usually 620–850 nm), or low-angle sunlight near sunrise or sunset, appears to improve mitochondrial function, blood flow and lymphatic function in skin. Studies show reduced inflammation and acne, better wound healing, and reduced lymphedema in breast-cancer patients.

4. Protect sleep for brain clearance

Everything that improves sleep also improves glymphatic clearance. Try side sleeping, slightly elevated feet and a cool room.

Transform Your Metabolic Health & Longevity by Knowing Your Unique Biology | Dr. Michael Snyder

Guest: Dr. Michael Snyder
Date: 2025-09-08 · Duration: 2:45:05
URL: https://www.youtube.com/watch?v=cjAvD-U5so0

KEYPOINTS

1. A healthy glucose response is a brief, modest spike
Snyder, a Stanford geneticist, says a normal post-meal spike returns to baseline within about 30–60 minutes. Fasting glucose for most people is around 90. 'Time in range' is a simple target: 70–140 mg/dL for healthy people, 70–180 for diabetics. It correlates strongly with hemoglobin A1c (6.5% or higher is diabetes, 5.7–6.4% is prediabetes), but a CGM shows what's happening in real time.

2. Many 'normal' people spike like diabetics
When Snyder's lab put CGMs on normal, prediabetic and diabetic people, they defined 'glucotypes'. Some people with no diagnosis spiked as badly as diabetics and had no idea. Glycemic response is also more personal than the glycemic index suggests: most people spike to white rice, but individual responses to specific foods vary a lot.

3. Type 2 diabetes is several different problems
Snyder's lab subdivides glucose dysregulation into muscle insulin resistance, liver insulin resistance, beta-cell defects (making insulin but not releasing it from the pancreas) and incretin defects. Muscle-resistant people spike to potatoes and pasta, while insulin-sensitive people don't. People with beta-cell defects also spike to potatoes. The shape of a glucose curve from an over-the-counter CGM can already predict muscle insulin resistance fairly accurately.

4. Your subtype determines what works
Snyder himself has a beta-cell defect. He switched from running to weight training about nine years ago and gained 10 lb of muscle, verified by about 20 whole-body MRIs, yet his glucose control didn't improve, because muscle wasn't his problem. He didn't respond to metformin. For muscle-resistant people, building muscle and training in the morning appear to give better glucose benefits, though exercise at any time beats none.

5. GLP-1 drugs worked dramatically for him, with trade-offs
Snyder's A1c was 8.4%. A lower-dose GLP-1 drug brought it to about 6.4–6.5%, and after he switched to Mounjaro because of modest nausea, it fell to 5.7%. His fat 'evaporated' and mild fatty liver disappeared. He lifts every day, alternating light, heavy and skill days, but still lost some muscle and strength after an injury. He felt gaunt, so he now doses less often than weekly on the lowest dose. He notes that some people use low doses from compounding pharmacies, which the pharmaceutical companies dislike.

6. Visceral fat stresses organs, especially beta cells
Snyder isn't an expert here, but he says fat around organs, such as fatty liver, clearly isn't good. He thinks the pancreas, and beta cells in particular, may be especially sensitive to that fat-related stress.

7. Fiber effects are personal
In an 18-person crossover study, people took 10, then 20, then 30 g per day of arabinoxylan (the fiber family found in psyllium/Metamucil-type products) or inulin, with washouts in between. On average, arabinoxylan lowered LDL cholesterol by about 25%, but some people saw no change even at 30 g, while inulin lowered theirs. Neither fiber affected glucose. Recommended intake is at least 25 g a day for women and 35 g for men, but people typically get 12–15 g.

8. Organs age at different rates: 'ageotypes'
After following about 109 people for more than 12 years with deep blood profiling, Snyder's group sees distinct aging patterns: cardio, metabolic, liver, kidney, immune, or several at once. Like a car where certain parts wear first, these patterns can be acted on. People who lost weight or exercised improved their metabolic ageotype. A company he helped commercialize, Iolo, profiles 650 metabolites from a mailed drop of blood. He notes that 95% of users improved their markers, which isn't the same as getting younger.

9. A whole-body MRI baseline helps when you track change over time
High-resolution scans almost always find nodules, which is why many doctors discourage them. Snyder argues the question is whether nodules grow, and you can't know without a baseline. None of his nine nodules are growing. His group has caught early problems from shifts in an individual's own values, such as liver enzymes, that standard ranges would miss.

EXAMPLES

1. Soleus 'push-ups'
Huberman describes a University of Houston study in which seated heel raises work the soleus. Although it is only about 1% of body muscle, it acts as a strong glucose sponge. Snyder prefers a brisk 20-minute walk after meals, which visibly blunts a rice spike, and uses 'exercise snacks' such as air squats when sitting a lot.

2. A viral illness that preceded his diabetes
Snyder developed a very high fever and became diabetic several weeks later. Because of his own profiling, his team saw DNA methylation shift at about 100 metabolic gene promoters, an example of environment reshaping gene regulation.

3. Immersive events and inflammation
In pilot studies with collaborator George Slavich, attendees at Byron Katie and Tony Robbins events were sampled before, right after and months later. Their mental-health questionnaire scores improved by the field's standards, and early unpublished omics data suggest lower inflammatory markers. The results are preliminary.

4. Berberine 'cheat days'

Huberman recalls that berberine, which he calls a 'poor man's metformin', let him eat a box of donuts without feeling the glucose crash. He flags that as a reason for caution rather than a strategy.

OTHER RELEVANT

1. Walk after meals, especially dinner

People who leave about three hours between dinner and bed, and who walk after dinner, have lower glucose the next day. Going to bed with a high glucose spike correlates with poor sleep. Consistent sleep timing also helps.

2. Find your own responses

An over-the-counter CGM worn for a couple of weeks with food logging shows which foods spike you. Snyder suggests self-experiments such as adding one pure fiber source for a few weeks and checking LDL, ApoB and CGM data before and after.

3. Long exhales during the day

Snyder suggests periodically emptying your lungs with long exhales, as free divers do, throughout the day rather than setting aside time for formal breathwork, to slow heart rate and support HRV.

Improving Science & Restoring Trust in Public Health | Dr. Jay Bhattacharya

Guest: Dr. Jay Bhattacharya
Date: 2025-06-09 · Duration: 4:26:33
URL: https://www.youtube.com/watch?v=2Y_PxTxLFVg

KEYPOINTS

1. Bhattacharya frames the NIH's mission around results for real people
Bhattacharya, the NIH director and a Stanford health economist, describes the stated mission as supporting research that advances the health and longevity of the American people. NIH work underlies almost every drug Americans take. But he says US life expectancy was almost flat from 2012 to 2019 while Europe's rose, and it only recently returned to 2019 levels, so the investment isn't translating into longer lives.

2. We have a 'sick care' system rather than a health system
The hoped-for 'compression of morbidity', where people live long and are seriously ill only briefly at the end, hasn't happened. Advances instead let people stay sick longer with dementia, diabetes complications, kidney failure and heart disease. Bhattacharya says basic science matters but must eventually translate into better health, and he links this to the Make America Healthy Again push to meet the country's chronic-disease needs.

3. Indirect costs concentrate funding in a few universities
On top of each grant, universities receive overhead: about 55% at Stanford, so a $1 million grant costs taxpayers roughly $1.55 million. Some institutions charge up to about 75%, while the Gates Foundation pays around 15%. Infrastructure attracts grant-winners and grant-winners fund infrastructure, a ratchet that favors coastal elite schools. He also questions why a computer-based epidemiology lab gets the same rate as a wet lab. He wouldn't comment on the litigation that blocked a proposed 15% cap.

4. Taxpayers fund research, then pay again for the results
Huberman notes the public pays for research yet had to buy journal articles (around $34 each). Under a policy begun by former director Monica Bertagnolli and moved up under Bhattacharya, NIH-funded papers must be free to read immediately on publication.

5. Americans pay 2–10 times more for the same drugs
Often the same drugs come from the same factories as Europe's. Bhattacharya argues US taxpayers fund most basic research through the NIH and, through higher prices, the expensive late-stage trials, making them 'the piggy bank for the world'. He says a recent executive order aims to equalize prices through trade negotiations, tariff linkage and drug reimportation, so other wealthy countries share research costs.

6. Young scientists get funding too late, which slows innovation
The typical age for a first major R01 grant rose from the mid-30s in the 1980s to the mid-40s. His research found that scientists use the newest ideas just after their PhD, and the ideas they work on age by roughly a year with each year of their career. Huberman describes the 'shell game' of proposing work that's already done. Bhattacharya calls funding early-career labs a major priority.

7. Bhattacharya wants replication rewarded, not buried
He cites John Ioannidis's 2005 paper 'Why Most Published Research Findings Are False': peer review doesn't rerun experiments, statistical significance allows false positives, and negative results go unrewarded. Drug companies replicate findings privately. He plans large NIH grants for replication and meta-analysis and an NIH journal for replication results, like a Cochrane-style 'community notes' for the scientific literature.

8. Bhattacharya says COVID lockdowns and school closures were known mistakes at the time
Sweden kept schools open for under-16s and, comparing with Finland in summer 2020, found no difference in COVID outcomes, with teachers no worse off. He says Sweden ended up with Europe's lowest all-cause excess deaths, while heavily locked-down Peru fared badly, so lockdowns were neither necessary nor sufficient and they harmed poor and working-class people and children. Many American children fell two or more years behind in school.

9. Bhattacharya says cloth-mask messaging wasn't based on evidence
A Cochrane review of about a dozen pre-pandemic flu trials found weak evidence for community masking, and no randomized trial studied children. Yet the US recommended masks from age two, while much of Europe started around age 12. He argues false reassurance may have led vulnerable older people to take risks, and that messaging like 'mask on to walk in, off to eat' eroded trust.

10. Bhattacharya says most vaccines save lives but the COVID vaccine wasn't net beneficial for everyone
He says many vaccines, including childhood ones, save lives. But he believes the COVID vaccine was likely net harmful for some groups, especially healthy boys and young men (very roughly 12–30), while declining to set a firm cutoff. The pivotal mRNA trials followed people for only about two months, measured symptomatic infection rather than death or transmission, and underrepresented older people. He considers long COVID and vaccine injuries both real.

EXAMPLES

1. Ben Barres on career timing
Huberman recalls his late postdoc adviser at Stanford saying the critical work is done early and 'nobody does anything after they get full professor', which supports Bhattacharya's finding that new ideas peak early in a career.

2. Linda Buck's retractions
Huberman praises the Nobel laureate for retracting three papers when a postdoc's data proved wrong, which didn't hurt her

career. Bhattacharya contrasts this with Alzheimer's research built on manipulated data that no one went back to check. He argues fraud is a symptom of incentives that make admitting error career-ending, rather than the main driver of the replication crisis.

3. The Great Barrington Declaration fallout

After he co-wrote the Declaration in October 2020 with Sunetra Gupta (Oxford) and Martin Kulldorff (Harvard), about 100 colleagues signed a petition asking Stanford's president to silence him. He says the medical school dean asked him to stop doing press, and the Twitter Files later showed he'd been placed on a trends blacklist.

4. Vaccines and autism

He calls the Wakefield data contaminated and cites a large Danish study that found no link between the MMR vaccine and autism. He thinks vaccines are unlikely to explain rising autism rates, but notes less research on other vaccines. He has launched a wide-ranging NIH initiative on autism's causes, looking at environmental chemicals, in-utero events, nutrition and more.

OTHER RELEVANT

1. Read health headlines with replication in mind

A single peer-reviewed study isn't proof. Bhattacharya stresses checking whether independent groups have reproduced a finding and paying attention to negative results.

2. Judge trials by what they actually measured

His critique of the COVID vaccine trials is a reminder to check how long a trial followed people, which outcomes it measured, and whether the people most at risk were well represented.

3. Bhattacharya says disagreement makes public health stronger

He argues that enforced uniform messaging and censorship backfired. Real debate among scientists, and acknowledging past mistakes, are what he believes will restore public trust.

Behaviors That Alter Your Genes to Improve Your Health & Performance | Dr. Melissa Ilardo

Guest: Dr. Melissa Ilardo
Date: 2025-05-26 · Duration: 1:52:10
URL: https://www.youtube.com/watch?v=ijdpvG24IkE

KEYPOINTS

1. Gene expression responds to behavior and environment on several timescales
Ilardo, a geneticist at the University of Utah, describes changes that happen within minutes or hours as genes respond to stimuli, and slower epigenetic marks (molecules attached to the genome) that can be passed to children. She cites refugee populations carrying inherited marks from events their children never experienced, and famine signatures in Dutch populations. Those marks may help survival during scarcity but could be maladaptive once food is abundant.

