

Extending the Clock

*Strategies for Targeting
Mitochondrial Dysfunction to
Enhance Longevity*

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@drrobsilverman

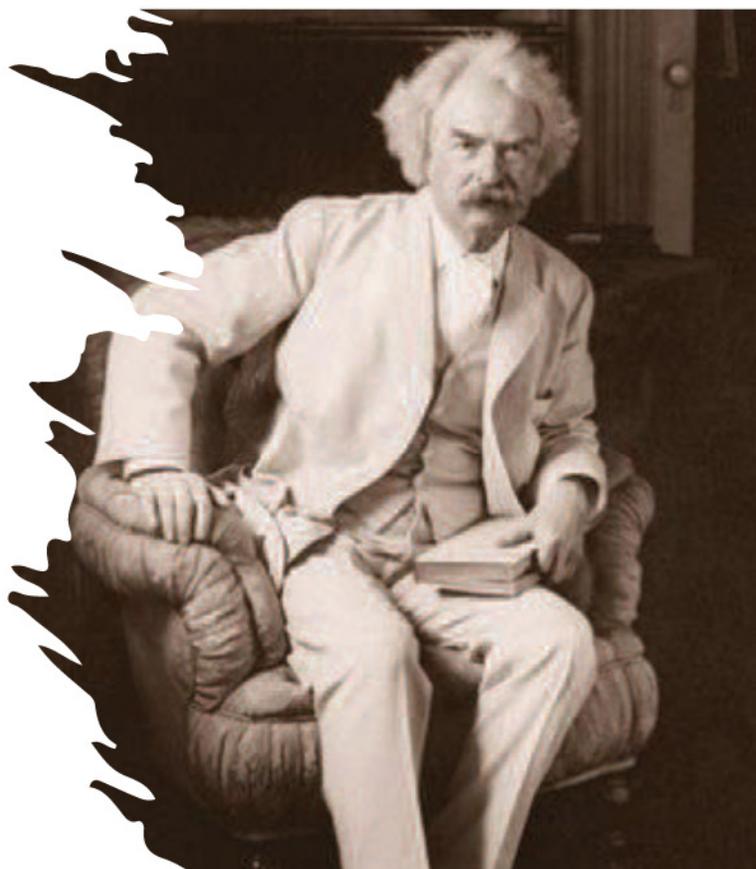


@drrobertsilverman



The two important days
in your life are the day
you were born and the
day you find out why.

Mark Twain



Lifestyle

Laser

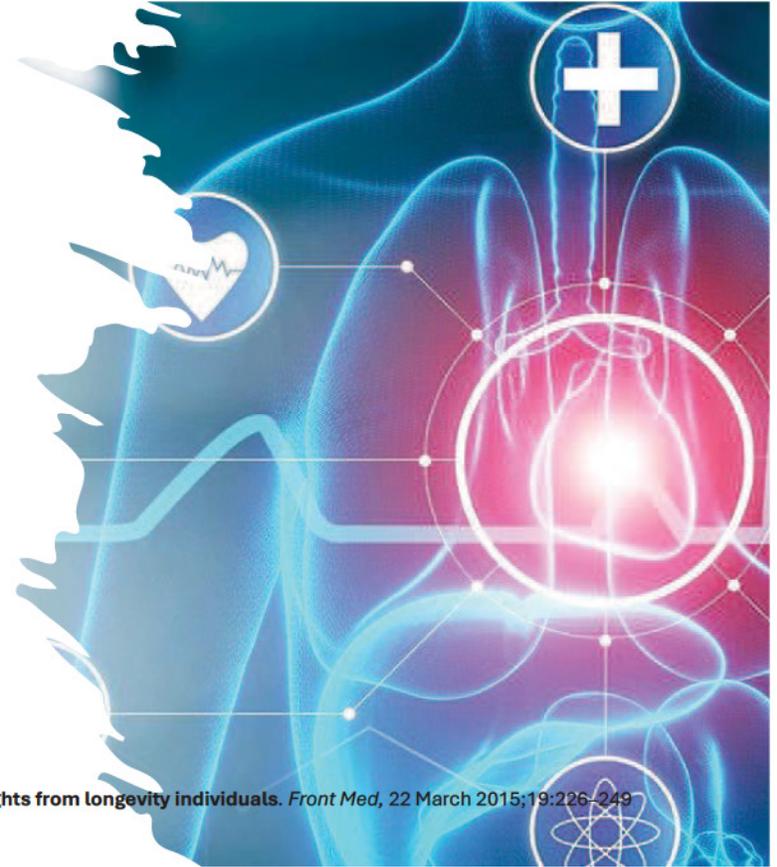


Longevity

New longevity study reveals
sophisticated interplay of:

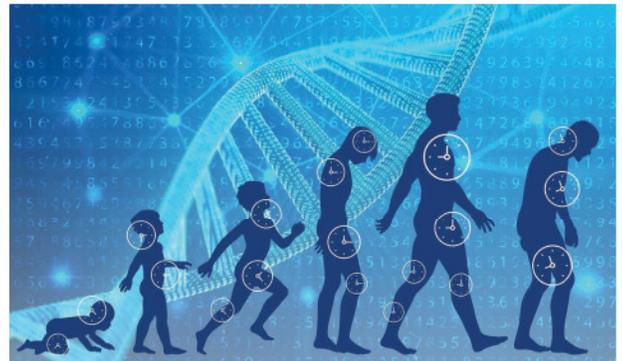
- Genetics
- Epigenetics
- Metabolism
- Immunity
- Lifestyle

FQ Yin, FH Xiao, QP Kong. **Factors involved in human healthy aging: insights from longevity individuals.** *Front Med*, 22 March 2015;19:226-249



Longevity (cont'd)

- Those who lived beyond 90 years, aka long-lived individuals, share remarkable traits:
 - They have less chronic illness
 - Push back onset of age-related diseases
 - Maintain better physiological function



FQ Yin, FH Xiao, QP Kong. **Factors involved in human healthy aging: insights from longevity individuals.** *Front Med*, 22 March 2015;19:226-249

WHO stats - 2022

- In the U.S.:
 - Expected to live – 77.5 years
 - Expected to live in full health – 66.1 years
- Global:
 - Lifespan – 73.3 years
 - Healthy lifespan – 63.7 years

<https://www.medrxiv.org/content/medrxiv/early/2023/03/01/2023.02.26.23286363.full.pdf>
<https://www.who.int/news/item/20-05-2022-world-health-statistics-2022>

Longevity 2023-24 recap

- Reducing daily caloric intake by 12% improves cell senescence, slows pace of aging

Waziry R, Ryan CP, Corcoran DL, et al. **Effect of long-term caloric restriction on DNA methylation measures of biological aging in healthy adults from the CALERIE trial.** *Nat Aging.* 2023 Mar;3(3):248-257

- Maintaining levels of taurine fought aging and improved healthspan and lifespan

Singh P, Gollapalli K, Mangiola S, et al. **Taurine deficiency as a driver of aging.** *Science.* 2023 Jun 9;380(6649):eabn9257

- Distinct longevity mechanisms:
 - Reduced activity of growth hormone called IGF-1 – found to extend lifespan across species
 - **Mitochondrial function found to be essential lifespan extending factor**
 - Metabolic energy pathways health and robustness – specifically oxidative phosphorylation, process where cells turn glucose into energy

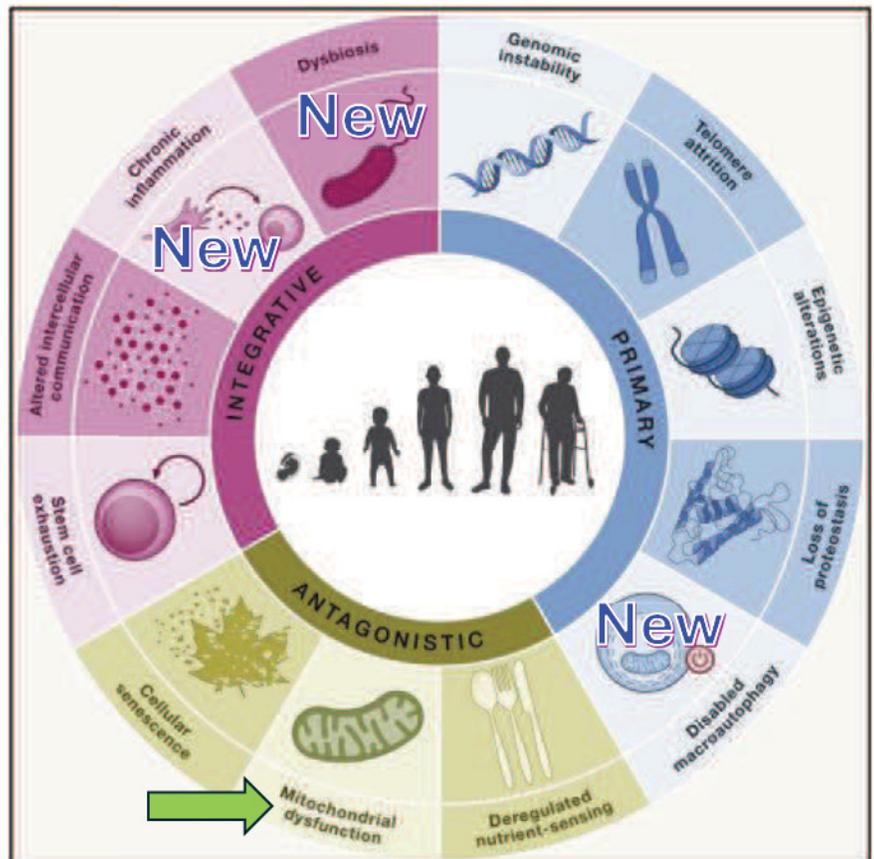
Zhang Z, Shayani G, Xu Y, et al. **Induction of Senescence by Loss of Gata4 in Cardiac Fibroblasts.** *Cells.* 2023; 12(12):1652

Hallmarks of aging

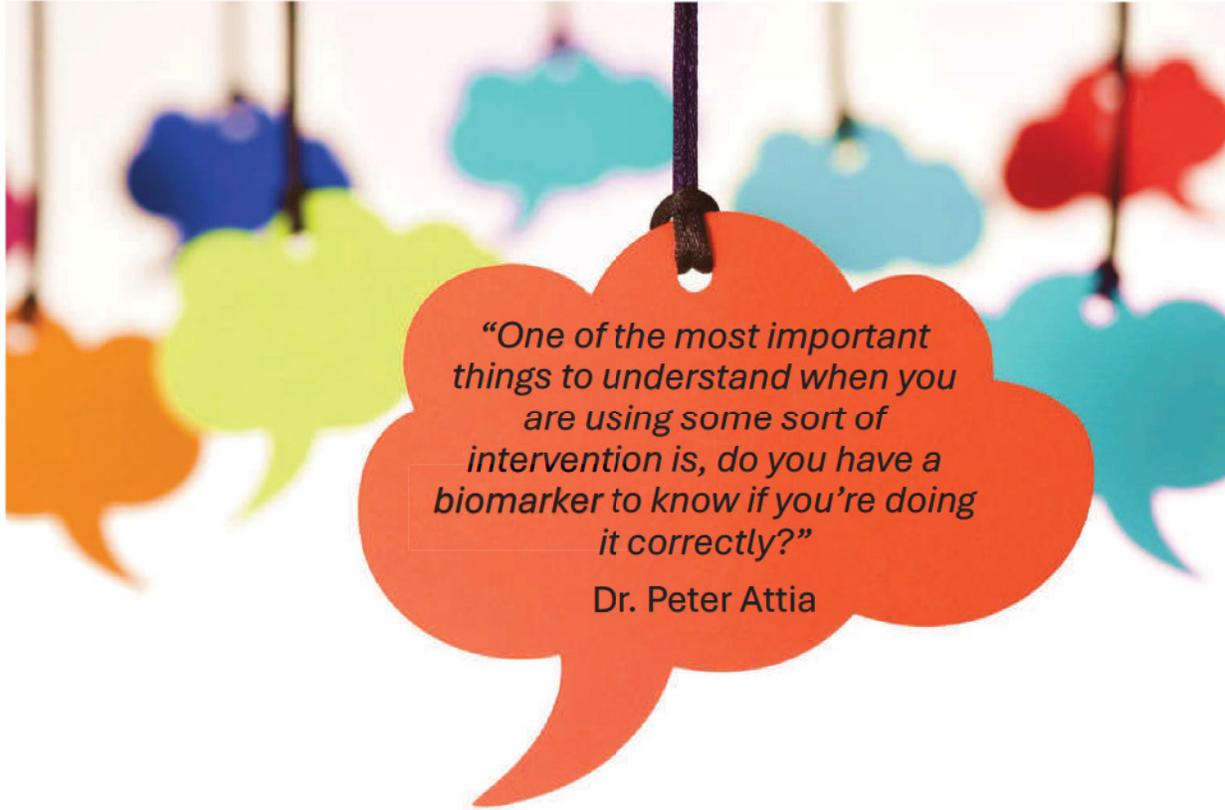
- Immune reboot
 - Immune health/resilience
- Inflammation
- Microbiome
- Mitochondrial dysfunction
- Fascial injuries
- Vagus nerve tone
- Telomere shortening
- Loss of muscle mass
- Disrupted nutrient sensing:
 - Insulin signaling
 - mTOR pathway
 - AMPK
 - Sirtuins
- Compromised autophagy
 - Zombie/senescent cells

Adapted from Hallmarks of Aging. Cell, 6 June 2013

Hallmarks of aging



C López-Otín, MA Blasco, et al.
Hallmarks of aging: An expanding universe.
Cell, 19 January 2023;186(2):243-278



Biomarkers for longevity

- IL-1 β
- IL-6
- IL-8
- TNF- α
- hs-CRP, CRP
- Hemoglobin A1C
- Vitamin D test
- ApoE-4
- LPS
- ApoB/LP(a)
- Omega-3 Index test
- Blood pressure
- Body composition/FFMI
- Vo2 Max
- Max grip strength
- HOMA-IR
- Mitochondrial dysfunction:
 - MDA, ROS
 - SOD, GPx
- Zonulin