2. Natural selection moves fastest when useful variation is already present
Most new mutations are harmful, and many produce non-viable embryos that are never seen. Waiting for a brand-new beneficial mutation can take a very long time. Rapid human adaptation usually draws on 'standing variation': differences that sit quietly until a group moves into a new environment or takes up a new behavior, such as breath-hold diving.

3. Some of the biggest human adaptations came from mixing with other groups
The Tibetan high-altitude adaptation is thought to come from interbreeding with Denisovans more than 10,000 years ago. The variant only became strongly advantageous once Tibetan ancestors moved to very high altitudes. Ilardo argues that today's globalized mixing creates gene combinations never seen before, bringing both new resilience and new disease risks. In her view humans have not stopped evolving.

4. Smell may track immune-gene differences in potential mates
In the sweaty T-shirt studies discussed, people rated the scent of opposite-sex strangers. They preferred the odor of people whose major histocompatibility complex (immune) genes were most different from their own. The proposed logic is offspring with a broader immune repertoire. Huberman notes these are not pheromone effects. The same logic explains why nature penalizes inbreeding: close relatives are more likely to share harmful recessive variants.

5. The mammalian dive reflex is triggered by breath holding with a cold face
Holding your breath with your face in cold water makes your heart rate slow and blood vessels in the limbs constrict, keeping oxygenated blood central for the brain. The spleen also contracts. Lab protocols use water at about 10 °C (50 °F) for as long as the breath hold lasts. Vagal nerve stimulation through the face appears important, though breath holding alone contributes. The reflex exists across mammals, including trained diving mice.

6. Splenic contraction releases stored red blood cells and gives about a 10% oxygen boost
The spleen acts as a reservoir of oxygen-carrying red cells, sometimes called a 'biological scuba tank'. Ilardo puts the boost at around 10% in most people. However, the spleen takes those cells back after the breath hold ends, so the boost is temporary. Spleens also contract somewhat during exercise, which may be why horses and greyhounds have large spleens.

7. The Bajau sea nomads have spleens about 50% larger than nearby farmers
Ilardo compared the Bajau of Indonesia with a nearby coastal population that farms and often cannot swim. Bajau spleens were roughly 50% larger on average, and this held for non-divers as well as divers. That points to genetics rather than training. Whether diving itself enlarges the spleen remains open: trained volunteers in other studies did show larger spleens.

8. A selected variant links higher thyroid hormone to bigger spleens and more red cells
The gene evolving in the Bajau correlates with higher-than-average (not clinically hyperthyroid) thyroid hormone levels. Europeans carrying the same variant also had higher thyroid levels and larger spleens. In mice carrying the change, spleens were larger but less dense, with higher hemoglobin, hematocrit and red cell counts. EPO levels did not change, which makes this an EPO-independent route to more red blood cells.

9. Korea's Haenyeo divers show one trained adaptation and one genetic adaptation
These all-female divers on Jeju Island have an average age of about 70 and dived in cotton suits until the 1980s, often through pregnancy. Trained divers showed an exaggerated slowing of heart rate on diving, which non-divers with the same genetics lacked. One diver dropped more than 40 beats per minute in under 15 seconds. Separately, a genetic variant lowered their diastolic blood pressure during dives.

10. Gene editing of embryos is still a blunt and ethically unresolved tool
Discussing the Chinese researcher who used CRISPR to edit babies' genomes, Ilardo notes off-target edits as a key technical problem, though the field is improving quickly. The harder question is where correction ends and enhancement begins. Some traits labeled defects are simply human variation to others, and it is unclear who would decide.

EXAMPLES

1. Blue eyes trace back to a single ancestor
Ilardo says everyone with blue eyes descends from one person in whom the change first arose. Brown was likely the original human eye color, and green arose separately in multiple people. Light eyes also tend to darken over a lifetime with UV exposure.

2. A reported 13-minute Bajau breath hold
Ilardo stresses she was told this figure by a diver's father and did not record it. Bajau divers hunt actively on the seafloor with spear guns, often below 100 feet; black coral jewelry worn as protection only grows from about that depth. Many Bajau children learn to swim before they walk.

3. Moken children see better underwater

A researcher found Moken children outperformed European children at underwater vision, largely by constricting their pupils. European children could later be trained to match them. Ilardo calls it a fallacy to conclude no genetic advantage exists just because others can be trained to the same level.

4. Haenyeo diving through pregnancy as a selection pressure

Pregnant women with sleep apnea are prone to hypertensive disorders such as preeclampsia, historically often fatal to mother and fetus. Ilardo hypothesizes, without direct proof yet, that diving apnea through pregnancy poses similar risks. That pressure, which can affect two generations at once, may explain the protective blood-pressure variant.

5. Retired Haenyeo who were over 100

A colleague at Seoul National University looking for retired Haenyeo could only find women over 100, because they rarely stop diving. Both Huberman and Ilardo caution that this is anecdote: there is no direct evidence that cold water or the dive reflex extends lifespan.

OTHER RELEVANT

1. Never practice breath holds in or near water alone

Huberman and Ilardo warn that free divers can push past the gasp reflex and then black out with no warning. Without someone to pull them up, they die. Anyone interested in free diving should learn from qualified experts under proper supervision.

2. A face-in-cold-water breath hold triggers the dive reflex at home

The lab version uses water at about 10 °C (50 °F) with a breath hold. Huberman speculates about using it for performance or immune benefits. Ilardo says no studies yet test immune effects, and the oxygen boost fades once breathing resumes.

3. Take sleep apnea seriously, especially in pregnancy

Apnea causes low blood oxygen, and in pregnancy it is linked to hypertensive disorders. Ilardo hopes that studying the Haenyeo's protective mechanism could one day lead to treatments for preeclampsia.

4. Being trainable does not mean a trait has no genetic component

Whether the subject is Kenyan marathoners, Moken vision or Bajau spleens, Ilardo argues that inherited advantages plus training can produce exceptional performers. Her caution runs in both directions: genes are not destiny, but neither is training everything.

How to Improve Your Vitality & Heal From Disease | Dr. Mark Hyman

Guest: Dr. Mark Hyman
Date: 2025-04-14 · Duration: 2:42:21
URL: https://www.youtube.com/watch?v=UyneMnERmnI

KEYPOINTS

1. Functional medicine treats the body as one network
Hyman describes functional medicine as a systems "operating system" for biology, not just lab tests or supplements. Rather than seeking one diagnosis and dismissing symptoms that don't fit (migraines to neurology, irritable bowel to the GI doctor, a rash to dermatology), it looks at how gut, hormones, mitochondria, inflammation, insulin resistance and toxins interact. His summary: remove the impediments to health, add the ingredients, and let the body's innate healing system work.

2. His own illness shaped the approach
At 36, after a year working as a doctor in Beijing when homes were heated with raw coal, Hyman developed severe mercury toxicity. He went from cycling 100 miles a day to brain fog, chronic diarrhea, rashes, autoimmune problems, and adrenal, thyroid and mitochondrial dysfunction. Doctors offered antidepressants. Guided by Jeff Bland's systems view, he says he reverse-engineered his recovery system by system, then saw patients improve within weeks on simple diet changes while medical director at Canyon Ranch.

3. Core supplements for most people
Citing national NHANES survey data, Hyman says over 90% of Americans are low in omega-3s, about 80% are insufficient in vitamin D and over 50% lack enough magnesium. He blames depleted soils and a diet narrowed from hundreds of plant species to a few. His basics: at least 1 to 2 grams of EPA/DHA, 2,000 to 4,000 IU of vitamin D3, and a quality multivitamin with bioavailable forms, third-party tested and free of fillers or dyes such as titanium dioxide. Iodine may help people who've switched from iodized salt to sea or Himalayan salt.

4. Test, don't guess
Needs vary. Some people need 10,000 IU of vitamin D to reach the blood level others get from 1,000, because of genetic differences in vitamin D receptors. Older men shouldn't take much iron, while menstruating women may need more. Hyman argues "normal" cutoffs are too low: ferritin of 16 can still bring fatigue, brain fog, hair loss and insomnia, and he prefers vitamin D and ferritin above about 45. Lipids can shift within a month of a change. Vitamin D and iron can take about three months to rebuild.

5. ApoB beats a standard cholesterol panel
Hyman calls the total/LDL/HDL/triglyceride panel outdated and says the American Heart Association recognizes ApoB as a better predictor of heart attack risk than LDL. Insulin resistance raises triglycerides, ApoB and small LDL particle number while lowering HDL. He's not a big statin fan but calls them a tool, like a hammer when you need one.

6. The same diet can move lipids in opposite directions
One overweight, prediabetic patient on a ketogenic diet saw total cholesterol drop 100 points, triglycerides drop 200, HDL rise 30, and lost 20 pounds. A lean mid-50s athlete on the same diet saw cholesterol, LDL and particle number soar, an example of the "lean mass hyper-responder" pattern. Hyman cites Ron Krauss's particle-size work and argues for comparing yourself against your own baseline.

7. GLP-1 drugs need guardrails
Hyman says these peptides are given at doses far above what the body makes. Much of the weight lost can be muscle, and over 65% of people who stop regain weight with less muscle. He'd require nutrition (protein) counseling and strength training alongside any prescription. He also urges DEXA scans before, during and after treatment, plus kidney, liver, amylase and lipase monitoring. He cites risks that rise with time on the drug, including roughly 4.5-fold higher bowel obstruction risk at four years, plus pancreatitis, which is rare. He says many of his patients have lost 100-plus pounds without them.

8. Support your own detox pathways
For heavy metals, Hyman's sequence is to cut exposure, then boost the liver's pathways with cruciferous vegetables, garlic, cilantro juice and fiber, then add nutrients: glutathione boosters like N-acetylcysteine (he takes 600 mg daily), lipoic acid, methylating B vitamins and adequate protein. He uses silica and seaweed alginates as binders, not charcoal, and sometimes the prescription chelator DMSA under a doctor's care. Huberman takes sulforaphane.

9. Hormones are falling earlier
Hyman says sugar- and starch-heavy diets push women toward PCOS and lower men's testosterone (bigger belly, lower testosterone), and endocrine disruptors add to it. He wants young men to exhaust lifestyle fixes before testosterone replacement, given its effects on sperm count unless offset with hCG. Huberman notes he started TRT at 45 and freezes sperm yearly. Hyman recommends regular sex hormone panels for both sexes, including DHEA sulfate in women as a possible PCOS marker.

EXAMPLES

1. Food as medicine for the brain
Hyman points to ketogenic diets, long used for epilepsy, now being studied for serious mental illness, including a Mayo Clinic grant of over $3 million, alongside metabolic and nutritional psychiatry programs at Stanford and Harvard. He says Alzheimer's has multiple causes (insulin resistance, toxins, mold, Lyme, the microbiome, deficiencies). He describes an older woman with early dementia who recovered after B12 and B-vitamin treatment for methylation problems.

2. Clean air and water
Air pollution travels: Hyman says mercury from coal burning in northeast China reaches Seattle in rain. Wildfire smoke from

burning homes adds chemicals like PFAS. He recommends a home HEPA filter where you spend the most time and changing HVAC filters. He avoids unfiltered tap water, citing dozens of wastewater contaminants on average including drugs, pesticides and hormones, and favors reverse osmosis filtration.

3. Eating well on a budget

Hyman calls the idea that health is expensive a myth. Sleep, breathing, bodyweight exercise and real food cost little. He grew up eating chicken liver and borscht made with cheap short ribs and cabbage, and cites estimates that eating well costs about the same or roughly 50 cents more a day. He recommends the Environmental Working Group's "Good Food on a Tight Budget" guide.

4. Lower-mercury fish

The bigger the fish, the more mercury, so Hyman rarely eats tuna. He favors "SMASH" fish: small wild salmon, mackerel, anchovies, sardines and herring.

OTHER RELEVANT

1. Magnesium forms matter

Magnesium oxide is poorly absorbed. Citrate works as a laxative, malate is often used for muscles, and glycinate and threonate are favored for brain and sleep, with glycinate unlikely to cause loose stools. Methylated B12 is mostly safe but depends on dose and genetics, since you can over- or under-methylate.

2. Peptides, with caveats

Hyman mentions PT-141 (FDA-approved as Vyleesi for low sexual desire in women; he says it works in men but can cause nausea), BPC-157, TB-500 and GHK for tissue repair, and thymosin alpha-1 for immune support as the thymus shrinks with age. Both stress cycling, physician oversight and safe sourcing. Huberman worries that continuous BPC-157 use promotes blood vessel growth, which could feed an undetected tumor.

3. Screening and NAD

Hyman favors broad early detection, including the Galleri cell-free DNA blood test (he cites about 50 cancers screened, a roughly 0.5% false-positive rate and about 75% accuracy) and whole-body MRI, and expects costs to fall. Note that he leads a testing company. Huberman cites UCSF neurosurgeon Eddie Chang seeing tumors and aneurysms caught by scans. Huberman takes sublingual NMN daily and notices more energy and faster hair and nail growth. Hyman uses NAD to activate sirtuins, which are involved in DNA repair.

How to Improve Your Teeth & Oral Microbiome for Brain & Body Health | Dr. Staci Whitman

Guest: Dr. Staci Whitman
Date: 2025-03-24 · Duration: 2:54:46
URL: https://www.youtube.com/watch?v=_oOEKKiwdDE

KEYPOINTS

1. Teeth are constantly losing and regaining minerals
Every time you eat, salivary amylase starts digestion and mouth pH drops, leaching calcium and phosphorus from enamel. Saliva, which carries minerals, enzymes and immune cells, then buffers the acid and puts minerals back. Whitman points to the Stephan curve: the mouth swings acidic and back to neutral across the day, and a small lesion that has not yet cavitated can remineralize if given the chance.

2. How often you eat matters as much as what you eat
Saliva begins buffering roughly 20 to 30 minutes after eating, and Whitman says full remineralization needs about two hours without food or caloric drinks. Constant snacking, grazing and sipping sweet coffee drinks keeps the mouth acidic all day. She treats time-restricted eating or simply eating on a schedule as a practical anti-cavity tool, and asks cavity-prone patients about frequency, not just sugar.

3. Flour behaves like sugar in the mouth, and stickiness is the problem
Cavity-causing bacteria ferment both sugar and refined flour and release acid. Dry, sticky, hyper-palatable foods such as crackers, chips, pretzels, toast and granola bars lodge in grooves and between molars, so the acid sits against enamel for hours. That is why she sees children with eight cavities, often between the back teeth.

4. Harsh mouthwash can undercut cardiovascular health
Bacteria on the back of the tongue reduce dietary nitrate to nitrite, a precursor of nitric oxide, which supports vasodilation and immune function. Whitman cites studies showing that habitual use of strong antimicrobial rinses, including alcohol-based products and prescription chlorhexidine, damages these bacteria and can raise blood pressure. Persistent bad breath, in her view, signals dysbiosis worth investigating rather than something to carpet-bomb.

5. Bleeding gums open a route into the bloodstream
She calls it 'leaky gums': inflamed, bleeding tissue lets oral pathogens and their endotoxins into circulation, provoking inflammation elsewhere. She names red-complex bacteria such as P. gingivalis, T. denticola and F. nucleatum, plus Aggregatibacter (AA) and Strep mutans. She cites links between gum disease and roughly twice the cardiovascular risk and three times the stroke risk, while acknowledging that much of this evidence is correlational.

6. Mouth breathing reshapes the mouth and the face
Breathing through the mouth dries out saliva and lowers pH, raising decay risk on its own. Whitman, drawing on the book Jaws by Sandra Kahn and Paul Ehrlich, argues that softer modern diets and less chewing (ancestral humans may have chewed up to four hours a day) and less breastfeeding mean narrower jaws, crowded teeth and airway problems. She urges airway screening for children.

7. Gum disease is linked to fertility outcomes
She describes associations between periodontal pathogens and reduced sperm motility in men, and in women about two months longer to conceive, plus higher risk of preterm and low-birth-weight births. The proposed mechanism is the same bacterial translocation and inflammation.

8. Fluoride works topically, so swallowing it adds risk without clear benefit
Whitman says the old idea that ingested fluoride strengthens developing enamel has been largely abandoned. The benefit is mainly topical. She describes the 2024 federal ruling by Judge Edward Chen ordering the EPA to address fluoridation, after a National Toxicology Program review linked higher exposure with lower IQ in children. She notes that critics point out many studies used 1.2 to 1.5 mg/L versus the U.S. level of 0.7 mg/L, and that total intake varies with water consumption, cooking, processed foods and some medications. She frames it as a personal-choice issue, and Huberman notes this is contested.

9. Hydroxyapatite toothpaste is her preferred alternative
Hydroxyapatite is the mineral enamel is made of, and she and Huberman both use it. It also brightens teeth by changing how light reflects from the surface, unlike peroxide bleaches that penetrate the tooth and can disturb the microbiome. Whichever toothpaste you use, spit but don't rinse vigorously, so the active ingredients stay on the teeth.

10. Nicotine pouches and gum carry oral costs
Nicotine is a vasoconstrictor. Whitman reports seeing gum recession, bone loss and leukoplakia (white, potentially precancerous patches) in pouch users. If you use them, she says to know the risks and keep regular dental checkups so early changes are caught.

EXAMPLES

1. The three-minute test before mouth taping
Before taping your mouth at night, check you can breathe calmly through your nose for three minutes, timed, with water held in your mouth or a strip of tape on your lips. Then build up: five minutes while chopping vegetables, 30 minutes during a show, a two-hour movie, then overnight. Children should be screened by an airway-focused dentist or ENT first. Whitman counts taping among the best things she has done for her own sleep data.

2. Xylitol gum after a snack
When a child, or adult, has just had crackers or chips, a piece of xylitol gum loosens trapped food, stimulates saliva and

suppresses Strep mutans. She is wary of tough mastic gum because heavy chewing can strain the jaw joint.

3. Waiting before you brush

Brushing immediately after eating or vomiting scrubs softened enamel and can cause sensitivity and recession. Wait 20 to 30 minutes; after vomiting, rinse with a little baking soda in water instead.

4. Reading saliva at home

Thick, ropy saliva suggests dehydration; watery saliva is healthy. Adding a pinch of salt or electrolytes to water, plus nasal breathing, helps keep saliva abundant, which matters especially for older adults and anyone with dry mouth from medications or cancer treatment.

5. A hydrogen peroxide cautionary tale

Huberman describes gargling with half water, half hydrogen peroxide on an acupuncturist's advice and developing a nickel-sized canker sore days later. Whitman says peroxide rinses will whiten but disrupt the oral microbiome and should be used sparingly. Mouth ulcers can also stem from sodium lauryl sulfate (SLS) or its derivatives in toothpaste.

OTHER RELEVANT

1. Daily routine she recommends

Soft brush with gentle circles twice a day; floss at least once, ideally before bed; a water flosser if you can; no alcohol-containing mouthwash; minimally processed foods; good hydration and sleep; and adequate minerals and fat-soluble vitamins.

2. Tongue scraping and oil pulling

A tongue scraper removes the bacterial film better than a toothbrush and can improve taste; a white coating can signal dysbiosis or candida. Scrape gently, since helpful nitrate-reducing bacteria live deeper in the tongue's crevices. Oil pulling with coconut oil a few times a week, not daily, adds mild antimicrobial action; spit it in the trash, not the sink.

3. Coffee is fine

It dries the mouth and stains, so counter it with water and regular cleanings.

4. 'Kiss the sky' for the airway

Huberman shares a neck exercise opera singer Renée Fleming suggested to him: look straight up and pucker for about 15 seconds per side to train the internal neck muscles, which he finds makes deep nasal breaths easier. This is a personal practice, not something Whitman studied.

How to Enhance Your Immune System | Dr. Roger Seheult

Guest: Dr. Roger Seheult
Date: 2025-02-24 · Duration: 3:28:12
URL: https://www.youtube.com/watch?v=N5DAW8mkJ6Y

KEYPOINTS

1. Staying well rests on the same pillars as general health
Seheult, a pulmonary and critical care physician, organizes prevention around NEWSTART, a mnemonic coined by Dr. Neil Nedley: nutrition (as natural and unprocessed as possible), exercise, water, sunlight, temperance (avoiding toxins), air, rest and trust. Exercise follows a J-curve: going from none to mild or moderate activity lowers inflammation, while elite-level loads can leave athletes more vulnerable to illness.

2. Infrared light penetrates deep and supports mitochondria
Seheult cites a 2019 paper in Melatonin Research by Scott Zimmerman and Russel Reiter showing long-wavelength infrared photons can scatter up to about 8 cm into the body, through clothing and skin. Mitochondria appear to make melatonin on site, in far higher concentrations than the pineal gland, and use it locally as a powerful antioxidant that mops up reactive oxygen species and upregulates glutathione, rather than as a sleep signal. Red and near-infrared light also act on cytochrome c oxidase and nitric oxide to improve mitochondrial efficiency.

3. Mitochondrial dysfunction underlies many chronic diseases
Seheult notes ATP output is said to drop about 70% after age 40 and that diabetes, hypertension, heart disease and dementia share mitochondrial dysfunction at their root. During the COVID pandemic, his ICU patients were dying with exactly those conditions, which led him to sunlight as a low-cost way to support mitochondria. This is his mechanistic framing, built partly on observational data.

4. Green spaces multiply infrared exposure
Chlorophyll strongly reflects infrared, so a sunny day among trees and grass delivers perhaps two to four times more infrared than open pavement. Living near green space correlates with less diabetes, hypertension and mortality. In a Louisville, Kentucky project, planting over 8,000 mature trees in a four-square-mile area, with no change in income or exercise programs, was followed by lower levels of the inflammation marker hs-CRP, an effect Seheult likens to exercising three times a week.

5. Sunlight appears protective against influenza
The 2009 H1N1 pandemic peaked in summer, decoupling flu from winter, and a Harvard analysis of solar radiation concluded sunlight strongly protects against influenza. A 2021 European COVID analysis found autumn surge dates were not predicted by temperature or humidity but tracked latitude, starting in Finland and ending in Greece. US flu deaths peak 1 to 3 weeks after the shortest day; Australia's peak in late June or early July; Singapore's are not seasonal.

6. Fever is a feature: heat boosts interferon
Interferon is the innate immune system's broad antiviral weapon, effective regardless of variant, which is why viruses such as SARS-CoV-2 carry genes to suppress it. In a lab study, lymphocytes exposed to bacterial LPS secreted 10 times more interferon once temperature reached 39°C (about 102.2°F). Seheult argues against reflexively suppressing fever, noting heavy aspirin use in 1918 army hospitals coincided with high case fatality.

7. Cold after heat mobilizes white blood cells
Brief cold causes vasoconstriction, which knocks white blood cells off vessel walls into circulation, a process called demargination, and also locks in core heat. The Battle Creek sanitarium protocol was about 20 minutes of heat followed by less than a minute of cold with rubbing of the chest.

8. NAC reduced flu symptoms, not infections
NAC replenishes glutathione and breaks disulfide bonds, thinning mucus and possibly limiting von Willebrand factor polymers implicated in the white clots seen in COVID autopsies. Seheult cites a multicenter, double-blind, placebo-controlled winter trial of 600 mg twice daily: infection rates did not fall, but symptoms did, especially runny nose and sore throat. He takes that dose during flu season but no longer than about three months; in vitro cancer-model concerns should be taken with a grain of salt, in his view.

9. Flu shots reduce severity more than infection
Strains are chosen by watching the opposite hemisphere six months earlier. Seheult gets one yearly because ICU work exposes him heavily, and recommends it for the immunocompromised, the metabolically unhealthy and the highly exposed. He gave his children the shot from their teens. Huberman has never had one; Seheult frames it as weighing risks and benefits using a Swiss cheese model of layered protections.

EXAMPLES

1. Glenn Jeffery's red-light trials
At University College London, Jeffery gave older adults 3 minutes of 670 nm red light in the morning, which improved color sensitivity for days; it only worked in the morning. In a blinded trial of 30 people given 75 g of glucose, red light on their backs lowered glucose peaks and raised exhaled CO2, consistent with more active mitochondria.

2. A Brazilian 940 nm COVID trial
A randomized, double-blind, placebo-controlled study found 15 minutes a day for 7 days of very low-power 940 nm light, about 2.9 mW/cm², got hospitalized COVID patients out sooner. Jeffery told Seheult benefits plateau after about 15 to 20 minutes across species.