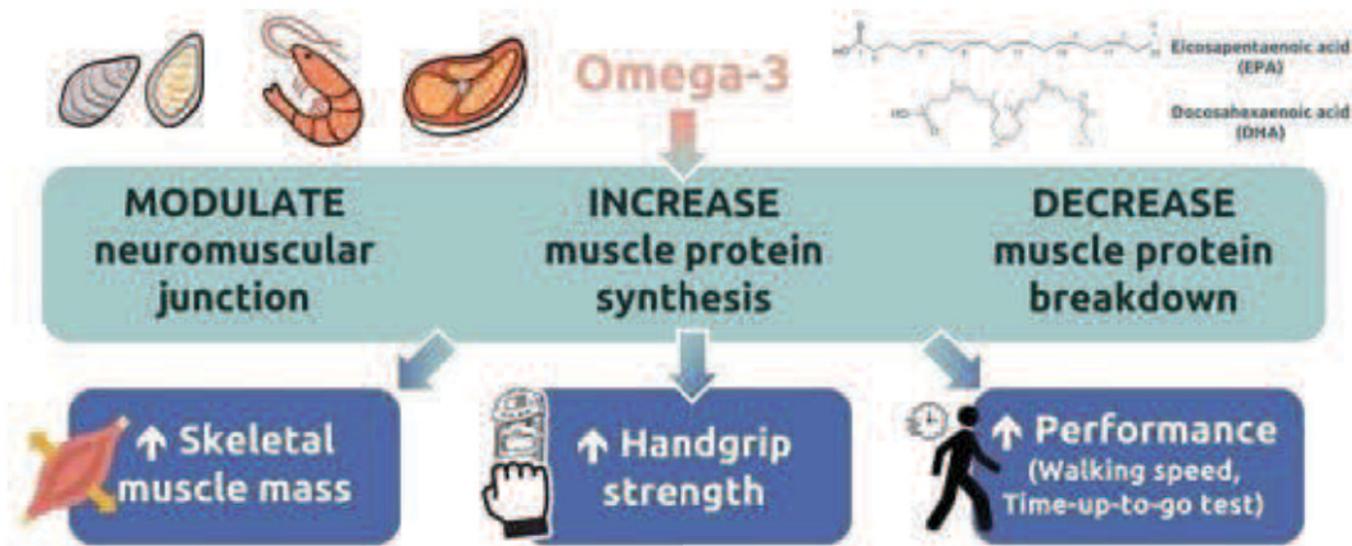
Adapted from **Ranking Biomarkers of Aging by Citation Profiling and Effort Scoring**. *Front Genet*, 21 May 2021;12

Longevity

Groundbreaking study – utilizing precise accelerometer data from the National Health and Nutrition Examination Survey – unveiled remarkable finding: Our daily **movement patterns** serve as single most powerful indicator of longevity



A Leroux, E Cui, E Smirnova, et al. **NHANES 2011-2014: Objective Physical Activity Is the Strongest Predictor of All-Cause Mortality.** *Medicine & Science in Sports & Exercise*, October 2024;56(10):1926-1934



The Effect of Omega-3 Fatty Acids on Sarcopenia: Mechanism of Action and Potential Efficacy. *Marine Drugs*. 2023; 21(7):399

Low vit. D linked to muscle loss

- Overall results showed those with higher vitamin D levels had more muscle mass
- Held true even accounting for factors that impact vitamin D status (e.g. race and time of year) and muscle mass (e.g. age, physical activity and weight)

Ren, Q., Liang, J., et al. (2025). **A Causal Effect of Serum 25(OH)D Level on Appendicular Muscle Mass: Evidence From NHANES Data and Mendelian Randomization Analyses.** *Journal of Cachexia, Sarcopenia and Muscle*, 16(2), e13778

“You are only as young as your immune system”



Mastering the Longevity Code: “Immune Resilience” Is Key to Resisting Disease and Living Longer



- Ground-breaking research study introduces concept of “immune resilience”
- Term represents ability to withstand/bounce back from infections and inflammatory stressors
- Using novel metrics – quantified the varying degrees of immune resilience among individuals
- Findings – not solely age-dependent and can affect lifespan/health outcomes

Ahuja, S.K., Manoharan, M.S., Lee, G.C. *et al.* Immune resilience despite inflammatory stress promotes longevity and favorable health outcomes including resistance to infection. *Nat Commun* **14**, 3286 (2023). <https://doi.org/10.1038/s41467-023-38238-6>

Immunocompetence

Ability of an organism’s immune system to effectively recognize and respond to foreign antigens, ultimately controlling infection and preventing disease

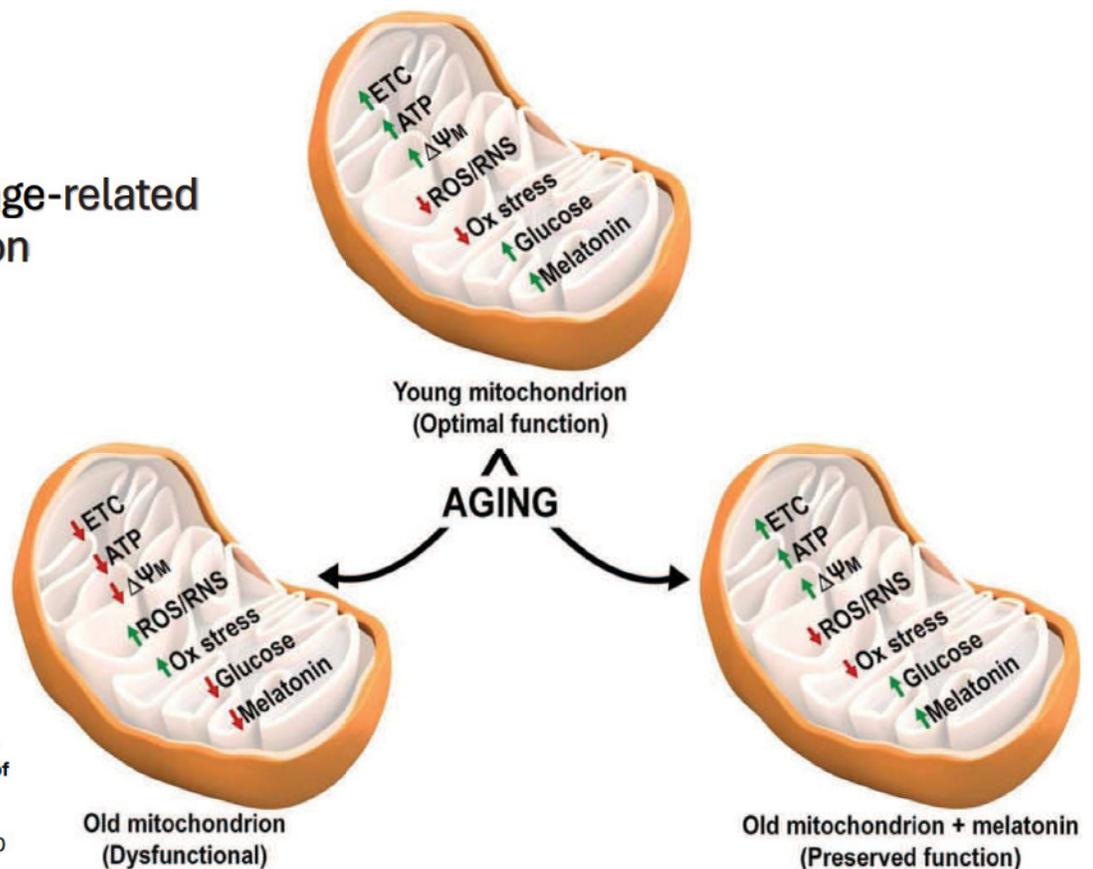


Longevity

- Immune system resilience:
 - Reduced inflammaging
 - Preserved immune cell function
 - Centenarians exhibit lower IL-6 levels, higher IL-10
 - Maintained T cell proliferation
 - Balance between pro-inflammatory Th17 and regulatory T cells
 - Environmental and lifestyle factors:
 - Gut microbiota
 - Exercise

FQ Yin, FH Xiao, QP Kong. **Factors involved in human healthy aging: insights from longevity individuals.** *Front Med*, 22 March 2015;19:226–249

Dysfunctional mitochondria in age-related neurodegeneration

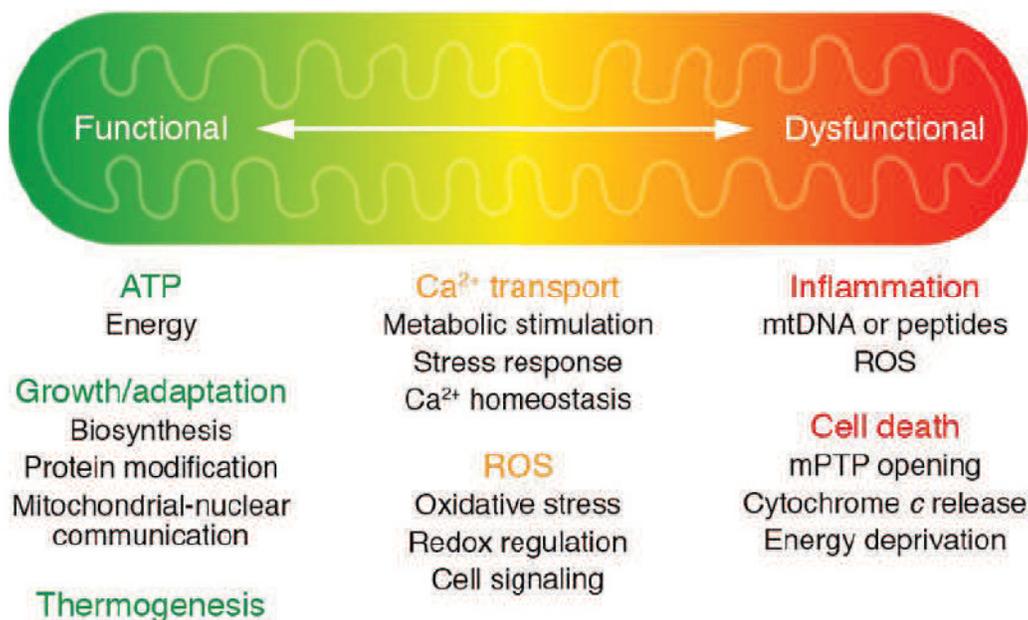


Dysfunctional mitochondria in age-related neurodegeneration: Utility of melatonin as an antioxidant treatment. *Ageing Research Reviews*, November 2024;101:102480

Mitochondria/inflammation

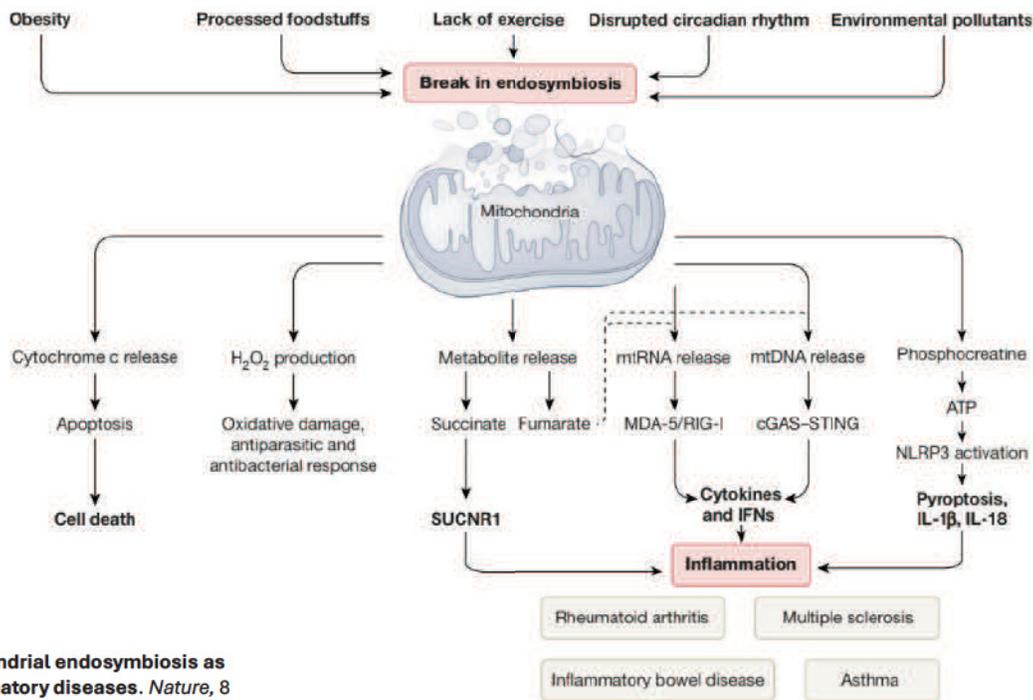
- Damaged mitochondria can become “leaky”
- Releases mitochondrial DNA (mtDNA) into the circulation and causes inflammation
- Inflammation can also be seen as stressor for mitochondrial damage
- It’s a circuit loop between these two pathways

Overview of mitochondrial function in health and disease



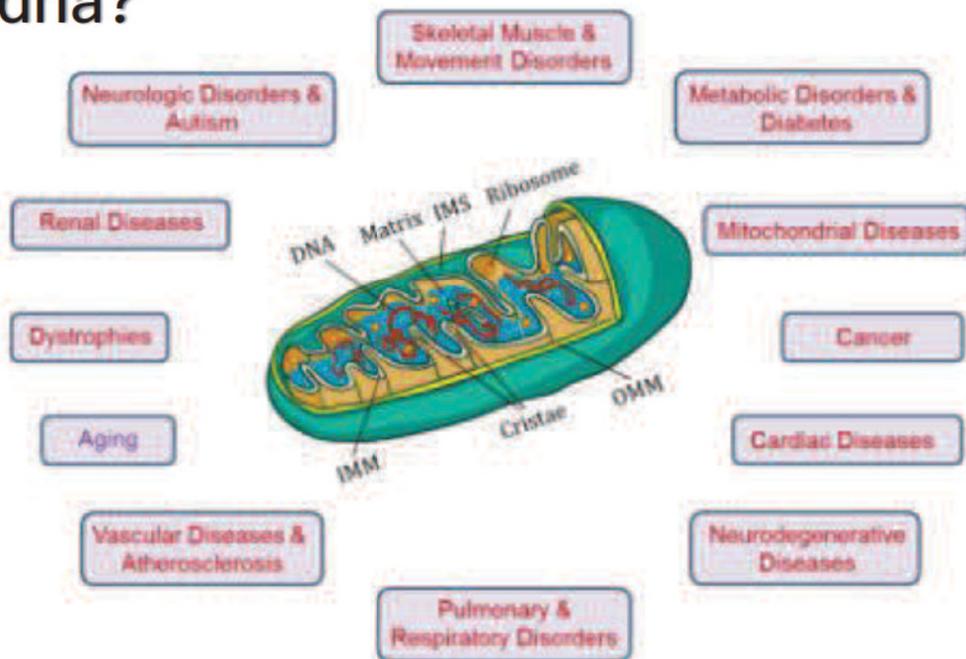
Mitochondrial dysfunction in pathophysiology of heart failure. *Journal of Clinical Investigation*, 20 Aug 2018;128

How breakdown in endosymbiosis can lead to inflammation



A break in mitochondrial endosymbiosis as a basis for inflammatory diseases. *Nature*, 8 February 2024;626:271–279

What diseases are affected by the mitochondria?