3. 1918 sanitariums versus army hospitals

Wells Ruble of the New England Sanitarium compared Adventist sanitariums using hydrotherapy and sunlight with army hospitals and reported about one-sixth as many flu patients progressing to pneumonia; once pneumonia set in, mortality was about 50% in both. Julius Wagner-Jauregg won the 1927 Nobel Prize for curing neurosyphilis by inducing malarial fevers.

4. Forest bathing in hinoki cypress forests

Japanese studies took Tokyo executives on three-day forest walks; tree-emitted phytoncides shifted innate immune markers for about seven days. Diffusing hinoki oil in a hotel room produced similar immune effects, though urinary cortisol fell only in the forest.

5. Eucalyptus oil and phagocytosis

An in vitro oncology study found a small amount of eucalyptus oil dramatically increased immune cells' engulfing of beads. Seheult warns it must never be taken internally, as deaths have been reported; he dabs a little on his upper lip to inhale.

OTHER RELEVANT

1. Get about 15 to 20 minutes of outdoor light daily, especially in winter

From November to mid-January many people go weeks without 15 minutes of daylight, and Americans spend about 93% of time indoors. Take lunch outside if that is your only chance. If you are fair-skinned, a single clothing layer and a broad-brimmed hat block much UV while infrared still penetrates. Red-light lamps should match sunlight's intensity; more is not better.

2. Keep nights dark

Use blackout curtains, foil for day-sleeping shift workers, or an eye mask. Huberman cites Charles Czeisler's lab: about 15 seconds of artificial light at night significantly suppresses melatonin. For bathroom trips, point your phone flashlight at the floor rather than looking at a screen.

3. Use heat, then brief cold, when you feel sick

Hot baths, sauna, hot showers or hot towels raise core temperature; finish with less than a minute of cold. Seheult would keep the fever over other symptoms.

4. Zinc, masks and handwashing

Seheult cites recommendations of about 40 mg of elemental zinc, read the label for elemental zinc, and monitoring copper, since excess zinc can deplete it. Surgical masks mainly stop outgoing droplets; N95s filter inhaled air but add breathing work for people with COPD. Handwashing data are mixed, but we constantly touch eyes, nose and mouth.

5. Recover lost smell with training

COVID damages ACE2-rich support cells around olfactory neurons. A randomized crossover trial found sniffing a variety of scents such as orange, lemon and chocolate on smell-training sticks helped restore smell.

6. In hospital, ask informed questions

Seheult says the best way to get attentive care is for a family member to ask intelligent questions about the condition, never to yell at staff.

How to Improve Skin Health & Appearance

Date: 2024-07-01 · Duration: 2:27:55
URL: https://www.youtube.com/watch?v=1CxJVdeyltw

KEYPOINTS

1. UV light damages the outer skin, while red light reaches deeper
Short-wavelength UV mostly hits the epidermis, where it can mutate DNA, disrupt collagen and elastin in the dermis below, and raise skin-cancer risk. Long-wavelength red and near-infrared light penetrates deeper. That difference is why Huberman treats UV as something to manage by dose, while red light shows up later as a possible therapy.

2. Some sun is good for you; excess sun ages skin
Every dermatologist Huberman consulted agreed on both points. Skin is an endocrine organ involved in vitamin D, testosterone and estrogen pathways, so some sun exposure is beneficial, while too much accelerates visible aging and raises cancer risk. He notes that some of the deadliest skin cancers arise independently of sun exposure.

3. Physical barriers are the least controversial protection
Hats, shirts and jackets block sun without any chemical debate. How much protection you need depends on your skin pigmentation, where you live, the season and what you're doing outdoors. Huberman places himself between the extremes of 'sunscreen truther' and 'beekeeper'.

4. Mineral sunscreens reflect UV; chemical sunscreens absorb it
Mineral ('inorganic') sunscreens use zinc oxide and/or titanium dioxide and are generally considered safe at up to 25% concentration. Chemical ('organic') sunscreens use compounds like oxybenzone and avobenzone, some of which raise endocrine-disruption concerns. Huberman notes those concerns come mainly from studies using very high application amounts.

5. No chemical sunscreen for babies under 6 months
Infant skin absorbs substances almost like mucosal tissue. Huberman personally avoids chemical sunscreens. If titanium dioxide worries you (suggestive evidence only, mainly about nano-sized particles crossing the skin), choose a zinc-oxide-only formula. Titanium dioxide is often added mainly to make zinc less pasty.

6. Sunscreen doesn't block your vitamin D
Dermatologists told Huberman that sun exposure still supports vitamin D even with sunscreen or clothing, because longer wavelengths get through. If you supplement, he suggests starting low, around 1,000–3,000 IU (up to 5,000), and testing your levels; even people who get a lot of sun can be low.

7. Oral collagen is a surprising exception to 'no targeted nutrients'
Eating liver doesn't specifically feed your liver, yet meta-analyses show that 5–15 g a day of hydrolyzed collagen, especially with vitamin C, can measurably improve elasticity and wrinkles. Dermatologists suggested 15–30 g a day of collagen peptides with 500–1,000 mg vitamin C, or food sources such as bone broth. The proposed mechanism is that di- and tripeptides increase fibroblast activity.

8. Niacinamide supports moisture, inflammation, pores and dark spots
Dermatologists recommended 500 mg twice a day of this vitamin B3 form, which boosts ceramides (skin lipids that hold moisture), reduces inflammation, balances oil and can lighten hyperpigmented spots. Effects take 3–6 months. Topical versions need about 2–10% niacinamide, often paired with hyaluronic acid as a humectant (it holds moisture in).

9. Retinoids are the dermatologists' top pick, with real cautions
Tretinoin (Retin-A) and related vitamin-A derivatives act through retinoic acid on gene expression, building collagen and new skin. Dermatologists were 'bullish' about starting in your 20s and reported 'remarkable results'. They must be avoided in pregnancy or breastfeeding because of fetal-development risk, and they increase light sensitivity, redness and dryness. Over-the-counter retinoid esters are popular but less studied.

10. BPC-157 and copper peptides: plausible mechanism, little human evidence
BPC-157 increases blood-vessel growth and wound healing in animals, but Huberman knows of only one weak human study. It's unclear whether it crosses the skin, and growing new vessels throughout the body could also feed undetected tumors. Copper supports DNA repair and acts as an antioxidant, but too much triggers inflammation, so aim for adequate dietary levels rather than extra supplements.

11. Insulin spikes fuel acne through mTOR and androgens
High-glycemic-load eating raises insulin and glucose, activating the mTOR growth pathway, which increases androgen signaling, sebum (skin oil) and the cells that clog pores. Processed, high-heat foods add inflammatory advanced glycation end products (AGEs). Huberman says the teenage myth is true: fried food can make skin worse.

EXAMPLES

1. Swedish study: sun avoiders lived 0.6–2.1 years less
In the Melanoma in Southern Sweden cohort, non-smokers who avoided sun had a life expectancy similar to smokers in the highest sun-exposure group. Huberman cautions against reading this as 'sun extends life': people who get more sun also exercise more and feel better, and longer lives also mean more cancers, including melanoma.

2. Low-fat dairy may worsen acne more than full-fat
A nutrition-minded dermatologist told Huberman that emulsifiers in non-fat and low-fat dairy can spike insulin more than full-fat dairy, so switching to skim sometimes makes acne worse. Heavy whey intake may also contribute; Huberman suggests running a personal experiment rather than cutting it automatically.

3. Red/near-infrared light protocol
Huberman cites a 2018 systematic review of randomized trials of LEDs in dermatology. The approach he and a dermatologist converged on was high-intensity red plus near-infrared light from 1–2 feet away, for 10–15 minutes, 5–7 days a week. Effects on skin appearance, acne and wound healing are mild to moderate, and many studies found no significant effect.

4. Popping pimples causes permanent scars
Squeezing releases matrix metalloproteinases, enzymes that eat into the extracellular matrix and leave indentation scars. Dermatologists 'practically begged' Huberman to pass this on. Leave the pimple alone, use a little corticosteroid cream for redness, or get a steroid injection before a major event.

5. Cutting alcohol often resolves rosacea
Many people with rosacea who stop drinking see it disappear or improve dramatically, whether through direct blood-vessel dilation or through effects on sleep and the gut. Spicy foods, heat and harsh astringents also aggravate it.

OTHER RELEVANT

1. Gentle daily skin care
Cleanse two to three times a day, not more, with a gentle unscented cleanser (Huberman uses unscented Dove bar soap) and lukewarm water. Apply salicylic acid only to clean skin, and only if recommended. Shower soon after the gym. Over-cleansing strips the skin's microbiome.

2. Eat for low inflammation
Aim for 75–100% minimally processed food. Include omega-3s (walnuts, flax, fatty fish or liquid fish oil), leafy greens, colorful produce, garlic and bone broth, plus 1–4 servings a day of refrigerated, low-sugar fermented foods. Get vitamin A from food, not supplements, because it's easy to overdose.

3. Lifestyle levers that show on your face
Consistent sleep, minimal alcohol, good hydration with electrolytes, and no smoking, vaping or nicotine (a vasoconstrictor). Managing stress with physiological sighs or 10–20 minutes of NSDR helps, because chronic adrenaline reduces blood flow to the skin.

4. Rosacea basics
Use a mineral SPF 30 sunscreen, a gentle moisturizer and possibly niacinamide or licorice root. Stubborn cases may come from over-cleansing, and visible vessels can be treated with pulsed dye laser. Get your whole skin, not just moles, checked once a year.

AMA #15: Fluoride Benefits/Risks & Vagus Nerve Stimulation

Date: 2024-02-01 · Duration: 0:29:03
URL: https://www.youtube.com/watch?v=j2sMqSDLd4k

KEYPOINTS

1. Whether fluoride harms you depends on the dose
Huberman pushes back on the listener's framing, 'how much is it harming us?', because it assumes harm. Fluoride clearly strengthens teeth and helps prevent cavities, but at high enough levels it is a poison. The real question is how much you are taking in from water, toothpaste and other sources. Note that this public portion of the AMA covers only fluoride; the vagus nerve stimulation segment is for premium subscribers.

2. Fluoride is legally contested in both directions
In 2024 a major lawsuit in California sought to remove fluoride from drinking water, citing evidence that high levels can disrupt thyroid function and possibly the brain. At the same time, residents of Buffalo, New York sued their city, arguing their water had too little or no fluoride and their children's teeth suffered. Huberman calls fluoride a 'barbed wire topic' because people get stuck on it whichever way they approach it.

3. Teeth constantly switch between losing and rebuilding minerals
Cavities form when bacteria, especially Streptococcus mutans, feed on sugar and produce acids that erode enamel (demineralization). Teeth can also remineralize by building organized crystals, like stacked Lego blocks, from hydroxyapatite. Early cavities that have not reached the deeper dentin layer can potentially fill in naturally this way.

4. Fluoride makes enamel crystals unusually strong
Fluoride inserts into the mineral crystals and forms bonds stronger than normal hydroxyapatite bonds. That makes teeth more resistant to acid, especially when exposure happens in childhood. Every dentist and periodontist Huberman consulted, from traditional to 'functional', agreed on this. Some noted that the bonds look structurally different under an electron microscope and would prefer natural remineralization.

5. Water fluoridation was a cheap public health measure, not the ideal method
Starting around the 1950s, governments added fluoride to tap water because it is an inexpensive way to reduce tooth decay across a population. Dentists told Huberman it was not chosen because it is the best way to care for teeth. It was chosen because many people do not look after their mouths well. Practices vary widely around the world.

6. High fluoride exposure may affect thyroid and possibly neurons
Huberman says high fluoride intake has been shown to disrupt thyroid hormone output and how the body uses it. Fluoride is also hypothesized, and still heavily debated, to be neurotoxic. Much of that evidence comes from cell studies in a dish, with some animal data. He stresses these effects are not necessarily occurring at drinking-water concentrations.

7. The CDC level is a concentration, not a personal dose
The CDC recommends 0.7 mg of fluoride per liter of drinking water as safe and effective for oral health. Your actual intake depends on how much you drink, whether a couple of cups or a gallon a day, and on body size. Children get proportionally more fluoride per kilogram from the same water, just as drug doses are scaled by body weight.

8. People tend to fall into three camps on fluoride
Some are not concerned and want strong teeth. Some are mildly concerned and want concentrations kept reasonable. Others oppose any fluoride in water. Huberman finds it understandable that people who read the health literature become more cautious, though he does not consider himself hyper-concerned.