Mitochondria – secretly helping fight bacteria

- Mitochondria – energy-producing components of cells
- Involved in immune function:
 - Controlling inflammation
 - Regulating cell death
 - Responding to infections
- They sense bacterial activity and help neutrophils – trap and kill

Wise, A. D., TenBarge, E. G., Mendonça, J. D., et al. **Mitochondria sense bacterial lactate and drive release of neutrophil extracellular traps.** *Cell Host & Microbe*, 12 March 2025;33(3):341- 357.e9

Mitochondria – secretly helping fight bacteria (cont'd)

- Dysfunctional mitochondria leads to weaken immune defense
- Neutrophils are most abundant immune cell and are immune system's first responder
- Key defense mechanism is neutrophil extracellular trap release (NETosis)
- Mitochondria can detect specific bacterial by-product – lactate – and use signal to initiate NETosis formation

Wise, A. D., TenBarge, E. G., Mendonça, J. D., et al. **Mitochondria sense bacterial lactate and drive release of neutrophil extracellular traps.** *Cell Host & Microbe*, 12 March 2025;33(3):341- 357.e9

Mitochondria – secretly helping fight bacteria (cont'd)

- Once bacteria are engulfed by phagosome, neutrophils can sense the presence of lactate
- When mitochondria's ability to sense lactate is compromised, neutrophils fail to produce NETosis effectively
- Bacteria is now more likely to escape capture and proliferate
- This is crucial mechanism to immune defense

Wise, A. D., TenBarge, E. G., Mendonça, J. D., et al. **Mitochondria sense bacterial lactate and drive release of neutrophil extracellular traps.** *Cell Host & Microbe*, 12 March 2025;33(3):341- 357.e9

Mitochondrial biogenesis

- Multiple research – LLLT can improve mitochondrial biogenesis
- Stimulates production of new mitochondria within cells
- Primarily by activating cellular pathways that lead to increased mitochondrial replication and function when exposed to specific wavelengths of light
- Mechanism – LLLT is believed to interact with mitochondria by directly stimulating the ETC, leading to increased ATP production and signaling pathways that trigger mitochondrial biogenesis

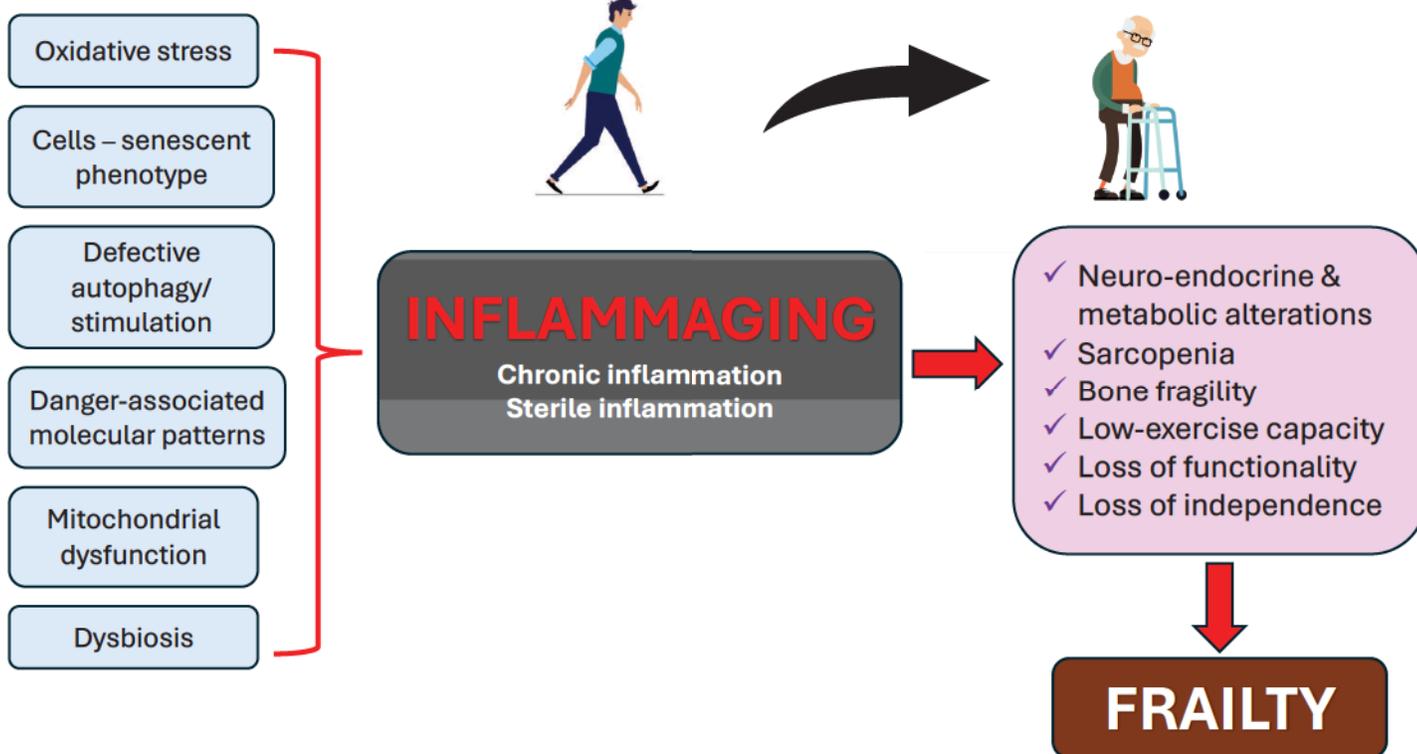
Ferraresi C, Kaippert B, Avci P, et al. **Low-level laser (light) therapy increases mitochondrial membrane potential and ATP synthesis in C2C12 myotubes with a peak response at 3-6 h.** *Photochem Photobiol.* 2015 Mar-Apr;91(2):411-6

MANAGE



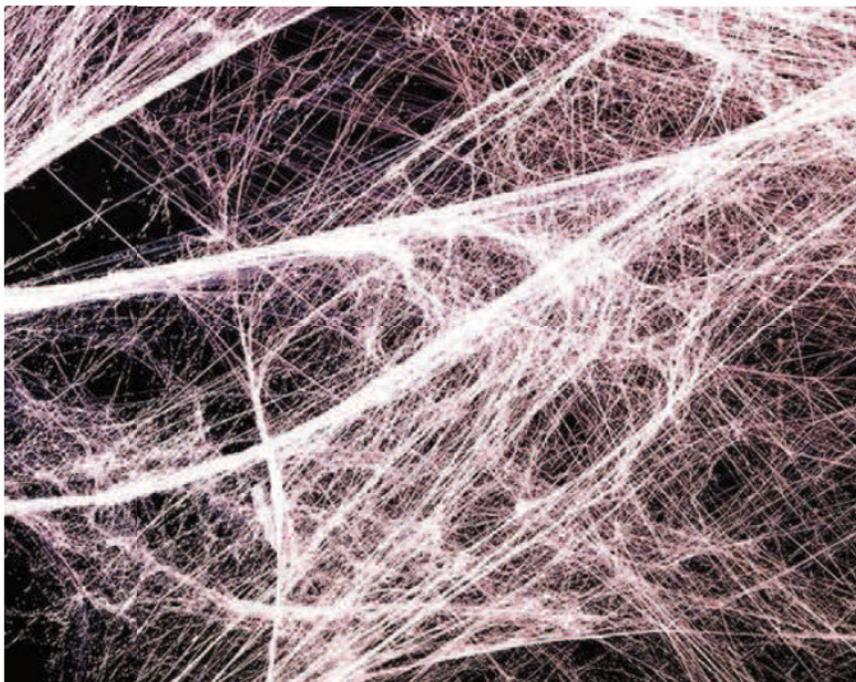
MODULATE

INFLAMMAGING



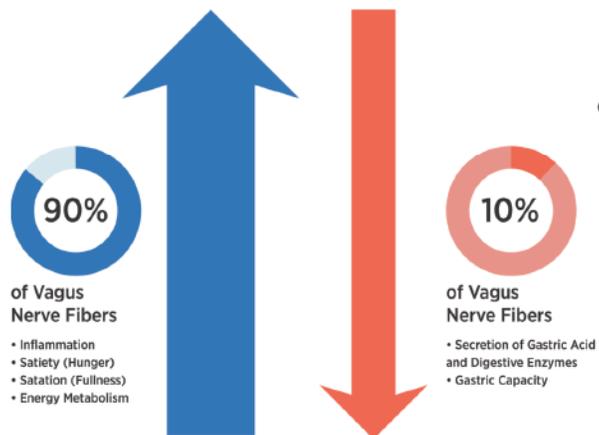
Fascia

- Living matrix
- Full-body “wetsuit”
- Connective tissue
- Sheath in the body
- Below skin and above muscle
- Lymph nodes live in fascia
- Nerves are in fascia
- Our sensory organ
- Meridians in fascia
- Accounts for 20% of body mass

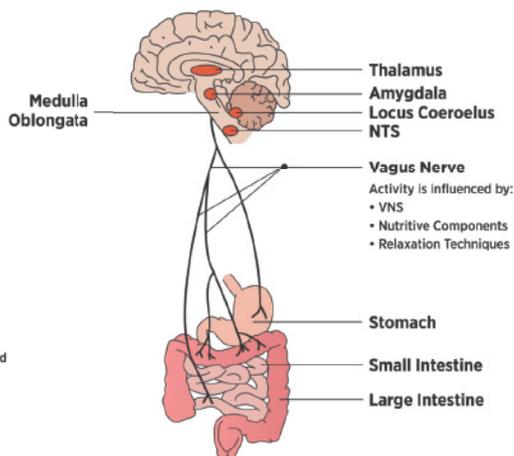


BASIC ANATOMY AND FUNCTIONS OF THE VAGUS NERVE

AFFERENT & EFFERENT CONNECTIONS



ANATOMY



DISORDERS

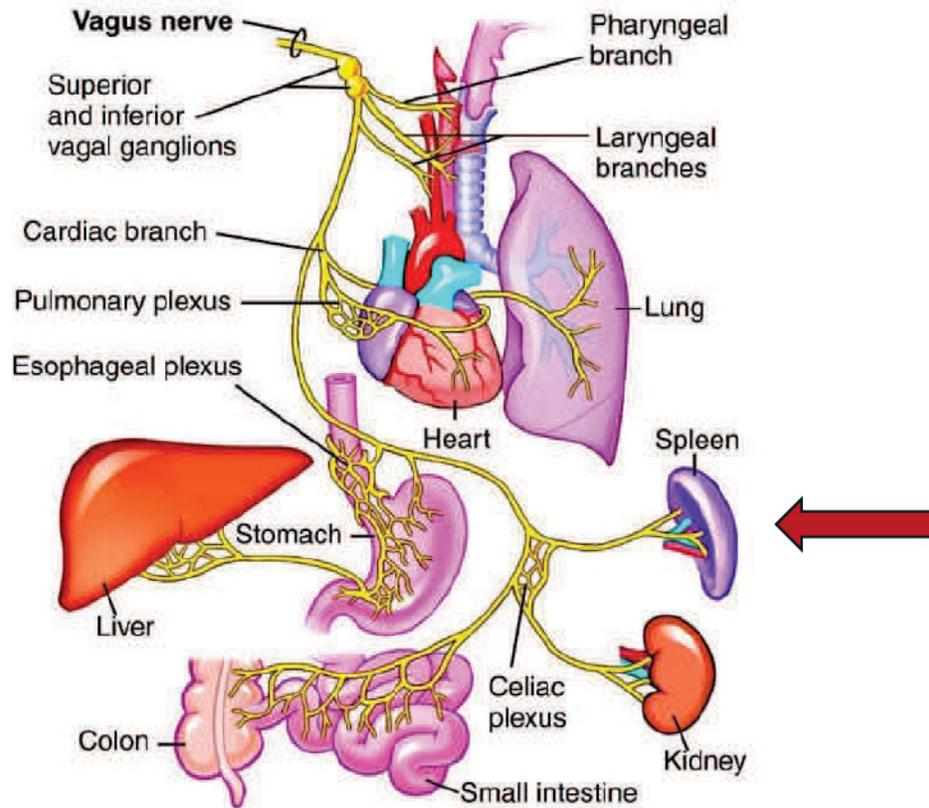
Psychiatric Disorders

- Major Depression
- PTSD

Inflammatory GI Disorders

- Ulcerative Colitis
- Crohn's Disease

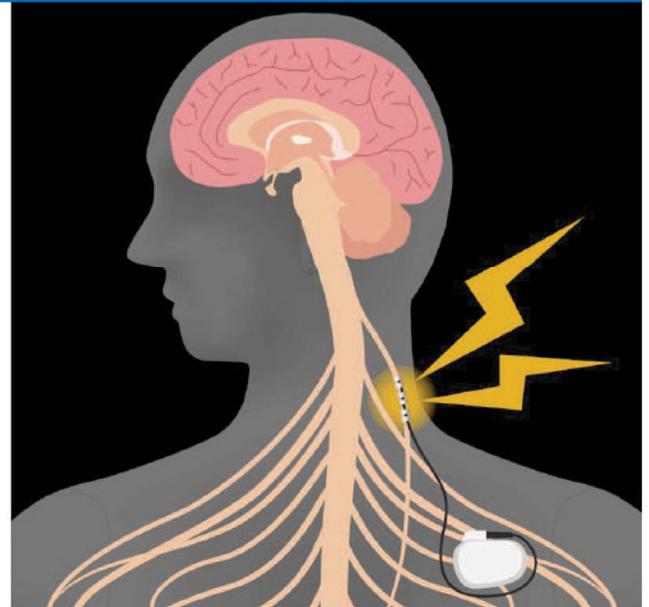
Frontiers in Neuroscience. Feb 7, 2018;12:1-8



VAGUS NERVE STIMULATION DRAMATICALLY REDUCES INFLAMMATION

Stimulating vagus nerve:

- Acetylcholine
- Reduces inflammation
- Improves outcomes in RA
- Inhibits cytokine production



Psychology Today. July 6, 2016

VNS in musculoskeletal diseases

Findings:

- In rheumatoid arthritis (RA) patients, VNS shown to dampen inflammatory response of circulatory peripheral cells
- Limit fatigue in Sjogren's syndrome and systemic lupus
- Decrease pain in fibromyalgia
- Decrease pain in erosive hand osteoarthritis

Courties A, Berenbaum F, Sellam J. **Vagus nerve stimulation in musculoskeletal diseases.** *Joint Bone Spine.* 2021 May;88(3):105149. Epub 2021 Feb 3

Vagus nerve stimulation/depression

- Clinical trial: 493 adults – major depression hadn't previously responded to treatments
- Patients followed for 10 months
- Patients received stimulation showed **improvements** in:
 - Depressive symptoms
 - Quality of life
 - Ability to carry out daily tasks in everyday life

CR Conway, ST Aaronson, et al. **Vagus nerve stimulation in treatment-resistant depression: A one-year, randomized, sham-controlled trial.** *Brain Stimulation,* 18 December 2024

VAGUS NERVE AT THE INTERFACE OF MICROBIOTA-GUT-BRAIN AXIS

- A low vagal tone:
 - Seen in IBS and IBD thus favoring peripheral inflammation
 - Decreased secretion of hydrochloric acid
 - Decreased secretion of pancreatic enzymes
 - Reduced activity of parietal cells
 - Reduced bile secretion
- Targeting the VN through stimulation would be of interest to restore homeostasis in the microbiota-gut-brain axis