EXAMPLES

1. Huberman's childhood fluoride poisoning
Around age five or six, during a dental fluoride-tray treatment, he decided to swallow all the sour gel to 'beat the test'. Within about three minutes he vomited. He tells the story to show fluoride really is toxic at high concentrations, not to scare parents away from fluoridated toothpaste or water.

2. How Huberman handles his own water
He filters the water he drinks, using pour-through and refrigerator filters and a recently installed whole-house filter on drinking taps. He does not bother filtering tap water used for cooking rice, pasta or oatmeal, and occasionally drinks straight from the tap. He has largely avoided fluoride toothpaste and reports very few cavities in adulthood.

3. Dueling lawsuits in California and Buffalo
The two cases ran at the same time: one arguing that any fluoride is too much, the other that its absence harmed children's teeth. Huberman notes he cannot confirm whether Buffalo's water truly had zero fluoride.

4. Brushing too hard backfires
Aggressive brushing can cause the gums to recede ('tenting'), creating pockets where bacteria get in. Huberman notes strong evidence linking oral bacteria to cardiac and metabolic disease, and possibly neurological disease. He recommends a soft toothbrush.

5. Two kinds of oral-health mistakes
Huberman sorts people into two groups. One is intensely diligent, using whiteners, mouthwash and constant brushing, and may harm the oral microbiome. The other brushes mainly for fresh breath and neglects the rest. Both damage oral health in different ways, and he promised a dedicated oral-health episode with mostly zero-cost fixes.

OTHER RELEVANT

1. Find out what is in your local water

Look up your city's fluoride level on public water-quality websites or get your tap water tested. Then factor in how much you drink and your body weight, or your child's, rather than relying on the 0.7 mg/L figure alone.

2. Filtering is a low-cost option if you are concerned

Many affordable filters reduce fluoride, and some people invest in whole-house systems. Huberman's view is that since inexpensive filters work and there is some concern about excess intake, removing fluoride from drinking water is reasonable. Where you land depends on your budget and level of concern.

3. Protect your teeth either way

Removing fluoride from water does not mean giving up on strong teeth. Twice-yearly cleanings, gentle brushing, protecting the oral microbiome rather than overusing harsh products, and fluoride or non-fluoride toothpastes all play a role. Huberman says early cavities can remineralize when they have not reached the dentin.

Journal Club with Dr. Peter Attia | Effects of Light & Dark on Mental Health & Treatments for Cancer

Guest: Dr. Peter Attia
Date: 2024-01-22 · Duration: 3:08:31
URL: https://www.youtube.com/watch?v=TG8VM5-CTfw

KEYPOINTS

1. Bright days and dark nights are linked to better mental health in 86,000 people
Huberman presents a Nature Mental Health paper that used wrist light sensors on roughly 86,000 UK Biobank participants. It builds on an earlier study of 400,000 Biobank participants linking outdoor time to better mood and sleep. The authors conclude that avoiding light at night and seeking light during the day may be a simple, effective non-drug way to broadly improve mental health. Huberman criticizes the title, which makes it sound as if light itself is harmful.

2. Night light showed a dose-response with depression, self-harm and PTSD
Against the quartile with the least night light, the depression risk rose to almost 20% higher in the third quartile and about 25% higher in the fourth. Self-harm was flat across the first three quartiles, then jumped about 30% in the top one. The highest daytime-light quartile had about a 20% lower risk of depression. The associations held largely independent of sleep duration and exercise. Attia singled out the links between night light and PTSD and between daytime light and psychosis, and found anxiety and bipolar results less striking.

3. In bipolar disorder, night light looked harmful even with plenty of daytime light
The authors emphasize that for bipolar symptoms, light at night appeared especially problematic regardless of how much daytime light people got. Huberman ties this to ICU psychosis: non-psychotic patients in windowless, constantly lit, noisy units can develop psychosis that clears once they go home.

4. The mechanism runs through melanopsin cells wired to mood centers
Intrinsically photosensitive retinal ganglion cells signal the circadian clock and, one synapse away, the habenula and other mood areas. They sit mostly in the lower two-thirds of the retina, so they sample light from above. They add up photons over time rather than switching on instantly. Huberman credits David Berson at Brown for showing these cells can fire for hours under bright light.

5. Indoor light is far dimmer than it seems
Huberman says a bright indoor space is about 4,000 to 6,000 lux, while noon sun is over 100,000 and can reach 300,000. An overcast day can still beat indoors. Light through a window you can't see the sun through is largely filtered, skylights help, and glasses or contacts are fine while sunglasses cut a lot. He notes people now spend about 90% of their daytime indoors.

6. Low-sun light sets the clock and midday light lifts mood
Color-opponent cells compare blue with yellow and orange at sunrise and sunset. Morning light advances the clock and evening light delays it, and the two balance. Midday is a circadian dead zone for shifting the clock, but bright light then still boosts mood. If you can only manage one, choose morning. If you miss a day, get roughly twice as much the next morning, because the system averages over two to three days.

7. Most solid tumors are visible to the immune system but evade it
Attia says lung, breast, prostate, colorectal and pancreatic cancers cause more than half of US cancer deaths, and at least 80% of solid tumors make antigens the immune system recognizes. They escape by secreting suppressors such as IL-10 and TGF-beta and by heavy glycolysis (the Warburg effect), which may serve cell building blocks per a 2009 paper by Vander Heiden, Thompson and Cantley, and acidify their surroundings to repel immune cells.

8. Checkpoint inhibitors take the brakes off T cells
CTLA-4 on T cells acts as a brake after antigen recognition. Earlier, high-dose interleukin-2 added gas, helping only about 10% of patients with melanoma or kidney cancer. Blocking CTLA-4 (ipilimumab) or PD-1 (pembrolizumab) removes the brake. The discoverers of these checkpoints won a Nobel Prize, which Attia believes is the only one for immunotherapy.

EXAMPLES

1. The ipilimumab phase 3 trial in metastatic melanoma
Patients had run out of standard options. They were randomized 3:1:1 to ipilimumab plus a gp100 peptide vaccine, ipilimumab alone, or gp100 alone, so about 80% got the drug. Median survival was about 10 months on either ipilimumab arm versus 6.4 months on gp100. Roughly 20% of treated patients were alive at about 56 months, while essentially all controls had died by about 44 months.

2. Median survival versus overall survival
Attia argues that treatments have extended median survival for metastatic solid cancers, but the long-term cure rate is still essentially 0%, as in 1970. Exceptions include testicular cancer and GIST. He criticizes drugs that cost $50,000 to $100,000 for weeks of benefit, citing a pancreatic cancer drug that added days.

3. Side effects track the mechanism
Nearly everyone in all arms had some adverse event, and grade 4 events were similar (about 6 to 8%), likely reflecting the advanced disease. Immune-related events were about 60% on ipilimumab versus about 30% on gp100, with grade 3 to 4 events in 10 to 15% versus 3%. These included colitis severe enough to need IV fluids, rashes and vitiligo. Attia once co-wrote a paper suggesting autoimmunity predicts response, and wished this trial had tested that. He also notes weight-based dosing (3 mg/kg) means men get larger doses, which may explain sex differences.

4. A Lynch syndrome patient cured, and left without a pancreas

Attia's friend with Lynch syndrome survived colon cancer, then developed unresectable pancreatic cancer about five years later. Because mismatch-repair defects create many mutations, he joined a pembrolizumab trial. His cancer vanished and he is cancer-free about 10 years later, but his immune system also destroyed his pancreas, leaving him insulin-dependent. Melanoma and kidney cancer responded early for a similar reason: high mutation counts.

5. Rick Rubin's red bulbs

While staying in Attia's guest house, Rubin replaced every bulb with red light, and Attia later took the bulbs home. Huberman notes cheap red bulbs work. Attia has softened on blue light: what he does on his phone at night, like doomscrolling or email, matters more to him than screen brightness.

OTHER RELEVANT

1. Huberman's four light habits

See low-angle sun in the morning and again in the late afternoon or evening; the sun doesn't need to cross the horizon. Get as much bright light as you safely can through the day; midday sunglasses are fine, but blink and don't stare. Keep nights dim but not pitch black, so you don't trip. Huberman says evening sunlight can halve melatonin suppression from later artificial light, citing a Scientific Reports study.

2. Read the study, not the headline

Attia's journal-club tips: redraw confusing figures with arrows, check whether error bars cross the 1.0 line (an odds ratio of 0.7 means about 30% lower odds), and expect large samples to give tight error bars. Remember that observational light data can't rule out reverse causality or a Hawthorne effect from wearing a sensor.

3. For hospitalized loved ones, get them near a window

Huberman's standard advice when people with a relative in the hospital contact him: get them near a window and protect their sleep-wake cycle as much as possible, given ICU psychosis.

Tools to Reduce & Manage Pain | Dr. Sean Mackey

Guest: Dr. Sean Mackey
Date: 2024-01-15 · Duration: 2:56:42
URL: https://www.youtube.com/watch?v=K9lORz2_XSU

KEYPOINTS

1. Nociception isn't pain; the brain creates the experience
Mackey's central message is that signals from an injured shoulder or neck are nociception, electrochemical impulses that the spinal cord modifies and relays upward. Pain only arises when those signals converge with brain systems for emotion, cognition, memory and action. That makes everyone's pain unique, and it's why the biomedical model's assumed one-to-one link between injury and pain is wrong. Chronic pain affects about 100 million Americans and costs roughly half a trillion dollars a year.

2. NSAIDs and acetaminophen: weigh healing against function
Ibuprofen and naproxen are the over-the-counter NSAIDs. Ketorolac and celecoxib (a COX-2 inhibitor that is gentler on the stomach) require a prescription. Acetaminophen acts more centrally in the brain. Mackey says two extra-strength Tylenol four times a day is safe for many people with good liver function who don't abuse alcohol, though guidance varies between 2 and 4 g a day. On worries that anti-inflammatories slow healing, his approach is pragmatic: if a drug helps you sleep and function, that also aids recovery.

3. Caffeine boosts painkillers
Caffeine touches the prostaglandin pathway, which is why it helps with headaches and migraines and potentiates analgesics. Because both caffeine and NSAIDs can irritate the stomach, Mackey suggests having food in your stomach when combining them.

4. Gate control and descending pathways change the volume of pain
Patrick Wall and Ron Melzack's 1960s gate control theory showed that fast touch fibers activated by stroking can damp pain signals in the spinal cord, which is why rubbing a bump helps. Pathways descending from the brain also inhibit spinal pain signals. In conditioned pain modulation ('pain inhibits pain'), a second painful stimulus reduces the first. This system appears impaired in conditions such as fibromyalgia.

5. Cold, heat and pain thresholds
The traditional rule is cold for about the first 48 hours after an acute injury, then heat. Cold reduces release of inflammatory sensitizers like prostaglandins, cytokines and histamine, and slows nerve firing. Heat increases blood flow and relaxes muscle. Mackey sees huge individual variation and tells people to use whichever works. On average, men have higher heat-pain thresholds than women, but he calls 'men are tougher' a terrible conclusion from small average differences, since a lower threshold may even be protective.

6. Psychological tools measurably reduce pain
Distraction helps but fails at night, when people with chronic pain most need it. Jon Kabat-Zinn's mindfulness-based stress reduction, which involves non-judgmental acceptance of pain, has evidence for low back pain, anxiety and depression. Mackey says 'everybody should do MBSR,' while stressing that these tools work for some people some of the time. Cognitive reframing of what the pain means is a third approach.

7. Hurt isn't harm, and catastrophizing amplifies pain
Knowing the difference between hurting and being injured is central. Anger reliably makes pain worse. Mackey cites John Burns's distinction between 'anger out' (expressed yelling) and 'anger in' (contained seething), with data suggesting 'anger in' is worse. His clinic tracks depression, anxiety, anger, fatigue and sleep to treat the whole person.

8. Opioids are a tool, and abrupt cutoffs backfire
Mackey rejects binary thinking about opioids, which the body also makes endogenously. Some doctors overprescribed after buying marketing claims, but he also describes a well-managed patient cut off from occasional Vicodin who turned to black tar heroin. When California targeted prescribers on death certificates to cut opioid deaths, deaths doubled because doctors abandoned patients. He favors gentle, compassionate tapering and not conflating the overdose crisis with the pain epidemic.

9. Kratom and cannabis remain uncertain
Mackey worries that kratom's purity and dose are unknown. In controlled lab settings, cannabis has been shown to reduce pain, but products vary widely in THC-to-CBD ratio and dose. He says cannabis 'clearly' should not be a Schedule I drug, which hampers research.