Frontiers in Neuroscience. Feb 7, 2018;12:1-8

L. reuteri and Autism

- *L. reuteri* has successfully reversed deficits in social behavior associated with autism
- Works via a mechanism that involves the vagus nerve and oxytocin-dopamine reward system
- When vagus nerve was severed, *L. reuteri* effect was rendered ineffective

Martina Sgritta, et al. *Mechanisms Underlying Microbial-Mediated Changes in Social Behavior in Mouse Models of Autism Spectrum Disorder*, *Neuron* 2018

Vagus nerve: lifestyle hacks

- Physiological sigh
- Submerging your face in freezing water
- Placing ice-pack on your chest
- Cold plunge

Rationale:

Sudden exposure to cold induces activation of the PNS

- Vagus nerve massage - stroking and twisting trapezius muscle by gripping between the trap. and SCM
- Massage increases HRV

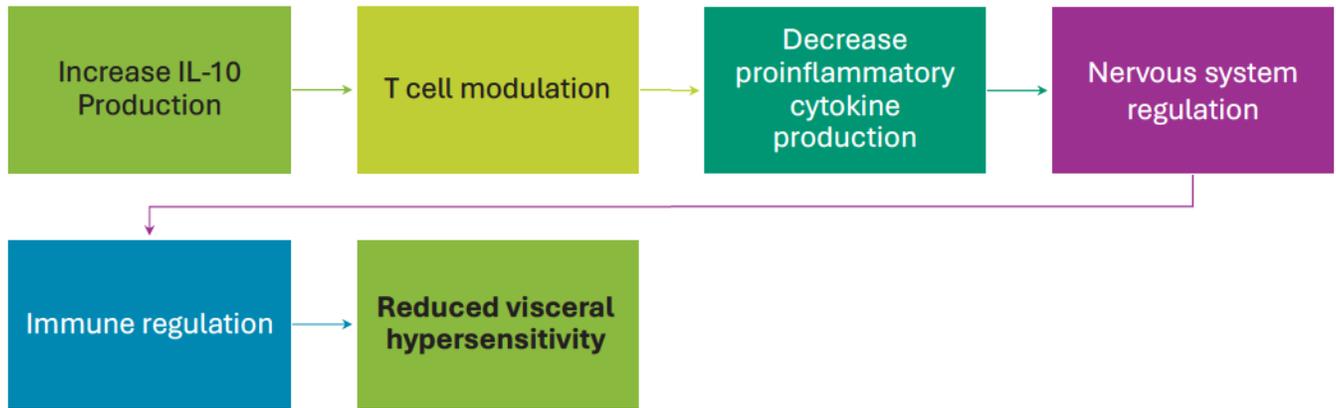
Today's Practitioner, 30 November 2023

VAGUS NERVE NUTRITIONAL SUPPORT

Function
Vagally-mediated probiotics
Short-chain fatty acids (butyric acid) - direct effect on afferent sensory firing
Fiber – increases GLP-1
Increase bile acid flow
Omega-3 fatty acids – increases HRV
L-citrulline – increases HRV
Time-restricted eating (TRE)
Sleep more

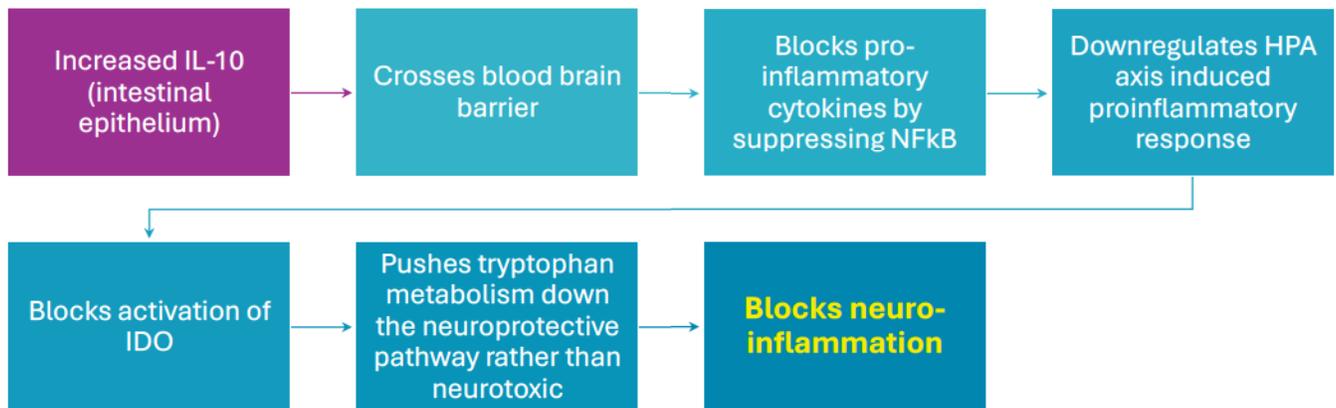
Metabolism. 2012 Sept;61(9):1312-20. Epub 2012 Mar 24
Mol Metab. 2014 Sept;3(6):595-607. Epub 2014 Jun 27

B. longum 35624 Mechanisms Summary



Disclaimer: This product is a dietary supplement and is not intended to diagnose, treat, cure, or prevent any disease. Statements reflect the speaker's views and not those of Microbiome Labs.

B. longum 1714 Mechanisms Summary



Disclaimer: This product is a dietary supplement and is not intended to diagnose, treat, cure, or prevent any disease. Statements reflect the speaker's views and not those of Microbiome Labs.

Vagus nerve demo

The perfect 10



Avoiding sarcopenia

- 1-2% muscle lost each year after age 40
- May lose 25% muscle mass by 65
- Less muscle mass leads to inability to efficiently dispose of glucose
- Microbiome modulation:
 - Probiotics aid in muscle recovery and growth
 - Production of SCFA
 - Impact muscle fatigue and recovery



MUSCLE MASS

= organ of longevity

Peter Attia's "4 Pillars" of fitness

1. Strength:

- Foundation of longevity
- 50% of your workout
- Shows up in practical applications of daily life:
 - Deadlifts, squats, shoulder presses, farmer's walk, pull-ups, push-ups, and lunges

2. Stability:

- Can help prevent injury as we age
- Being able to control your body:
 - 1-minute plank, balance on one leg
- Exercise choice: goblet squat

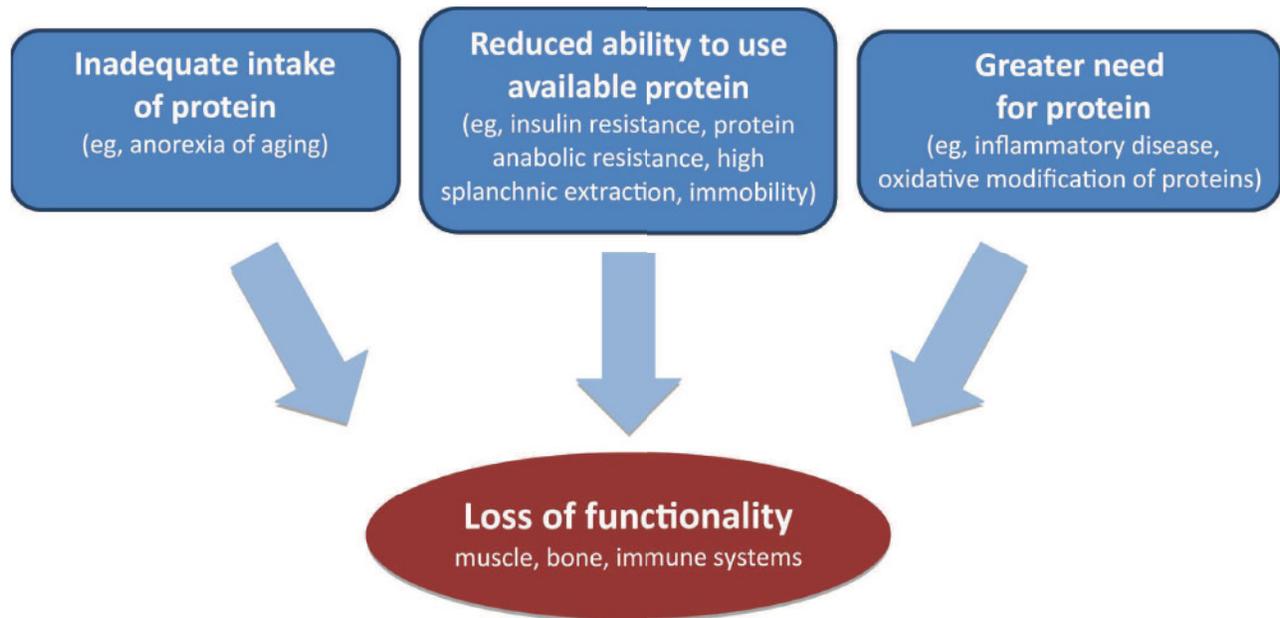
3. Low-intensity cardio:

- Boosts heart health/stay healthy
- Promotes mitochondria biogenesis

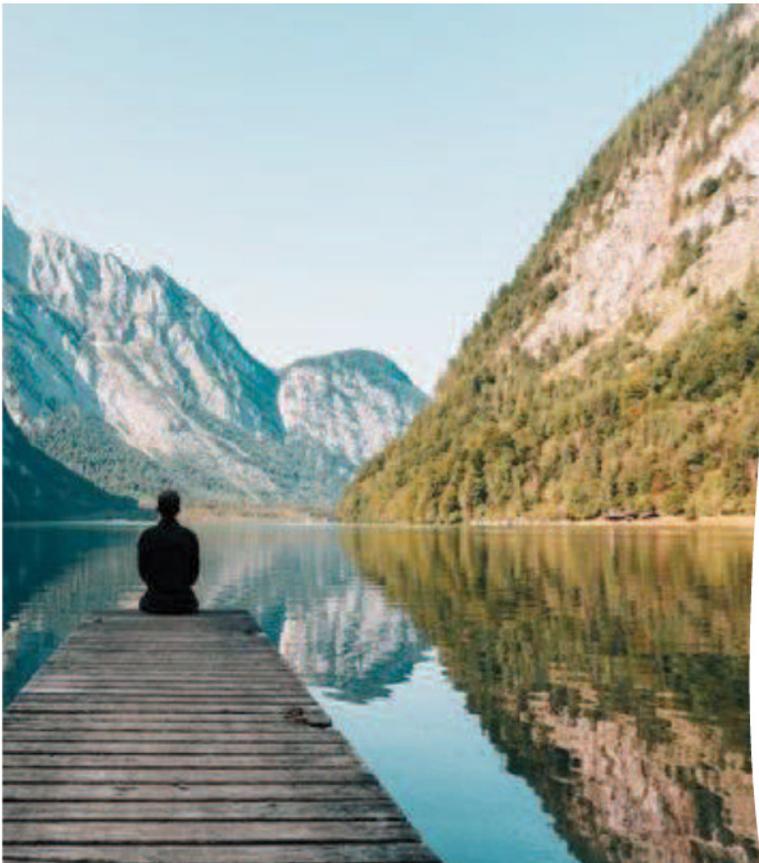
4. Intense exercise:

- Small doses increase lifespan
- Climbing multiple flights of stairs, "rucking", measure VO2 max

Aging-related causes of protein shortfall

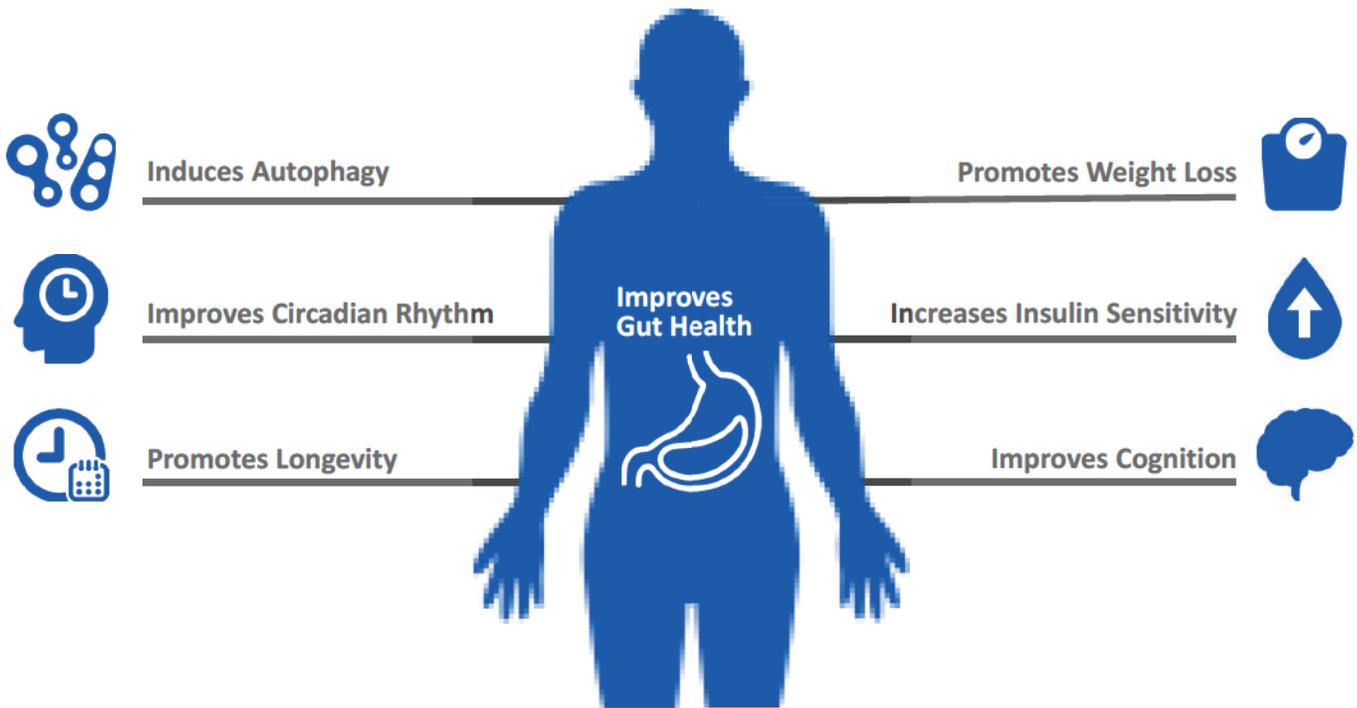


Evidence-Based Recommendations for Optimal Dietary Protein Intake in Older People: A Position Paper From the PROT-AGE Study Group. *J Am Med Dir Assoc*, August 2013;14(8):542-559



“Fasting is the greatest remedy, the physician within”
Paracelsus

Benefits of Fasting (TRE)



Intermittent/periodic fasting

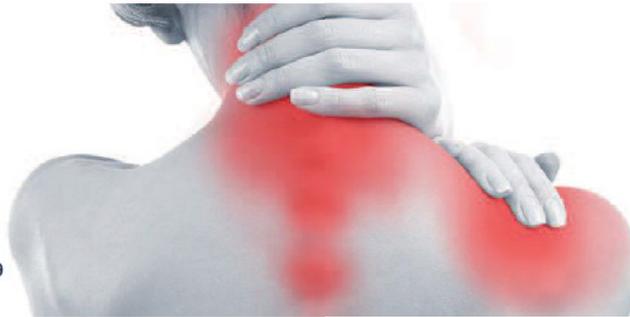
- Time restricted eating: 12 – 16 hours/day
- 24 – 72 hour/week-long fasts
- Fasting mimicking diets (800 cal/d x 5d)
- Ketogenic diets
- 5:2 Diets

Benefits:

- Inhibits mTOR
- Reduces insulin signaling, improves insulin sensitivity
- Activates AMPK
- Activates sirtuins
- Activates PGC-1 alpha and FOXO
- Activates autophagy and cell repair
- Stem cell renewal

Fasting reduces inflammation and improves chronic inflammatory diseases

- Mt. Sinai researchers: fasting reduces inflammation and improves chronic inflammatory diseases without affecting the immune system's response to acute infections
- Intermittent Fasting (IF): reduced the release of “monocytes”. These cells go into “sleep mode” and are less inflammatory than those found when fed



Cell, Mt. Sinai Hospital, Aug 22, 2019



Dr. Rob's leading-edge nutrients for longevity

- Akkermansia
- Creatine
- XOS
- NAD
- Pro-Resolving Mediators
- PEA
- BPC-157

What is BPC-157?

A peptide referred to as
“**Wolverine**” supplement
– amazing healing capabilities

BENEFITS

- Speeds up tissue healing and recovery
- Promotes joint and tendon health
- Aids in angiogenesis - the regeneration of blood vessels
- Reduces the risk of oxidative stress
- Helps in the regulation of blood pressure
- Protects the gut and prepares damages caused by excessive NSAID intake, IBS, short bowel syndrome, ulcers
- Reduces post-workout pain
- Improves gum or periodontal disease
- Accelerates bone healing

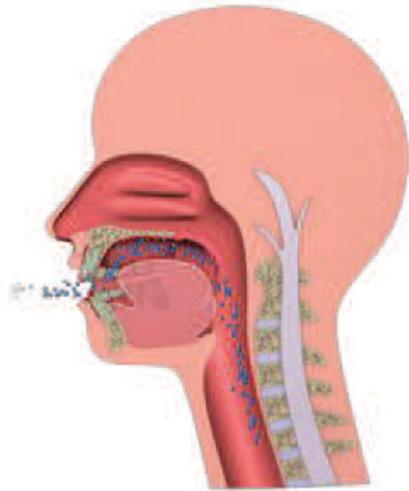
Longevity

First-time study investigated how the epigenetic clock reacts to targeted treatment. Participants too:

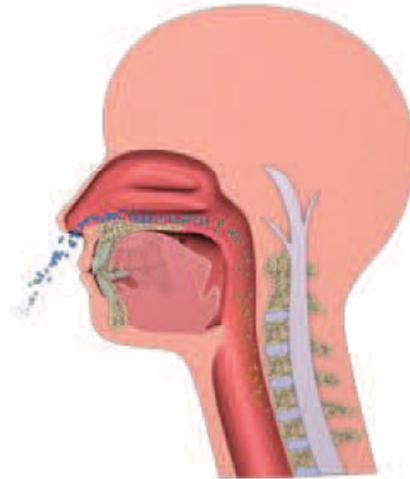
- 2,000 IU vitamin D
- 1 g Omega-3 (Algae)
- 30 mins strength training, 3 x per week

This combination reduced risk of infections and falls, prevented cancer and premature frailty

Mouth breathing vs. Nose breathing



MOUTH BREATHING
Incorrect Breathing Habit



NOSE BREATHING
Correct Breathing Habit

Breathing

- Our body is designed to release 70% of its toxins through breathing

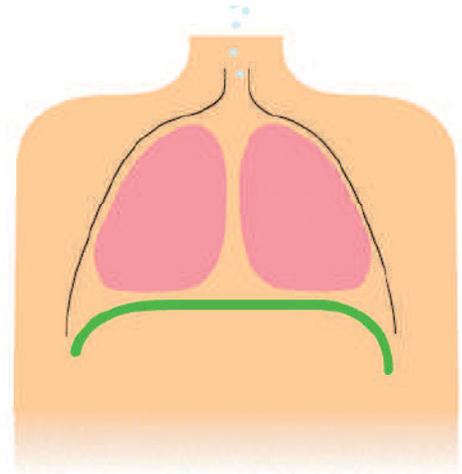
Immunity

- Nose breathing – more beneficial than mouth breathing
- Breathing through nose can help filter out dust and allergens
- Nasal breathing warms, filters, and humidifies inhaled air before it recycles in the lower respiratory tract
- Helps reduce pathogen load

<https://www.healthline.com/health/nose-breathing>

Phrenic nerve

- If you lose 10 lbs of fat, precisely 8.4 lbs comes out through your lungs and the remaining 1.6 lbs turns into water
- Fat is converted to carbon dioxide and water. You exhale the CO₂



Sauna affect on CV risk

- Improves body's circulation
- Decreases BP
- Decreases inflammation and oxidative stress

T Laukkanen, SK Kunutsor, H Khan, et al. **Sauna bathing is associated with reduced cardiovascular mortality and improves risk prediction in men and women: a prospective cohort study.** *BMC Med*, 29 November 2018;16:219

How often?

2-3 x per week – decreases CV risk by 27%

5-7 x per week – decreases CV risk by 50%

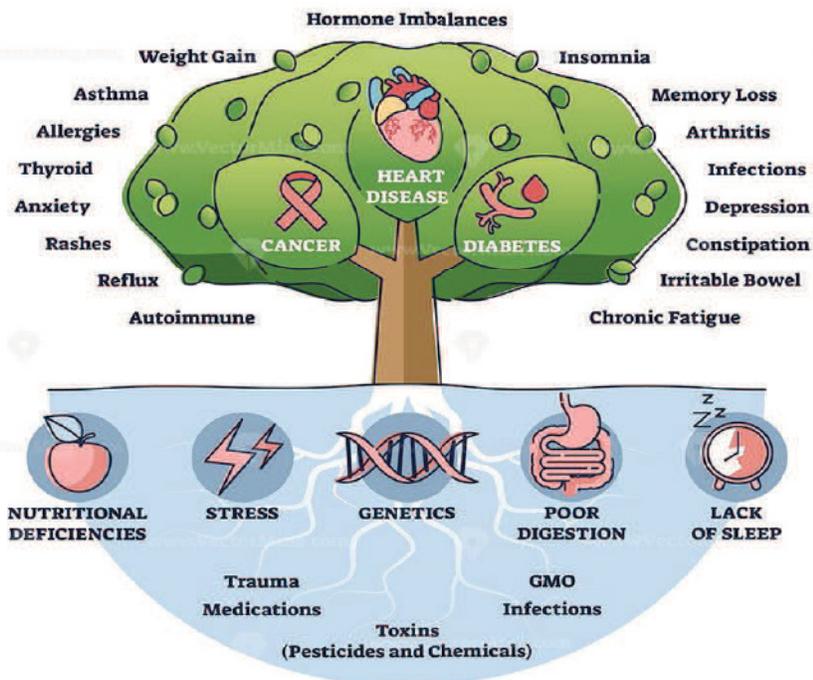
How long?

19 mins. cut-off

11-19 still gives significant CV decrease

FUNCTIONAL MEDICINE

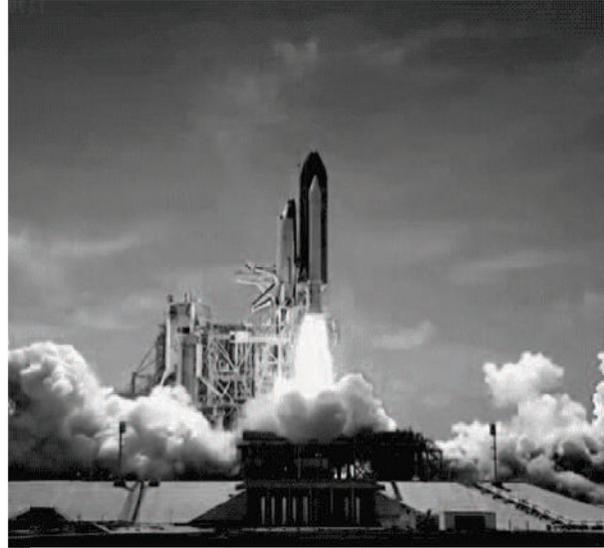
✚ LOOKS FOR THE ROOT CAUSE ✚



Is it root cause, or
root causes
resolution?

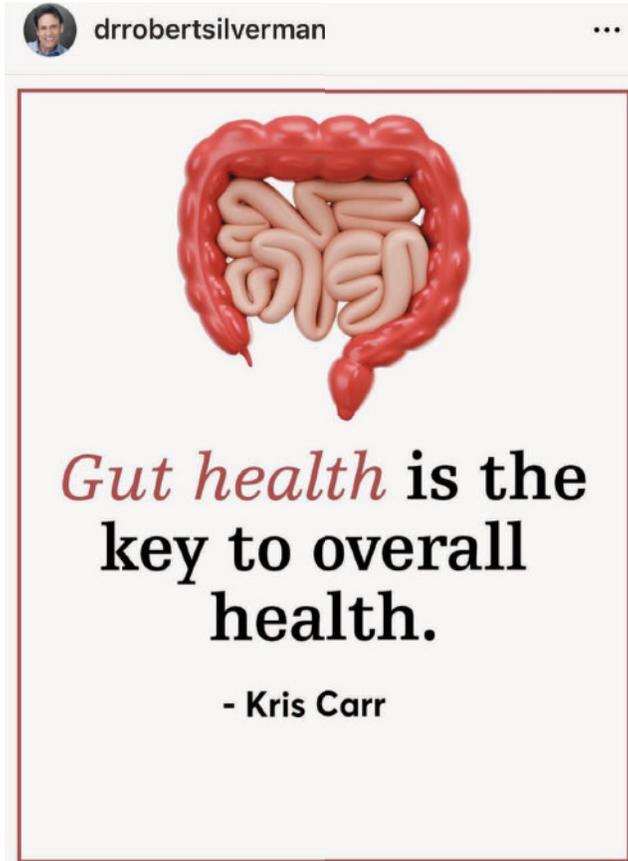
Concept

N-of-1

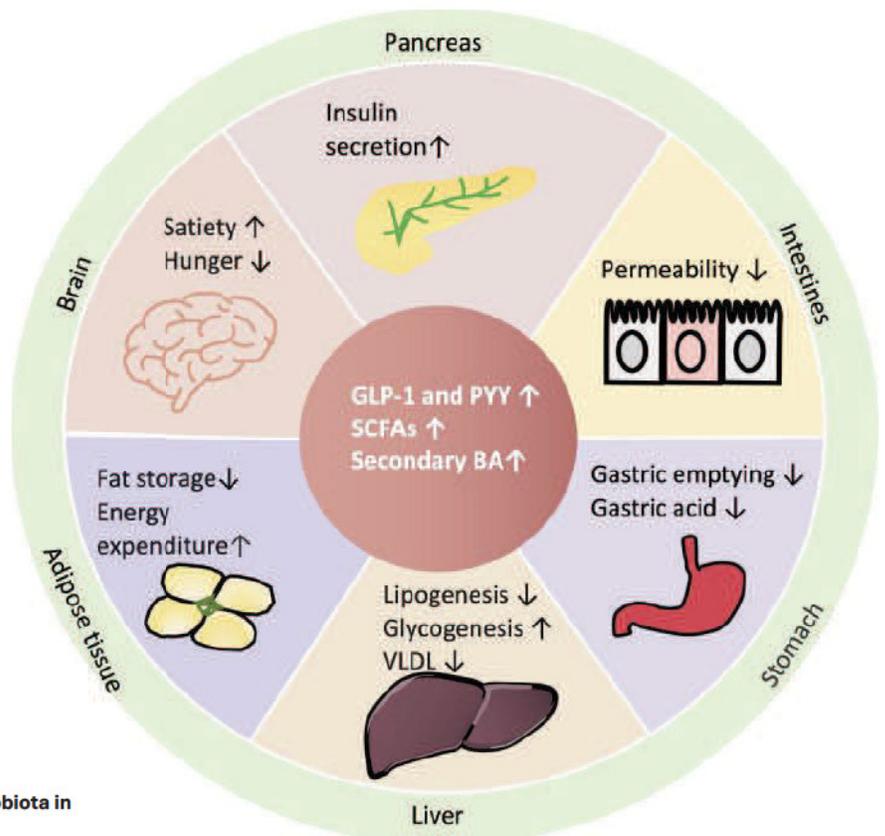


Dr. Rob's longevity hacks

- 1) Nutrition – food “[Food is medicine](#)”
- 2) Dramatically reduce sugar, starch, ultra-processed foods intake
- 3) Exercise – incorporate resistance training
- 4) Sleep
- 5) Health detectables
- 6) Meditate
- 7) Intermittent fasting
- 8) Breathwork
- 9) Purpose/mission/community
- 10) Hormesis - hot and cold exposure
- 11) Supplements
- 12) Methylation
- 13) Gut barrier health/body composition
- 14) Low-level laser**

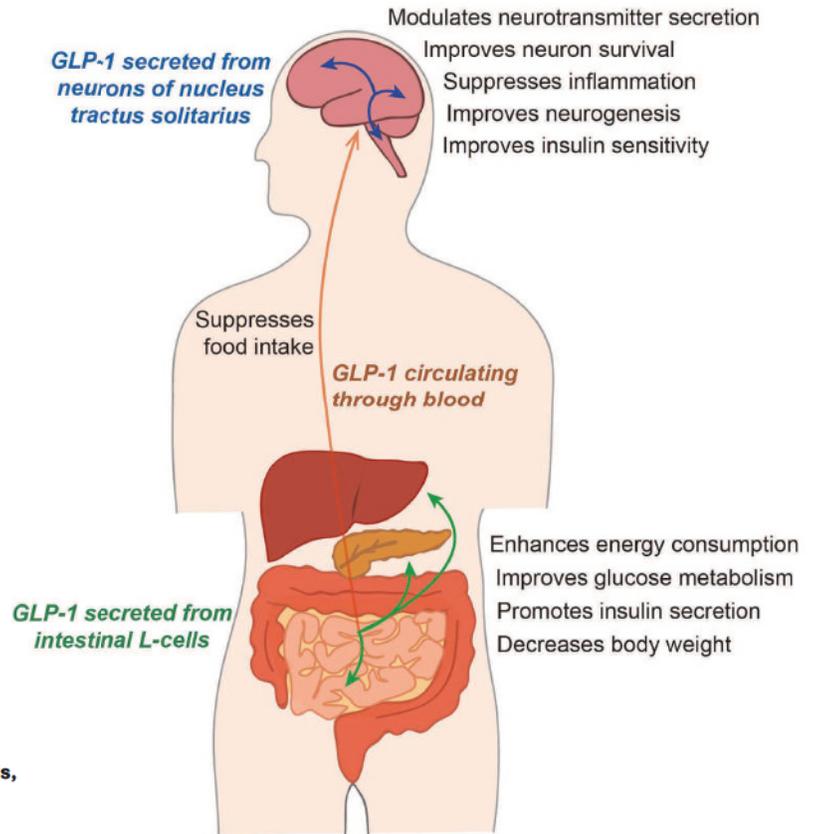


Physiological benefits of gut peptides and gut microbiota metabolites



Crosstalk between glucagon-like peptide 1 and gut microbiota in metabolic diseases. *mBio*. 2024 Jan 16;15(1):e0203223

Function of glucagon-like peptide 1 (GLP-1) in humans



Alleviation of Depression by Glucagon-Like Peptide 1 Through the Regulation of Neuroinflammation, Neurotransmitters, Neurogenesis, and Synaptic Function. *Frontiers in Pharmacology*, 13 August 2024;11: 560086

What is GLP-1? (cont'd)

GLP-1:

- Released within 15-30 minutes after eating
- Allows pancreas to secrete insulin
- Suppresses release of glucagon
- Moderates leptin
- Slows gastric emptying
- Decreases the speed of glucose entering blood stream

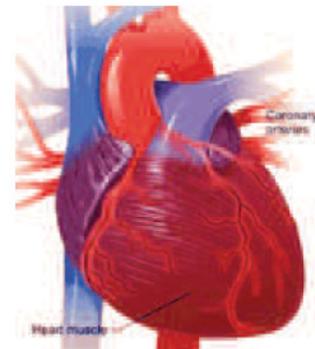
Ozempic

- Over 1,000 genes play a role in obesity
- Obesity – disease of the brain
- Diminishes food chatter
- Send post-nutrient hormones to gut, brain, pancreas
- Allows for satiety
- Disrupts brains' reward center

CNN – special report. “Is Ozempic Right For You.”