EXAMPLES

1. The tennis player with Morton's neuroma
A master's-level tennis player arrived on crutches, depressed after months of being told not to bear weight. Mackey diagnosed a Morton's neuroma, a painful but harmless thickening around toe nerves, and explained it hurt without causing harm. The patient lit up: 'You mean I can play tennis?'

2. Love as an analgesic
In Mackey's study, Stanford students in the early phase of a romantic relationship felt significantly less pain from a stimulus delivered in a brain scanner while viewing photos of their beloved than of an equally attractive acquaintance. The more in love they were on the passionate love scale (some reported thinking of their partner 80% of the day), the greater the relief. A demanding distraction task also reduced pain.

3. Huberman's dog

Huberman says low-dose testosterone eased his elderly dog's aches, improving movement and sleep. Instead of backlash, he heard from hundreds of veterinarians wishing they could prescribe it.

4. Mackey's alpha-lipoic acid trial run

Taking alpha-lipoic acid himself, Mackey couldn't push his heart rate past 150 during high-intensity intervals. He attributes this to its action on T-type calcium channels, which are also present in the heart, and calls it an annoyance rather than an adverse event.

OTHER RELEVANT

1. Pace activity to break the boom-bust cycle

Chronic pain waxes and wanes. Overdoing it on good days leads to crashes and bed rest, which entrains pain in the brain. Physical therapists, psychologists and physicians teach steady pacing. Mackey calls PT 'absolutely crucial' for chronic pain.

2. Supplements with some evidence

Acetyl-L-carnitine improved nerve conduction velocity in diabetic neuropathy studies. Alpha-lipoic acid (a free-radical scavenger and T-type calcium channel modulator) may help neuropathic pain but can upset the stomach. Vitamin C before nerve-related surgery may reduce some post-surgical nerve pain conditions. Omega-3s help with chronic pain, and creatine shows benefit in small pilot studies. Discuss these with a clinician.

3. Judge therapies by durable benefit

For acupuncture, chiropractic or massage, ask whether the relief lasts beyond a few hours. Mackey's advice on acupuncture: 'if you can afford the wallet biopsy, give it a try,' with a skilled practitioner.

4. Hunt food triggers carefully

Food-related pain can lag by days, which makes patterns hard to spot. A safe elimination diet of eight to ten basic foods, adequate in calories and macronutrients, with foods added back gradually, can reveal triggers.

How to Prevent & Treat Colds & Flu

Date: 2024-01-08 · Duration: 2:05:49
URL: https://www.youtube.com/watch?v=AtChcxeaukQ

KEYPOINTS

1. Cold viruses usually get in through the eyes
Cold viruses are tiny, travel through the air and skin contact, and can survive on surfaces for up to 24 hours. Huberman says the most common route of infection is touching your eye region, and the mouth and lips much less often. Symptoms typically show up 1–2 days after exposure.

2. Exposure doesn't guarantee infection
Even with a serotype you've never encountered, a well-functioning immune system can fight off the virus before you get sick or pass it on. That's why most of the episode focuses on tools that strengthen innate immunity.

3. 'I'm past the contagious stage' is usually a myth
You're most contagious when you feel worst, and still contagious as you start to recover. Most data suggest the contagious phase ends about 5–6 days after your worst symptoms. Anyone still sneezing, coughing, blowing their nose or waking up groggy is still a 'walking, talking' vector and should stay home where possible.

4. A flu shot is a bet on which strains are circulating
Huberman personally doesn't usually get the flu shot, but frames it as an individual decision to make with your physician. He suggests weighing it more heavily if you live with immune-compromised family, work in a school or have high exposure. He also notes most people can't reliably tell whether they have a cold or flu.

5. Nasal breathing protects the upper airway
Breathing through your nose, except when talking, eating or exercising hard, keeps the nasal microbiome healthy and diverse. Huberman cites a study of mouth-breathing children showing altered oral and nasal microbes and more upper-respiratory infections, plus the book 'Jaws' by Stanford colleagues. Nasal breathing also warms incoming air, which makes it harder for viruses to embed in the nasal lining.

6. Up to 60 minutes of hard exercise boosts innate immunity; marathon-level loads suppress it
Citing a 2019 review in the Journal of Sport and Health Science, Huberman says sessions of 60 minutes or less at high subjective effort (not all-out) improve exchange between blood and lymph and keep innate immune activity raised for up to 24 hours. Brisk 60-minute walks increase T-cell, natural killer cell and macrophage activity. People training for or just finishing a marathon show sharply reduced T-cell and NK function and very high stress hormones and inflammatory cytokines.

7. After a bad night, sleep first; if you can't, train lighter
If you can go back to sleep, that's the better choice. If you can't, exercising at 25–50% lower intensity and duration can offset some immune and blood-sugar effects of one night's sleep loss and help you fall asleep on time that night. Exercise is not a replacement for sleep.

8. Zinc has the strongest supplement evidence, at the right dose
Doses below about 75 mg don't seem to work; around 100 mg (once, or as two 50 mg doses) does, taken with a meal because zinc on an empty stomach causes nausea. Adults over 65 may benefit most. Children under 15 shouldn't take much zinc, and pregnant women should ask their doctor first.

9. Vitamin C megadoses are probably not worth it
There's weak evidence that 6–8 g a day might delay or shorten a cold, at the cost of likely stomach upset. A 2023 meta-analysis of nine randomized trials claiming a benefit was retracted because placebo groups had been double-counted. If your diet or a multivitamin covers vitamin C, extra is probably a poor immune investment.

10. Vitamin D matters most if you're deficient
An individual-participant meta-analysis of more than 20 randomized trials found supplementation reduced acute respiratory infections overall, and deficient people have weaker immune function. Huberman says most physicians would consider 1,000–2,000 IU a day safe for most people, but you need blood work to know whether you need more.

EXAMPLES

1. Huberman's 30-second daily health log
Huberman gets a serious cold or flu about every 18–24 months and logs workout intensity and sleep quality in his calendar each day. Looking back, illnesses followed two hard workouts in one day or hard training combined with cold exposure during overseas travel. He calls it a limited personal data set but recommends the habit.

2. Sauna study
Participants did 10 sessions over 3 weeks, each three 15-minute rounds (roughly 176–210°F in practical terms) separated by 2-minute cool showers. Cortisol rose after the first and tenth sessions, along with leukocyte counts, but in trained athletes the increase only became significant by the last session. Huberman's takeaway is that heat-adapted people need a stronger stimulus. He adds that sauna isn't for pregnant women or children.

3. Carbohydrates after training
Eating complex carbohydrates (rice, oatmeal, pasta) or fruit after exercise reduced inflammatory markers by about 30–40% compared with water alone, especially after fasted training.

4. Zinc acetate and recovery speed
In one study, people who already had a cold and took 90 mg a day of zinc acetate recovered three times faster than those

who didn't.

5. NAC instead of decongestants

A 1997 study found that 600 mg of N-acetylcysteine twice daily for 6 months significantly lowered the chance of getting influenza. During a sinus infection, after consulting ICU physician Dr. Schwell, Huberman took 600–900 mg three times a day and found it a powerful mucus-clearer. He avoids alpha-1 agonist decongestants, which cause rebound congestion and can become habit-forming.

OTHER RELEVANT

1. Keep your hands away from your eyes

After shaking hands, people usually touch their face within about 30 seconds. Sanitize or wash before touching your eyes, and in high-risk periods think twice about hugs and cheek kisses, without becoming fearful of the gym or the office.

2. Eat 2–4 servings of low-sugar fermented foods a day

Choose refrigerated sauerkraut, kimchi, pickles with live cultures, plain yogurt and lower-sugar kombucha; the brine counts too. A diverse gut microbiome supports innate immunity, and sugary versions bring their own problems.

3. Use echinacea sparingly, if at all

Huberman found no strong evidence for echinacea, and prolonged use may reduce white blood cell and natural killer cell counts. If you like it, limit it to times you feel run down or your worst winter month, and never take it for more than four weeks straight. Check any supplement plan with your physician.

How to Improve Your Eye Health & Offset Vision Loss | Dr. Jeffrey Goldberg

Guest: Dr. Jeffrey Goldberg
Date: 2023-06-26 · Duration: 3:08:44
URL: https://www.youtube.com/watch?v=_ltcLEM-5HU

KEYPOINTS

1. Eye checks in childhood screen for a few key problems
Goldberg, a Stanford ophthalmologist, explains that newborns get a 'red reflex' check in the nursery and then at well-child visits. In elementary school, screening looks for amblyopia, where one eye stops communicating properly with the brain. It can come from very different prescriptions in the two eyes or from strabismus (misaligned eyes). A child saying 'I can't see the board' is another common reason for an exam.

2. Outdoor time, not just less close-up work, seems to slow nearsightedness
Myopia is described as an epidemic in China and is common at Stanford. Older cohort studies blamed near work, but newer research points to time spent in indoor light versus outdoor full-spectrum light. Early randomized trials found that children assigned to spend time outdoors progressed less over a couple of years. One to two hours a day clearly beats none, but the ideal amount is still unknown.

3. Undercorrecting can help train children's eye muscles
For misalignment in kids and young adults, clinicians often deliberately give less than a full prism correction so the eye muscles keep working to align both eyes. Sometimes they use a mild plus lens in children who over-converge when reading. An optometrist is usually the right first stop.

4. Needing reading glasses around 40 is presbyopia
The lens inside the eye stiffens with age, making it harder to shift focus from distance (3 feet or more) to reading distance (12–14 inches). Most people notice it around 40, give or take five to ten years. Goldberg found an abandoned pair of +1.25 readers at about 40–42 and 'got addicted' because his near vision was suddenly sharp.

5. UV blocking is worthwhile, unlike all-day blue blocking
UV light dries and irritates the eye's surface and, over the long term, speeds up cataract formation, a clouding of the lens caused by oxidation. Very intense UV exposure can damage the retina. Goldberg calls UV filtering 'absolutely standard' and safe in eyeglasses. Huberman adds that blue light isn't inherently bad: get plenty of bright light during the day and avoid bright light of any color late at night.

6. Dry eye worsens with age and screen time
People blink less while reading, using screens or watching TV, so tears spread less and less oil is released. Preservative-free artificial tears can be used as often as needed, even hourly. Clean the eyelids with lid scrubs or diluted baby shampoo to keep the oil glands working, and treat allergies. In severe cases, eye drops made from a patient's own blood serum, rich in growth factors, can help.

7. Glaucoma is the world's leading cause of irreversible blindness
Glaucoma is a degenerative disease of the optic nerve and causes no symptoms until late, when peripheral vision is already lost. Screening checks eye pressure, the appearance of the optic nerve head, imaging and peripheral vision. Lowering pressure helps even in people whose pressure is normal. Treatment starts with eye drops or selective laser trabeculoplasty (SLT), then surgery. Even with treatment, 10–20% of patients lose meaningful vision.

8. What's good for the heart is good for the eyes
Smoking and vaping are 'a no-no' for both macular degeneration and glaucoma. The optic nerve head sits where two blood supplies meet, which makes it vulnerable. Goldberg advises glaucoma patients to eat well, take a multivitamin and exercise.

EXAMPLES

1. Huberman's double vision after swimming
After swimming as a child with one eye shut, Huberman came out seeing double until doctors patched his good eye. Vision recovered in about a day, but his depth perception remains poor. Goldberg guesses he already had intermittent strabismus that the swim tipped over, since an hour with one eye closed rarely causes this on its own.

2. The LiGHT trial
In this large trial, glaucoma patients were randomly assigned to SLT laser or the most common first-line eye drop. Both worked at least as well on many measures, and over the long term the laser had advantages, including not having to remember nightly drops.

3. AREDS and AREDS2 for macular degeneration
The original AREDS trial tested high-dose vitamins C and E, zinc, copper and beta-carotene, and slowed macular degeneration. Beta-carotene showed a slight increase in cancer risk. AREDS2 found lower-dose zinc worked as well, and swapping beta-carotene for lutein and zeaxanthin did even better, cutting progression of moderate-to-severe dry macular degeneration by about 25% over a couple of years. Goldberg calls this a strong 'yes, you should do this', though the benefit for mild disease is less clear.

4. High-dose vitamin B3 for glaucoma
B3 (nicotinamide) feeds the NAD pathway, which helps cells manage energy and oxidative stress. After strong mouse data, two small randomized trials found it very safe and found short-term improvements in visual fields and retinal electrical activity. Three or four larger trials are under way. Goldberg already suggests it to patients who are running out of options, but warns against generic 'glaucoma preservation' supplements.

5. Red light therapy for the retina

Huberman describes two published studies in which a few minutes of red or near-infrared light in the morning, from about 2 feet away a few times a week, offset some age-related vision loss in people over 40. Goldberg calls the data 'very compelling' but says the ideal dose, wavelength and timing are still being worked out. Both warn that light of any color can damage the eye if it's too bright.

OTHER RELEVANT

1. If you have glaucoma, take your drops

Skipping preventive drops is common because they don't make you feel better right away. For severe glaucoma, sleeping propped up at about 30° may help, but not at the cost of good sleep. Studies conflict on whether sleeping on one side matters, and it probably doesn't.

2. Floaters and eyelid twitches are usually harmless

Most floaters fade on their own, and surgery to remove the eye's gel isn't worth the risk just for floaters. Eyelid twitches usually come from a single irritable nerve ending, often worse with fatigue.

3. The retina may become an early warning system for brain disease

The retina is part of the brain, and its degeneration tracks with Alzheimer's and other neurodegenerative diseases. Retinal imaging may become a way to screen for these conditions and track their progression.

The Science of Healthy Hair, Hair Loss and How to Regrow Hair

Date: 2023-04-10 · Duration: 2:04:47
URL: https://www.youtube.com/watch?v=6ZrlsVx85ek

KEYPOINTS

1. Hair loss starts long before people notice it
By about age 50, roughly half of men and women have noticed significant hair loss, and up to 85% of them feel anxious enough to seek treatment. Huberman stresses that the loss is gradual from about 30 to 50 and is usually noticed only under bright bathroom light. Psychological state can affect hair color and growth, and hair changes in turn affect mood.

2. Each hair comes from a stem cell niche that needs blood flow
Below the skin, a bulb holds stem cells that build the hair's keratin from the bottom up, melanocytes that pigment it, a sebaceous gland whose sebum seals and protects the follicle, and capillaries supplying oxygen and nutrients. Growth is metabolically active, which is why so many folk remedies — scalp massage, tingling oils, avoiding hats, light devices — aim to raise blood flow. None of these alone robustly regrows hair.

3. Three phases: anagen, catagen, telogen
Anagen is the growth phase; catagen is when the hair recedes from the bulb outward; telogen is rest, when the bulb pinches off. Scalp follicles can re-enter anagen if stem cells, blood supply and the right hormonal signals remain. Because anagen is long, treatments take many months to show results.

4. Hormones are the accelerators and brakes
IGF-1 extends anagen, and cAMP signaling also supports growth. PDE (a phosphodiesterase) and TGF-beta 2 act as brakes. DHT, made from testosterone by 5-alpha reductase, shortens anagen and promotes catagen and telogen, so most treatments target DHT or the enzyme. Pattern hair loss reflects where androgen receptors sit on your scalp.

5. The 'mother's father' rule is a myth
You can't predict your hair loss from a photo of your maternal grandfather. Huberman says the androgen-receptor pattern is inherited through the mother's side, so logically you'd look to your mother's mother, but women's hair loss is usually less visible or hidden by longer hair.

6. Minoxidil works through blood flow, with real side effects
Oral doses range 20-fold, from 0.25 to 5 mg a day; topical is typically 5% once daily and can still reach the bloodstream through the follicle. Side effects can include fluid retention and raised prolactin (lower libido, lethargy). Huberman advises starting at the lowest dose, 0.25 mg orally. Like low-dose tadalafil (2.5–5 mg, which some doctors prescribe), it mainly preserves hair rather than reversing loss.

7. Topical caffeine may rival minoxidil for slowing loss
Caffeine inhibits PDE, indirectly boosting IGF-1, and appears to reduce stem cell death. Huberman cites head-to-head data showing topical caffeine about as effective as minoxidil for preventing loss, without the blood pressure or prolactin issues. He notes that much of the evidence is from cell studies and concentrations haven't been systematically tested. Use about three times a week. Drinking coffee won't help, since adenosine receptors elsewhere soak up most of it.

8. Finasteride is the most potent mainstream option, but dose carefully
Huberman says it can increase hair count by up to 20%, reduce loss in about 90% of users, and thicken hair 20–30%. DHT suppression is logarithmic: very low doses already cut blood DHT by about 50%, with diminishing returns up to 5 mg. His suggested starting points, ideally with a doctor and hormone monitoring: 0.5–1 mg oral daily, or 1 mL of 0.25% topical once a week. Wait up to about 25 weeks before raising the dose.

9. Post-finasteride syndrome is a serious, poorly understood risk
Mostly in men in their 20s and 30s, stopping finasteride has been followed by severely reduced libido and erectile function and depression, sometimes suicidal. Older men taking about 5 mg for the prostate rarely report it. Huberman suggests DHT may keep shaping the hypothalamus and the brain-genital axis into the 20s and 30s. Topical finasteride is reported to cause 30–50% fewer or milder side effects.

EXAMPLES

1. Dutasteride: faster, stronger, riskier
It inhibits all three 5-alpha reductase isoenzymes, cuts DHT by about 95% at 0.5–2.5 mg orally, and works roughly two to five times faster than finasteride. It also raises the risk of low drive, higher estrogen and prolactin, and gynecomastia.

2. Huberman's turmeric reaction
High-dose curcumin (about 1–2 g) inhibits 5-alpha reductase in some people. Huberman felt so terrible, confirmed in blood work, that he says he'd rather lose all his hair than take it again, while noting many people tolerate it well.

3. Botox for a 'squinting' scalp
Injections relax scalp tension to improve blood flow. People with cutis verticis gyrata (Shar-Pei-like scalp folds) regrew hair after Botox flattened the folds. It must be repeated, needs a skilled injector, and lacks large trials.

4. PRP is not stem cells
Platelet-rich plasma is your own spun-down platelets reinjected. For the scalp it costs thousands of dollars, shows moderate and transient success, and may work partly through the needling itself. Huberman warns that anyone claiming stem-cell injections in the US, Canada or northern Europe is likely injecting something else.

OTHER RELEVANT

1. Combine a mechanical and a chemical stimulus

Meta-analyses show combinations beat single treatments. Microneedling (needles 0.5–2.5 mm) creates micro-inflammation that reawakens telogen follicles. Paired with finasteride it produces the most robust regrowth Huberman has seen, though not a full head of hair on a completely bald scalp.

2. Gentler DHT-pathway options

Saw palmetto: about 300 mg a day (studies used 200–500 mg), split into two or three doses because it's short-acting, with side effects in about 1% of people. Ketoconazole 2% shampoo: two to four times a week, massaged in for 3–5 minutes. Avoid stacking so many that DHT drops too low.

3. Fix insulin resistance and iron

Insulin resistance can thin hair via reduced IGF-1 activity. Exercise and body composition come first. Myo-inositol at about 900 mg roughly 30 minutes before bed has the fewest side effects; berberine and metformin sharply lower blood sugar. Test iron rather than guessing; Huberman gives target levels of about 25–100 for women and 30–150 for men.

4. Be patient and start low

Raising a dose after a week or two misreads the long growth cycle. Lower the dose if side effects appear, but give any regimen months before judging it.

Exercise, Nutrition, Hormones for Vitality & Longevity | Dr. Peter Attia

Guest: Dr. Peter Attia
Date: 2022-08-15 · Duration: 2:50:02
URL: https://www.youtube.com/watch?v=DTCmprPCDqc

KEYPOINTS

1. Bloodwork helps with lifespan but says little about healthspan
Attia splits longevity into lifespan (not dying of the 'four horsemen': atherosclerotic disease, cancer, neurodegeneration and metabolic disease) and healthspan (cognitive, physical and emotional function). Biomarkers give decent insight into heart disease and Alzheimer's risk, which overlap heavily, but have a big blind spot for cancer and Parkinson's. Healthspan needs functional testing. He calls emotional health the piece without which none of the rest matters.

2. Everyone should be screened for Lp(a) early
Lipoprotein(a) is the most prevalent genetic driver of atherosclerosis. Roughly 8–12% of people (possibly up to 20%) have levels high enough to contribute to disease, yet most physicians do not check it. Because it is genetic, a single early test is informative.

3. Plan from your 'marginal decade' backward
Patients answer about 50 prompts describing what they want to be able to do in their last decade, such as picking up a great-grandchild or getting up off the floor. Attia then compares that with how strength and VO2 max decline with age. He borrows the term 'backcasting' from Annie Duke. Nearly everyone finds they need to be much fitter and stronger now than they assumed.

4. Fitness and strength outweigh most other modifiable risk factors
Smoking raises all-cause mortality risk by about 40% at any given moment (it does not shorten life by 40%). High blood pressure and type 2 diabetes each add roughly 20–25%, and end-stage kidney disease about 175%. By contrast, low versus high muscle mass is about a 3× hazard and low versus high strength about 3.5×. Bottom-quartile VO2 max versus the top 2.5% for one's age is roughly 5×, the strongest association he has seen for any modifiable behavior.

5. Exercise is the most important thing for brain health, and the first dose matters most
In the context of Alzheimer's prevention, Attia says going from sedentary to about 15 MET-hours a week (roughly three hour-long brisk walks) cuts risk by about 50%. More exercise still adds benefit at a slower rate, and it supports the functional, healthspan side that mortality data do not capture.

6. Strength training is the best bone builder, especially before age 25
His team expected running to win, but powerlifting came out best because muscles pulling on bone through tendons activate osteoblasts. Peak bone density is set in youth, which matters most for women. Heavy inhaled or oral corticosteroid use during that window can impair it. Attia tracks DEXA Z-scores; for example, he aims to move a " 1 to 0 over four years even though bone density would normally decline.

7. The WHI hormone-therapy scare rested on a misleading headline
The trial enrolled women more than 10 years past menopause, without symptoms, and disproportionately unhealthy (he recalls about 40% were smokers). It used horse-derived conjugated estrogen and synthetic MPA instead of today's bioidentical estradiol patch and micronized progesterone. The reported 27% relative rise in breast cancer was an absolute change from 4 to 5 cases per 1,000, or 0.1%. Estrogen given without progesterone to women with a uterus does raise endometrial cancer risk.

8. Testosterone therapy in men: modest doses, careful estradiol, and fertility first
Attia's clinic uses lower, more frequent subcutaneous testosterone cypionate injections, once or twice a week with a small needle, and avoids pellets. About 20% of men need a micro-dose of anastrozole to keep estradiol at 30–50 pg/mL, and he never wants it below 25. Men who still want children are steered toward hCG alone because TRT lowers sperm count. He has stopped using Clomid after seeing it raise desmosterol, an unpublished clinic observation.

9. ApoB is the causal lipid target, and diet alone rarely gets it low enough
Atherosclerosis essentially cannot develop below about 20–30 mg/dL of apoB, a level most people pass by their teens. Cutting carbohydrates lowers triglycerides, but raising saturated fat can push apoB up. Drug options include statins (which in trials do not impair cognition), ezetimibe (better responders show high phytosterols), bempedoic acid (liver-only and fewer side effects) and PCSK9 inhibitors, the most potent.

EXAMPLES

1. 'Attia's rule' for supplement debates
Huberman's paraphrase: don't argue about supplements or diet tribes until your VO2 max is at least 75th percentile, you can dead hang for a minute, wall-sit for two and deadlift your body weight for 10 reps. Attia also gives supplement-heavy patients a seven-question spreadsheet, and many find they cannot justify about 80% of what they take.

2. Nicotine lozenges, not stimulants
Attia has cycled on and off low-dose nicotine for about 10 years and says he gets no withdrawal. He warns it is addictive for many people, and that lozenges deliver 4–8 mg compared with about 1 mg per cigarette. His clinic will not prescribe Adderall or Vyvanse for focus. He recalls a half dose of armodafinil leaving him so locked in during a talk that he stopped blinking.

3. Semaglutide in practice
The trial dose of 2.4 mg weekly took about 16 weeks of titration. Attia's clinic usually gets enough benefit at 1–2 mg, though some patients can't tolerate the nausea. He thinks about 80% of the effect is in the hypothalamus. The drugs are catabolic,

so patients lose muscle as well as fat, and weight returns after stopping.

4. Strength Metrics Assessment

His clinic runs patients through 11 hard tests, including dead hangs, and grip strength, leg extensions and wall sits, which are the strength measures most studies use.