Ozempic/heart muscle

- Lose skeletal muscle mass
- Heart muscle mass reduction
- Heart muscle cell reduction
- Both occur whether lean or not

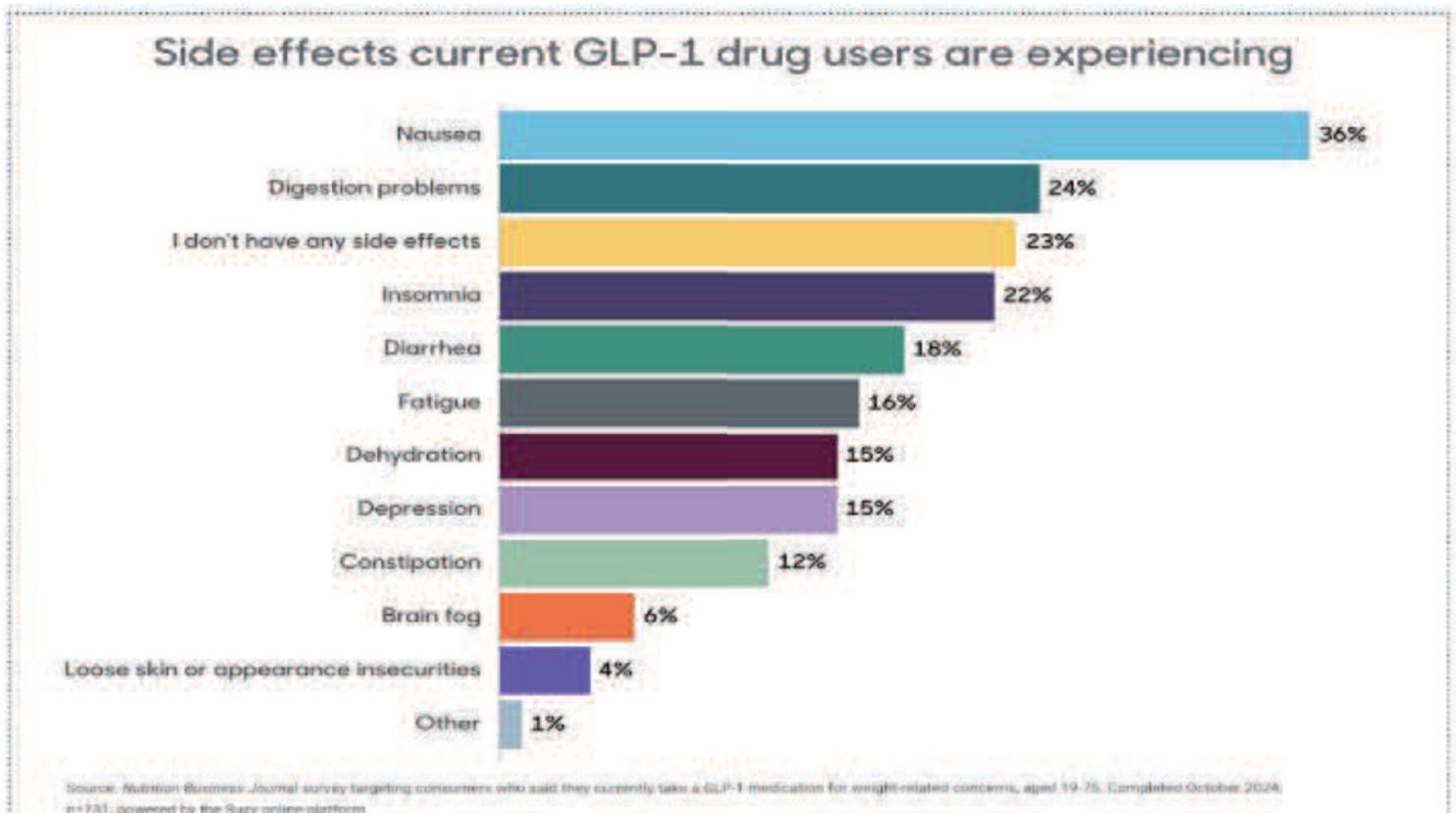


MD Martens, Y Abuetabh, et al. **Semaglutide Reduces Cardiomyocyte Size and Cardiac Mass in Lean and Obese Mice.** *JACC: Basic to Translational Science*, December 2024;9(12):1429-1431

Muscle mass loss: Effects of medically induced weight loss on skeletal muscle

- GLP-1 receptor agonists
- Approximately 40% muscle mass loss over 36-72 weeks on meds
- Age-related muscle loss – 0.8% per year based on 8% muscle loss per decade from ages 40-70 years
- Non-pharmacological caloric restriction 10-30% of muscle loss

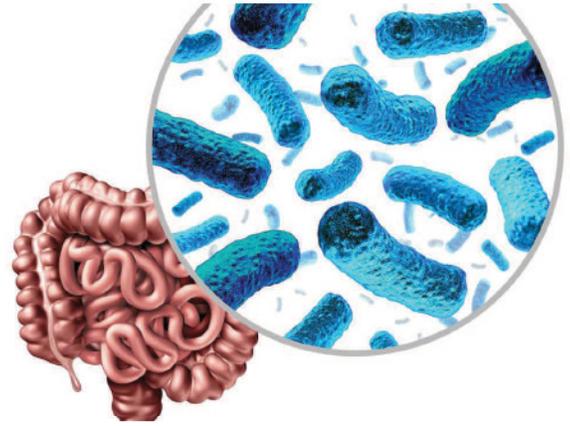
Prado, Carla M et al. **Muscle matters: the effects of medically induced weight loss on skeletal muscle.** *The Lancet Diabetes & Endocrinology*, November 2024;12(11):785-787



GLP-1/SIBO

Researches suggest – link between GLP-1 use and increased risk of SIBO due to:

- Decreased gut motility
- Changes in gut microbiome



NW Carris, S Wallace, et al. 2024. **Discontinuing semaglutide after weight loss: strategy for weight maintenance and a possible new side effect.** *Canadian Journal of Physiology and Pharmacology*. 102(6): 391-395

Kato S, Sato T, Fujita H, et al. **Effects of GLP-1 receptor agonist on changes in the gut bacterium and the underlying mechanisms.** *Sci Rep*. 2021 Apr 28;11(1):9167

A hand holding a magnifying glass over a collage of text. The magnifying glass is focused on the text 'GLP-1' and 'Semaglutide'. Other visible text includes 'Drug', 'obesity', 'Weight loss', and 'Diabetes'.

GLP-1 and the paradox of fat cell growth during weight loss

GLP-1 promotes overall fat reduction, also stimulates growth and differentiation of new fat cells (adipogenesis)

T Bu, ZY Sun, Y Pan, et al. **Glucagon-Like Peptide-1: New Regulator in Lipid Metabolism.** *Diabetes & Metabolism Journal* 2024;48(3):354-372

GLP-1 factoids

- GI tract – largest hormone-secreting gland in our body
- Releases more than 20 different peptide hormones
- GLP-1 lines both gut and brain
- GLP-1 drug trials:
 - 52 weeks duration
 - Led to 19 lbs. weight loss (Ozempic)
 - Wegovy (high dose Ozempic) lost 27 lbs. and 3.5 in. off waist
 - Mounjaro – 45 lbs.; 5.5 in. off waist
- Weight loss **stalls** after a year



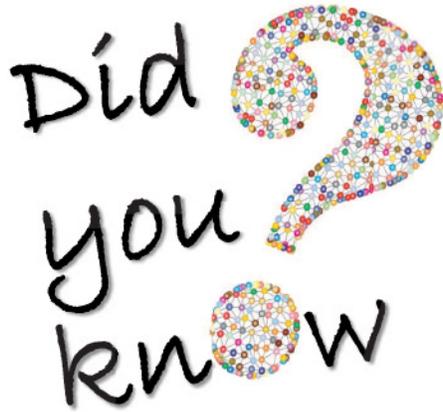
Heliyon. 2023;9(2)

GLP-1 factoids (cont'd)

- Most start out obese and end up obese
- Weight resistance can cut muscle loss by 50% or more
- Ozempic face vs. butt



Heliyon. 2023;9(2)



In the real world, the use of Wegovy produced far less weight loss than in randomized clinical trials, largely because people discontinue using them or use lower maintenance doses (over 80%)

H Gasoyan, W Butsch, et al. **Changes in weight and glycemic control following obesity treatment with semaglutide or tirzepatide by discontinuation status.** *Obesity*, 10 June 2025

GLP-1 increases preingestive satiation via hypothalamic circuits

GLP-1:

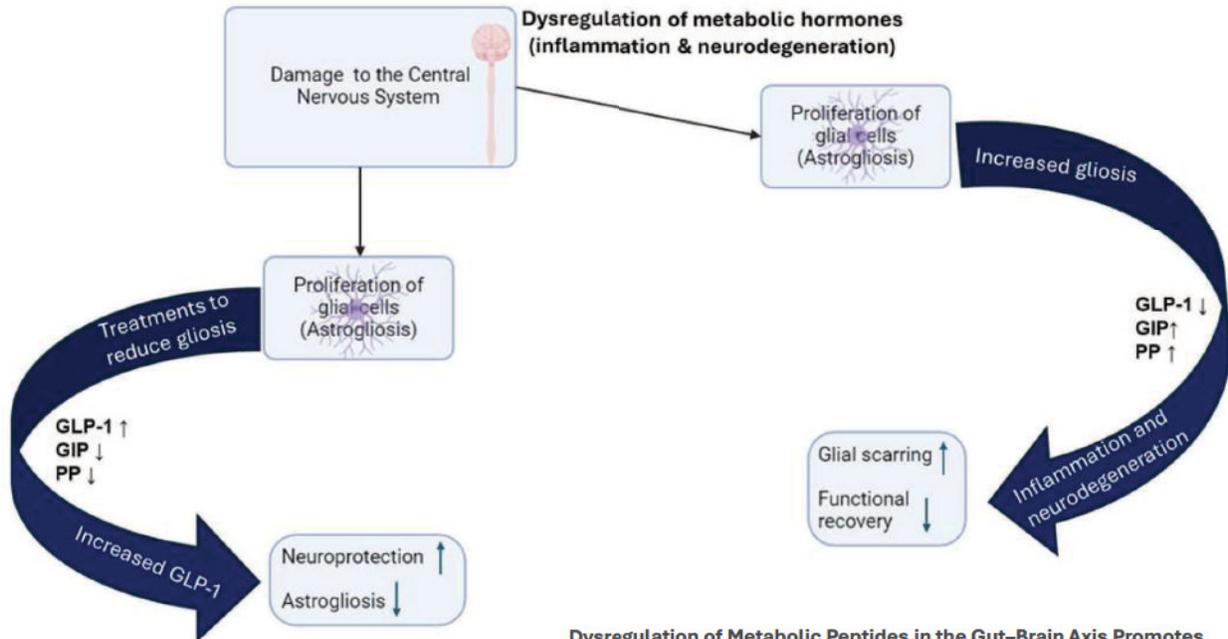
- Plays pivotal role in signaling the termination of food consumption
- GLP-1 receptor agonists:
 - Linked to shifts in food cognition, including diminished hypothalamic responses to food cues and alterations in the perception of food palatability in humans

Conclusion:

Increased activity of DMH neurons increases preingestive satiation

Kyu Sik Kim et al. **GLP-1 increases preingestive satiation via hypothalamic circuits in mice and humans.** *Science*, 27 Jun 2024;385(6707):438-446

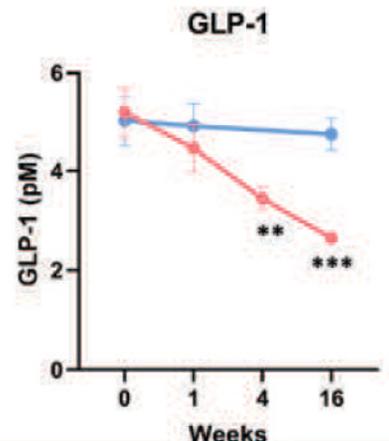
Dysregulation of glucagon-like peptide 1 (GLP-1), gastric inhibitor polypeptide (GIP), and pancreatic peptide (PP) disrupts cellular functions and contributes to the development of various inflammatory and neurodegenerative diseases