OTHER RELEVANT

1. Get early, broad screening, then retest roughly yearly

Include Lp(a), apoB and genetics such as APOE. Pair the blood panel with a DEXA scan for lean mass, fat and bone density, plus functional strength and VO2 max tests.

2. Put exercise first

Aim beyond minimal guidelines: build VO2 max and strength well above where you need to be at 90. The 'glider' of aging descends faster than people expect.

3. For menopausal symptoms, revisit HRT with a doctor

Vasomotor symptoms (hot flashes and night sweats) usually pass within a few years. Vaginal atrophy, bone loss and brain fog persist. Attia believes the WHI-era fear is largely unfounded for modern bioidentical regimens started near menopause, and that progesterone must be included if the uterus is intact.

Micronutrients for Health & Longevity | Dr. Rhonda Patrick

Guest: Dr. Rhonda Patrick
Date: 2022-05-02 · Duration: 2:49:33
URL: https://www.youtube.com/watch?v=XcvhERcZpWw

KEYPOINTS

1. Small, intermittent stressors switch on protective pathways
Patrick, a biomedical scientist, frames plant compounds, cold, heat and exercise as hormetic stressors: brief challenges that activate the body's own repair and antioxidant programs. She credits Dr. Mark Mattson with the phrase 'intermittent challenge'.

2. Sulforaphane activates Nrf2 and glutathione
Sulforaphane from cruciferous vegetables activates the transcription factor Nrf2, turning on detoxifying genes, including those that make glutathione, a major antioxidant. Patrick cites human evidence of raised glutathione in plasma and brain, and of lower DNA damage in white blood cells. Studies in polluted regions of China showed increased excretion of benzene, an airborne carcinogen. She notes broccoli sprouts carry up to 100 times more sulforaphane than broccoli.

3. Cooking cuts sulforaphane, but mustard seed restores it
Sulforaphane forms when the heat-sensitive enzyme myrosinase acts on glucoraphanin in broccoli. A study found that adding 1 gram of ground mustard seed powder, which contains myrosinase, to cooked broccoli boosted sulforaphane about fourfold. It should have a little kick; if it doesn't, the powder is likely expired.

4. EPA omega-3s may help mood by countering inflammation
Patrick describes a placebo-controlled study in which injecting endotoxin (lipopolysaccharide) caused depressive symptoms, and about 2 g of EPA beforehand blunted them. Huberman takes about 2 g of EPA a day, citing comparisons of 2–4 g daily with SSRIs. Both stress that depression treatment should not be self-managed.

5. The Omega-3 Index tracks long-term status
Bill Harris's Omega-3 Index measures omega-3 in red blood cells, which turn over about every 120 days. That makes it a long-term marker, unlike standard plasma tests that reflect recent meals. Americans average about 5%, the Japanese around 10–11%. In Framingham data, an index of 4% or below was associated with about five years' shorter life expectancy than 8%. Smokers with high levels had life expectancy similar to non-smokers with low levels; these are observational findings.

6. Krill oil absorbs well but is impractical
DHA in phospholipid form, as in krill, is more bioavailable and reaches the brain through the MFSD2A transporter. Patrick says this may matter for APOE4 carriers (about 25% of people, with roughly double the Alzheimer's risk for one copy). But krill supplements are low-dose and often rancid, and the body can make phospholipid DHA from triglyceride forms, so she favors about 2 g or more of fish oil.

7. Test vitamin D, because response varies
Common gene variants impair vitamin D conversion. Mendelian randomization studies link genetically low vitamin D to higher all-cause, cancer and respiratory mortality and to multiple sclerosis. Typically, 1,000 IU raises blood levels about 5 ng/mL, so moving from 20 to 40 ng/mL needs at least 4,000 IU. Patrick takes 5,000 IU and sits around 50 ng/mL; she says toxicity requires very high doses over a long time. Exposed skin area matters for producing it from sunlight.

8. Magnesium insufficiency may quietly impair DNA repair
Patrick says about 40% of Americans are insufficient. Magnesium is needed to make and use ATP and is a cofactor for DNA repair enzymes, so the damage is invisible. It sits at the center of chlorophyll, so dark leafy greens like kale, spinach, chard and romaine are her main source. She supplements around 130–135 mg at a time to avoid gut upset and prefers malate. Huberman uses threonate or bisglycinate 30–60 minutes before bed.

9. Regular sauna use is linked to large drops in disease risk
In Jari Laukkanen's Finnish cohorts, using a sauna 4–7 times a week, compared with once, was associated with more than 60% lower dementia and Alzheimer's risk. In men it was linked to about 50% lower cardiovascular mortality. Sessions needed to be more than 19 minutes at about 174°F, while 11-minute sessions showed only about an 8% reduction. Patrick argues the dose-response pattern strengthens a causal case, and notes that sauna mimics moderate cardio in its effects on heart rate and blood pressure.

EXAMPLES

1. Patrick's broccoli and moringa routine
She lightly steams broccoli, adds butter and mustard seed powder, and adds a heaping tablespoon of moringa powder, which Jed Fahey's research suggests activates Nrf2 similarly, to smoothies.

2. Short, cold plunges
She uses three minutes at 49°F, mainly before talks or when anxious. Huberman cites a 2000 study in which an hour at about 59°F produced long-lasting rises in plasma dopamine. Repeated cold 'browns' fat via norepinephrine, PGC-1; æB T5 à Patrick warns that going straight from a 30-minute, 104°F hot tub into cold water made her lightheaded, so she now waits a few minutes between.

3. Studying in the sauna
Patrick rehearses talks in the heat. Huberman links this to James McGaugh's inverted-U relationship between adrenaline and memory. She also hypothesizes that dynorphin released during heat stress sensitizes the brain's mu-opioid receptors, boosting later feel-good endorphin effects.

4. Hot-bath alternative

Studies typically use about 104°F for 20 minutes from the shoulders down, which raises heat shock proteins and BDNF. Local heat prevented nearly 40% of disuse muscle atrophy in one study. Heat lowers sperm count and motility, which Patrick says recovers after about six months without exposure.

OTHER RELEVANT

1. HIIT builds new mitochondria

Patrick cites Matthew Robinson's study showing large increases in mitochondrial biogenesis from high-intensity interval training, especially in older adults. She sees fresh mitochondria as an anti-aging lever.

2. Get the right test

Ask for an Omega-3 Index rather than plasma omega-3, and retest vitamin D (25-hydroxy) after starting supplements. Check with your physician before changing supplements.

3. Know what kind of evidence you trust

Huberman notes that people differ in whether they will act on mouse data or only on human trials. Patrick takes magnesium threonate on promising animal data while acknowledging the human results are thin.

Control Pain & Heal Faster with Your Brain

Date: 2021-03-01 · Duration: 1:37:58
URL: https://www.youtube.com/watch?v=mcPSRWUYCv0

KEYPOINTS

1. Pain and tissue damage can be completely separated
Neuroscientists prefer the term 'nociception' because pain is subjective. Radiation and excessive X-rays can damage tissue with no sensation at all, while a man in a British medical case report was in agony after a 14-inch nail went through his boot, only for doctors to find it had passed between his toes without breaking the skin. Seeing the nail produced a specific, nail-like pain.

2. Receptor density shapes both sensitivity and healing
Areas packed with receptors, such as the fingertips and lips, have more 'pixels' in the brain's body map, the homunculus. They also have more blood vessels and glia to drive inflammation. As a rule of thumb, large, low-sensitivity areas hurt less when injured but tend to heal more slowly because fewer cells are nearby to mount repair.

3. Some pain is necessary, and acute inflammation is good
People born with mutations that prevent them from sensing pain never trigger the inflammatory response, and their joints literally disintegrate. Huberman's main message is that acute inflammation is the tissue-repair response that calls in cells to clear an injury. Only chronic, out-of-control inflammation is the problem.

4. The brain can relieve pain from the top down
Phantom limb pain arises because the brain's map of the missing limb is intact but has no proprioceptive feedback, so it ramps up activity. V.S. Ramachandran's mirror box let amputees 'see' the missing limb move into a comfortable position, giving immediate relief and remapping. The brain adapts to whatever input it receives, as cochlear implants also show.

5. Use the injured side and restrict the healthy one
Much of the atrophy after a cast comes from inactive nerves rather than unused muscle. About a dozen papers from Timothy Schallert's lab (with Theresa Jones and others) in the 1990s–2000s showed that after one-sided brain or limb damage, restricting the healthy limb forces use of the injured one. This produced plasticity on both sides of the brain via the corpus callosum and faster recovery, provided the injured side is used without pain or further harm.

6. For brain injury, avoid a second hit and support the glymphatic system
Concussion and TBI symptoms include headaches, light sensitivity, poor sleep, poor concentration and mood changes. The agreed priority is to avoid another TBI. The glymphatic system, the brain's 'sewage' clearance, works mostly during slow-wave sleep early in the night. Sleeping on your side, or with the feet slightly elevated, appears to increase clearance (limited but solid data); Huberman puts a thin pillow under his ankles.

7. Zone 2 cardio supports brain clearance
A review he cites found that conversational-pace cardio for 30–45 minutes three times a week improved clearance of debris after injury and glymphatic flow generally. Clear it with your physician if you are injured. He contrasts this with the popular focus on high-intensity intervals.

8. Belief, adrenaline and love all blunt pain
Punches barely hurt during a fight because adrenaline and noradrenaline shut down pain pathways; it hurts afterwards. People expecting morphine report relief before receiving it. Sean Mackey's Stanford imaging study found that looking at a romantic partner's photo raised heat-pain thresholds, and the effect was stronger the newer and more obsessive the love. Huberman thinks dopamine is the likely driver, though it hasn't been measured.

9. Acupuncture effects depend on where and how hard you stimulate
Qiufu Ma's lab at Harvard found that weak stimulation of the abdomen did nothing, while intense electroacupuncture there was pro-inflammatory via a splenic sympathetic pathway. Low-intensity stimulation of the hind limbs activated the vagus nerve and lowered inflammatory markers such as IL-6. So acupuncture can't simply be called good or bad; it maps onto real body–autonomic wiring.

EXAMPLES

1. Kelly Starrett's injury basics
Developed with Starrett of The Ready State: at least 8 hours in bed per night, even if not all asleep, with NSDR if you can't sleep; at least a 10-minute walk a day if it doesn't aggravate the injury; and heat rather than ice. Restricting blood flow above and below an injury and then releasing it may also boost perfusion.

2. Why ice may backfire
The exercise physiologists and physicians Huberman spoke to described ice as largely numbing or placebo. It may 'sludge' blood, lymph and fascial interfaces and slow macrophages carrying debris away. Heat seems to help by improving tissue viscosity and fluid clearance rather than through heat-shock proteins. Huberman notes this may be contested.

3. Wim Hof / Tummo breathing and endotoxin
A PNAS paper showed that this adrenaline-releasing breathing helped counter endotoxin. Stress liberates killer cells, so acute stress fights infection. People often get sick once a prolonged stressor, such as the Texas cold snap, ends and the immune response drops.

4. Young blood
Tony Wyss-Coray's Stanford lab reported in 2014 that young rodent blood restored memory and vitality in old rodents. Umbilical cord blood did the same, and one candidate factor is TIMP2. Huberman offers no protocol from this.

OTHER RELEVANT

1. Think twice about turmeric and early anti-inflammatories

Turmeric is anti-inflammatory, but Huberman is skeptical: a Stanford-linked study found much of it contaminated with lead, and it can antagonize DHT, with some men reporting blunted libido and mood. NSAIDs that block prostaglandins may be useful for function and pain but may work against the early inflammation you want.

2. Be cautious with PRP and stem cell offers

PRP has never been properly tested against injection alone, and its stem cell content is 'infinitesimally small'. A Florida clinic was shut down after patients went blind from stem cell injections into the eye, and uncontrolled stem cells can form tumours. Hold off on stem cell treatments for now.

3. For whole-body pain, consider light and sunlight

Fibromyalgia involves too little central inhibition of pain. Local red light may help, but experts Huberman spoke to see systemic red light as 'approximating nature', so sunlight may do as much or more. The strong red-light data he knows of come from Glen Jeffery's macular degeneration work in people over 40.

4. Combine movement, heat, light and sleep

Huberman's synthesis for recovery: protect the injury, keep gently moving (movement itself has an analgesic effect), use heat, get light, and prioritize sleep. Consult your physician before adding or dropping any protocol.