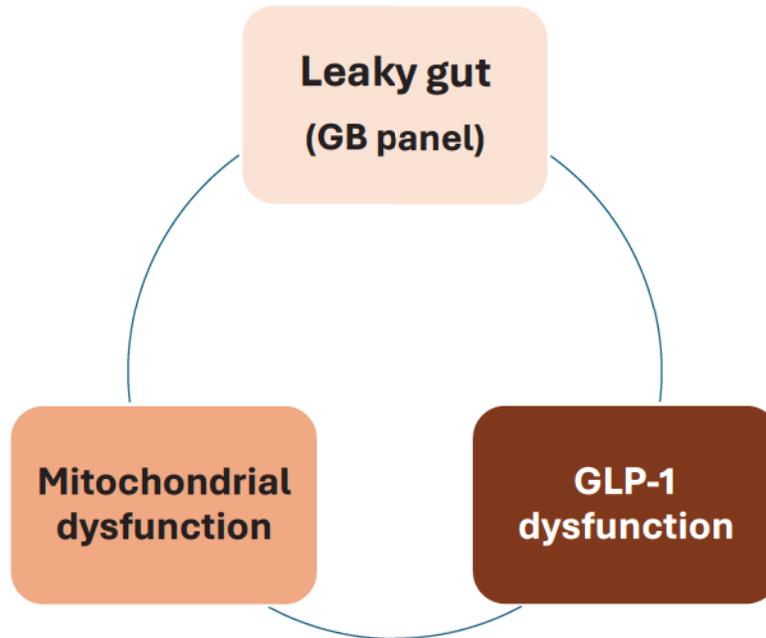
Dysregulation of Metabolic Peptides in the Gut–Brain Axis Promotes Hyperinsulinemia, Obesity, and Neurodegeneration. *Biomedicines*. 2025; 13(1):132

Statins/GLP-1

- Statin use leads to significant increase in:
 - Hemoglobin A1C
 - Insulin levels
 - Insulin resistance (measured by HOMA-IR)
 - **Caused sharp drop in GLP-1 – nearly 50% by end of 4-month period**

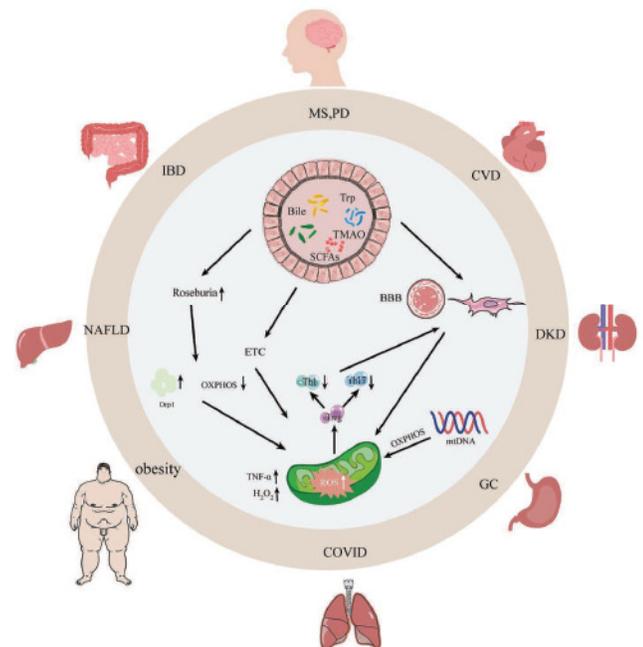


Statins aggravate insulin resistance through reduced blood glucagon-like peptide-1 levels in a microbiota-dependent manner. *Cell Metabolism*, 6 February 2024;36(2):408-421.e5



Leaky gut negatively impacts mitochondrial function

- Triggers oxidative stress
- Disrupts mitochondrial processes
- Leads to impaired energy production
- Increased inflammation generating reactive oxygen species (ROS)
- Expression of LPS
- Ending in cellular damage



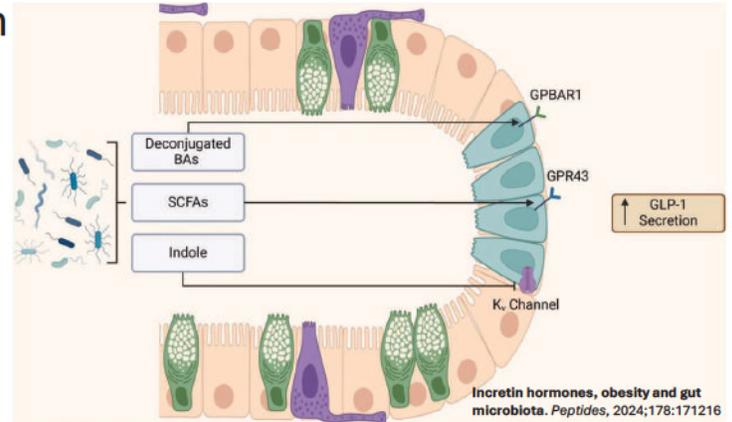
Intertwined Relationship of Mitochondrial Metabolism, Gut Microbiome and Exercise Potential. *International Journal of Molecular Sciences*, 23(5), 2679

Leaky gut can negatively affect GLP-1 production

- Leaky gut disrupts microbial balance, leading to decreased SCFAs production and lowered GLP-1 levels
- Inflammation can inhibit GLP-1 production and function
- LPS – decreased GLP-1 production

Consequences:

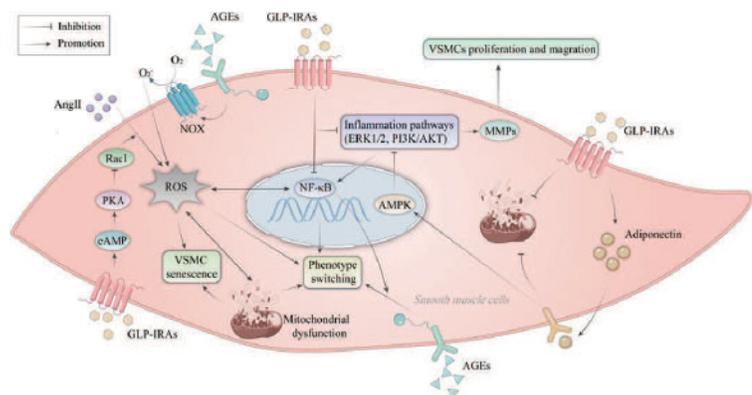
- Impaired glucose control
- Increased diabetes risk



Usuda H, Okamoto T, Wada K. Leaky Gut: Effect of Dietary Fiber and Fats on Microbiome and Intestinal Barrier. *Int J Mol Sci.* 2021 Jul 16;22(14):7613

Mitochondrial dysfunction/GLP-1

- Impaired mitochondrial function can lead to decreased GLP-1 RA sensitivity and signaling
- Conversely, studies show activating GLP-1 can positively influence mitochondrial function



Luna-Marco C, de Marañon AM, et al. Effects of GLP-1 receptor agonists on mitochondrial function, inflammatory markers and leukocyte-endothelium interactions in type 2 diabetes. *Redox Biol.* 2023 Oct;66:102849

WOW!

Dysfunctional mitochondria may trigger Crohn's disease by disrupting the gut microbiome

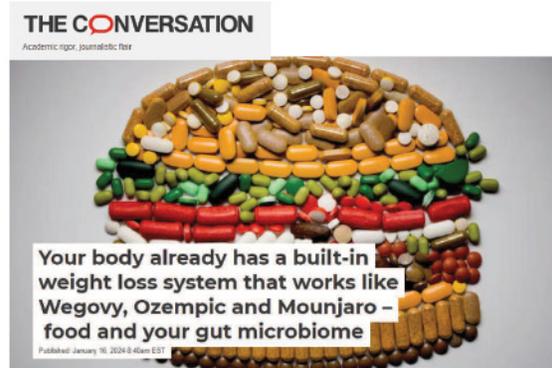
E Urbauer, D Aguanno, et al. **Mitochondrial perturbation in the intestine causes microbiota-dependent injury and gene signatures discriminative of inflammatory disease.** *Cell Host & Microbe*, 14 August 2024;32(8):1347-1364.e10

Okay...
let's see what supplements might help...



Activate GLP-1 naturally

- Berberine
- Ginseng
- Green tea extract
- Pomegranates
- Probiotic strains:
 - Akkermansia muciniphila
 - Clostridium butyricum
 - Bifidobacterium infantis
- Fiber: psyllium
- Omega-3 FA
- Eat protein
- Magnesium
- Glutamine
- Caffeine
- Probiotic strain: L. reuteri
- Fermentable fiber (SCFA)
- Bitter melon
- Allulose



Activate GLP-1 Naturally

Foods that boost GLP-1:

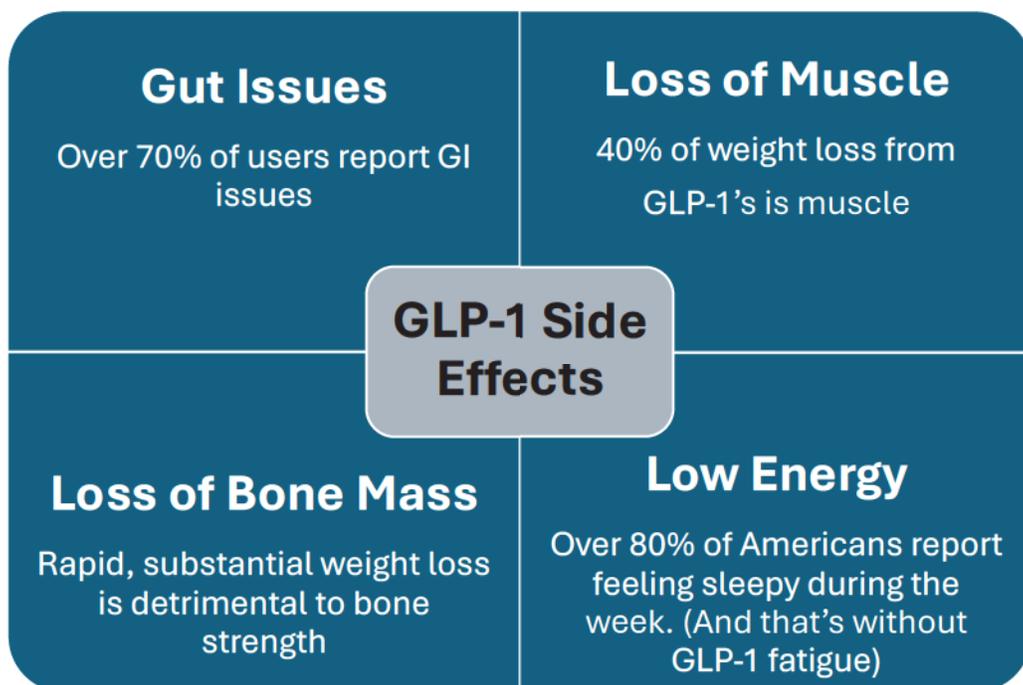
- Red onions
- Buckwheat
- Ginseng
- Ginger root
- Gardenia
- Green tea
- Resveratrol
- Wheat fiber
- Soybeans
- ★ Cinnamon
- Berberine
- Quercetin
- ★ Curcumin
- ★ Cayenne pepper
- Himalayan Tartary buckwheat

GLP-1/exercise

4 out of 5 studies on exercise found higher concentration of total GLP-1 after both HIIT and moderate-intensity concentrated training – no apparent difference between them



Heliyon. 2023;9(2)



GLP-1: Side effects, key ingredients

Gut issues:

- Butyrate
- SBI
- XOS
- B. subtilis
- Glucosamine HCl
- Zinc carnosine
- Pro-resolving mediators

Loss of bone mass:

- Calcium/Magnesium
- Vitamin D

Muscle loss:

- Creatine
- Leucine (BCAA)
- Glutamine
- Collagen peptides
- HMB

Low energy:

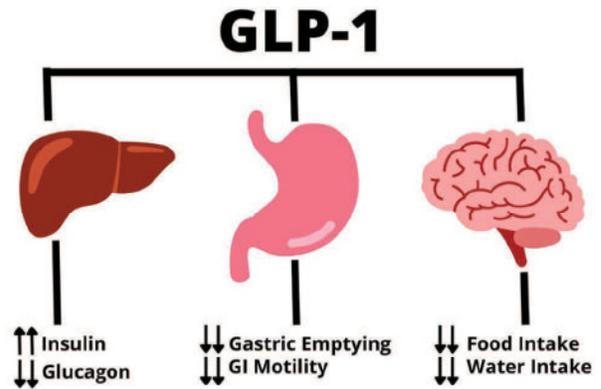
- EGCG
- L-theanine
- Alpha GPC
- NAD+
- Ginseng
- CoQ10



**LLLT can
stimulate
production of
GLP-1!**

GLP-1 protocol

- Supplements
- Master gut: 4,4,9,26
- Pancreas: 9,46,52,88
- Vagus nerve: 10,10,10,10
- Brain: 1, 10, 13, 40
- Phrenic nerve: 10,10,10,10



A hand is shown holding a glowing DNA double helix structure. The DNA is rendered in a wireframe style and emits a bright light from its base, which is held by the hand. The background is a solid blue color.

LASER FOR LONGEVITY

Could Non-Thermal Laser (NTL) be the answer and why?

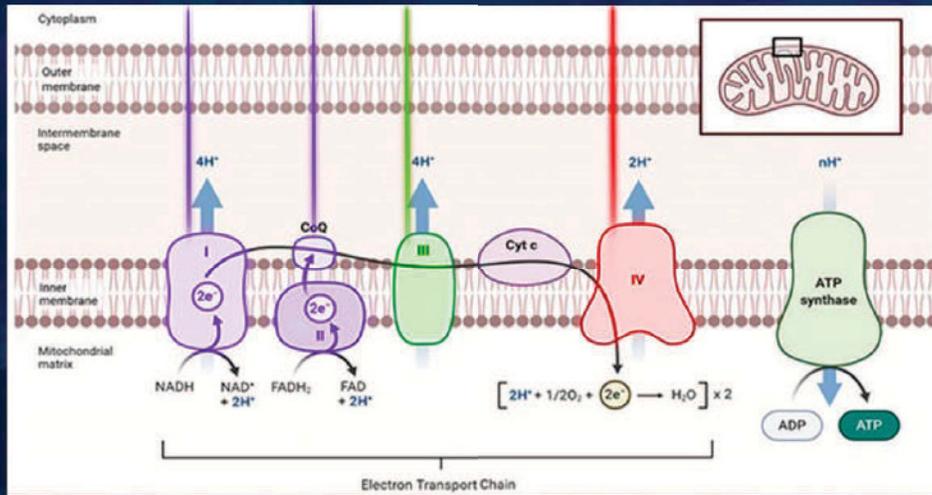
- Non-invasive
- No downtime
- No pain
- Short treatment time
- Pain-relieving properties
- Decreases swelling
- Improves blood flow
- Enhances energy production
- Optimizes mitochondrial function
- Anti-inflammatory
- Immune boosting properties
- Promotes stem cell production
- Decreases stress hormones
- Neuroprotective
- Down-regulates stress responses in brain
- Accelerates wound-healing
- Upregulates collagen production
- Fat loss
- Cellulite reduction
- Skin conditions



Laser **energy** fuels mitochondria

NTL can dampen inflammation, improve mitochondrial function, and optimize our genetic expression to enhance overall quality of life

Mitochondria Electron Transport Chain



Photon Energy (Wavelength) required to excite each complex.

Complex 1&2

405nm

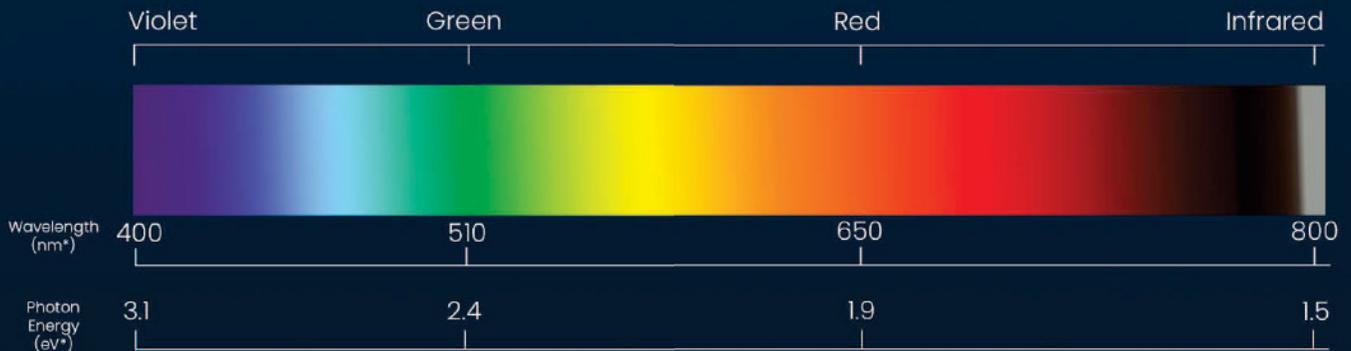
Complex 3

520nm

Complex 4

635nm

The most **energetic** laser in the world.



Photochemistry is dependent on the Photon Energy (**Electron Volts**).. **NOT POWER**

Key Concept: A minimum Photon Energy of 1.7 eV is required to cause electrons to jump to higher orbits. You can NOT make up for a lower eV by increasing the wattage (power) to trigger the same reactions.

Wavelengths/properties

635nm

- Mitochondrial activity
- Proliferative activity
- Production of IL-10

405nm

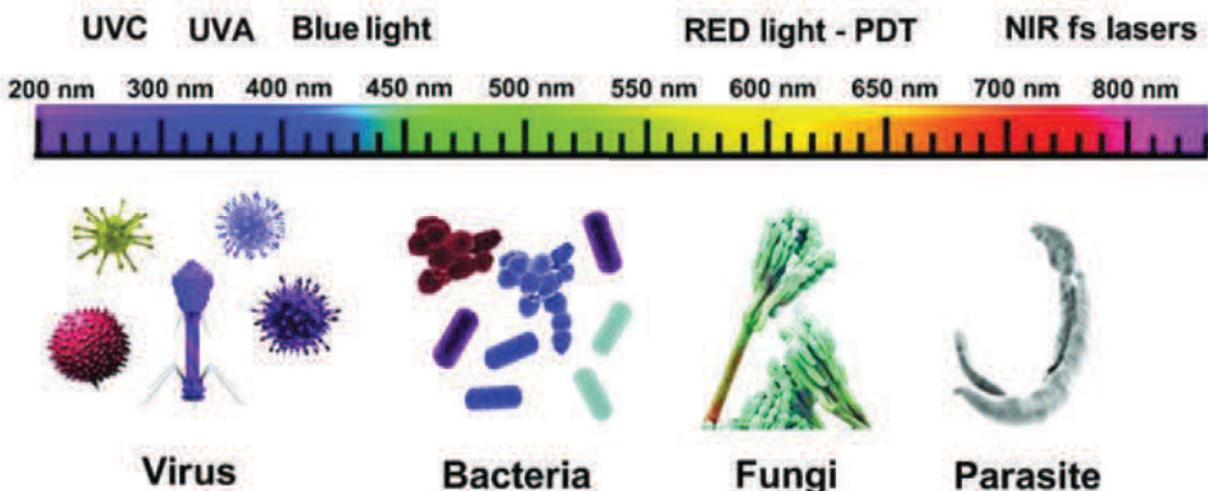
- Reduction of Apoptotic cells on fibrous tissues
- Improved breakdown of scar tissue due to high eV
- Antimicrobial support
- Stimulate **VEGF**

520nm

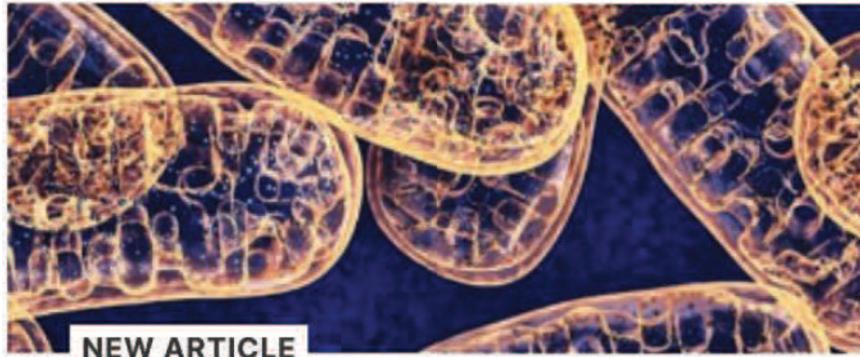
- Reduction of TGF-B
- Biggest stimulation of stem cells
- Facilitate nerve regeneration
- Stimulate osteoblast differentiation
- Improvements for fibromyalgia
- Promotes immune function
- Reduces oxidative stress

O'Connor M, Patil R, Yu J, et al. **Mesenchymal Stem Cells Synergize with 635, 532, and 405 nm Laser Wavelengths in Renal Fibrosis: A Pilot Study.** *Photomed Laser Surg.* 2016 Nov;34(11):556-563

Electromagnetic spectrum and its physiological effects on various microorganisms



Can biowarfare agents be defeated with light?. *Virulence.* 2013;4(8):796-825



NEW ARTICLE

Laser Therapy for Mitochondrial Dysfunction

“The use of low-level laser therapy (LLLT) across three different wavelengths simultaneously is an exciting new development for treating mitochondrial dysfunction.”

Robert Silverman, DC

CE CHIROPRACTIC
ECONOMICS



As simple as 1, 2, 3

- Point and shoot – static positioning of the patient and laser
- passive – doctor moves patient and moves laser
- Active – patient moves limb and doctor moves laser

Bonus

Laser cerebellum for brain up-regulation (laser “locomotor lock-in”)

Laser “Locomotor Lock-In”

- Resets NMS in 3D motion
 - Facilitated bodies global integration
 - 5 sec. eyes open, 5 sec. eyes closed
 - Cross-crawl: right arm – left leg, left arm – right leg
 - Aim posterior midline-spine
 - Repeat pointing at brain
- 1) Violet 405 Nm – directly over spinal cord
 - 2) Green 520 Nm – over adjacent nerve roots
 - 3) Both lights - cerebellum

Frequency: 1,13,10,13

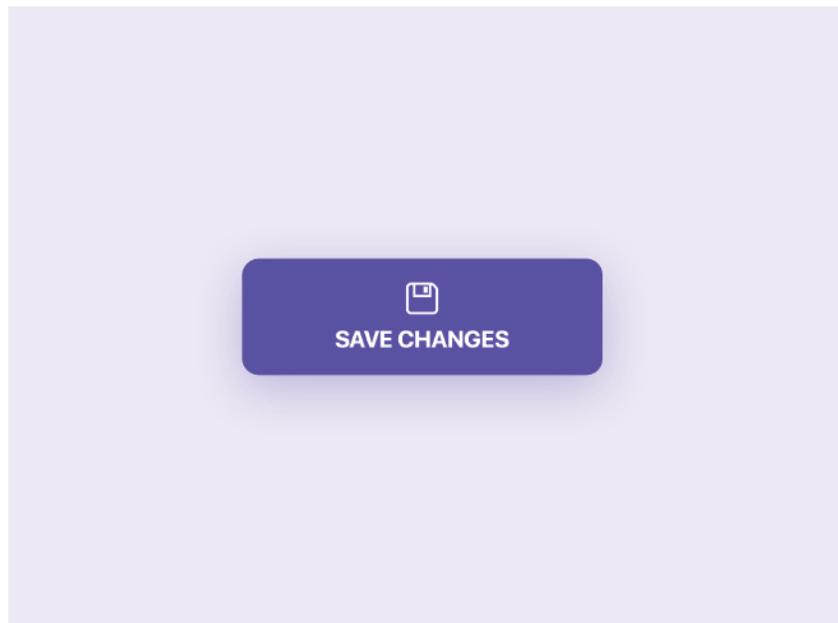
“Let there be light”



Cerebellum – 13 Hz

- 13 Hz stim delivered to cerebellum improves coordinated muscle movements
- Combining physical activity on a treadmill at 13 Hz on the cerebellum enhanced treatment efficacy

LN Miterko, T Lin, J Zhou, *et al.* **Neuromodulation of the cerebellum rescues movement in a mouse model of ataxia.** *Nat Commun*, 26 February 2021;12:1295



Advanced Laser “Locomotor Lock-In”

Posterior chain and cross-body
activation (hand to heel across
middle)

- 1) Violet 405 Nm – directly over
spinal cord
- 2) Red 635 Nm – over adjacent
nerve roots
- 3) Both lights - cerebellum



The neurotoxic loop

- Why your brain blocks healing – trauma, toxins, and infections all hijack the same pathways
- Fight or flight
- Why doing all the “right things” won’t work if your nervous system isn’t regulated first
- Most effective protocols treat both brain and body – not either one in isolation

Tinnitus & LLLT

Key study highlights:

- 55.5% of patients in one study reported significant improvement in tinnitus symptoms after LLLT compared to just 11.75% in placebo group
- Use of LLLT demonstrated statistically significant reductions in both VAS (Visual Analog Scale) and Tinnitus Severity Index (TSI) scores
- Short-term effectiveness of LLLT for tinnitus caused by sensorineural hearing loss – effects lasting up to 3 months post-treatment
- Study involving daily transmeatal application of 650nm laser over 3 months showed < 56.9% patient-reported improvement in tinnitus symptoms

Tinnitus & LLLT (cont'd)

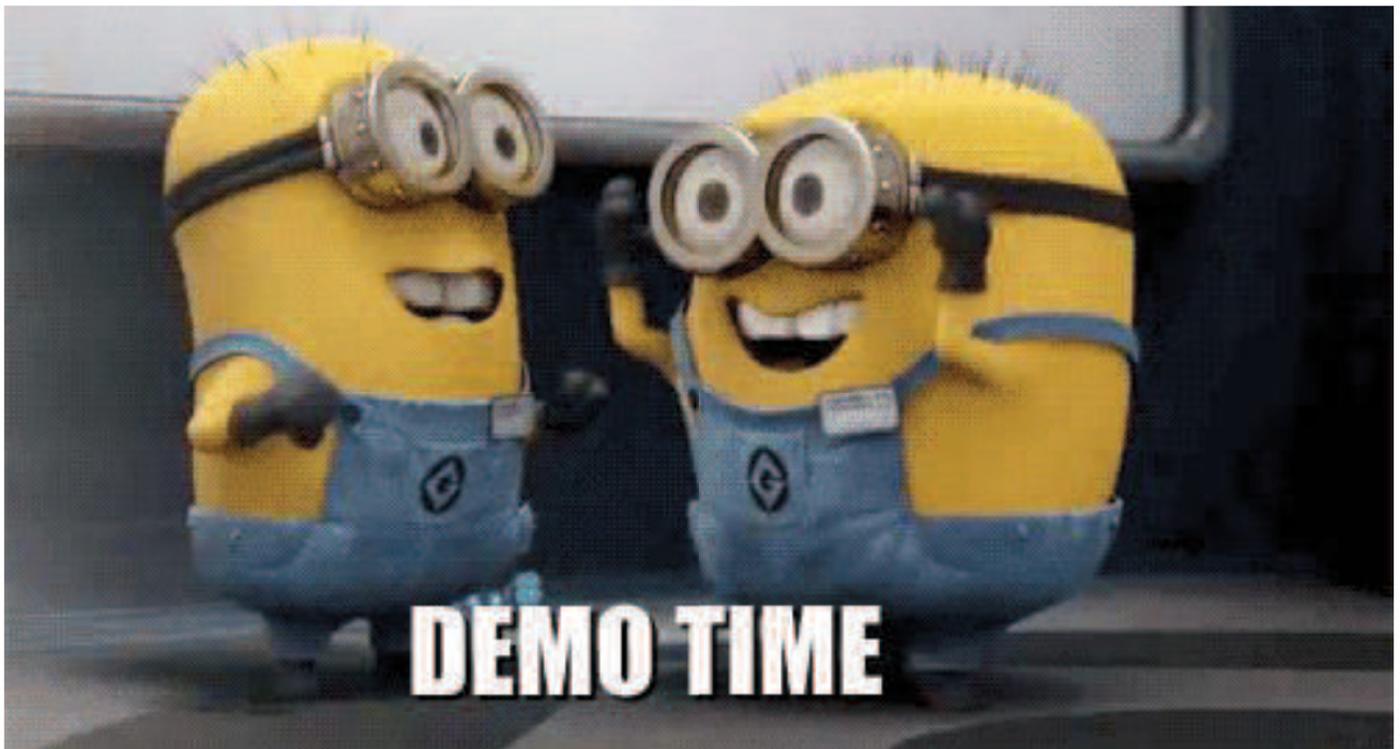
Key study highlights (cont'd):

- Patients receiving LLLT showed notable improvements in tinnitus loudness and annoyance on five-point scales, particularly among younger individuals
- Animal model research confirmed laser-assisted recovery of cochlear hair cells after damage from ototoxic drugs, suggesting potential for hearing preservation
- Study combining LLLT with counseling techniques (like muscle relaxation) showed greater reduction in THI scores than placebo alone

Tinnitus & LLLT (cont'd)

Key study highlights (cont'd):

- Histological analysis revealed – laser exposure alters collagen organization in basilar membrane, potentially impacting cochlear tuning and function
- **Vagus nerve stimulation using non-invasive laser showed potential for autonomic balance restoration via heart rate variability analysis**
- Transmeatal LLLT can be promising alternative treatment for idiopathic and refractory tinnitus patients
- Laser therapy effective in treatment of tinnitus of scuba divers. Its effect is increased by the number of laser sessions



Tinnitus

- Use **GVL** – applied to effected **ear canal** – 9,12,16,18 for 3 mins.
- Ipsilateral temporal lobe – 1,5,10,40 for 3 mins.
- Ipsilateral TMJ:
 - Ligament: 5,9,125,272 – 1 min.
 - Nerve: 4,9,33,60 – 1 min.
- Vagal protocol (SCM & auricular regions) – 10,10,10,10 for 3 mins.
- Cerebellum – 1,13,10,13 for 1 min.
- **Nutritional supplementation:**
 - Test for food sensitivities
 - Gingko biloba
 - Zinc
 - B12
 - Melatonin
 - Magnesium
 - Potassium
 - Increase fiber
 - CoQ10

Tinnitus linked to obesity and body composition in men

- 2,257 participants
- Men more prevalent over women
- Higher % of fat in:
 - Total body
 - Arms
 - Trunk
 - Legs
 - Waist
- Decreased muscle mass in tinnitus group

Conclusion:

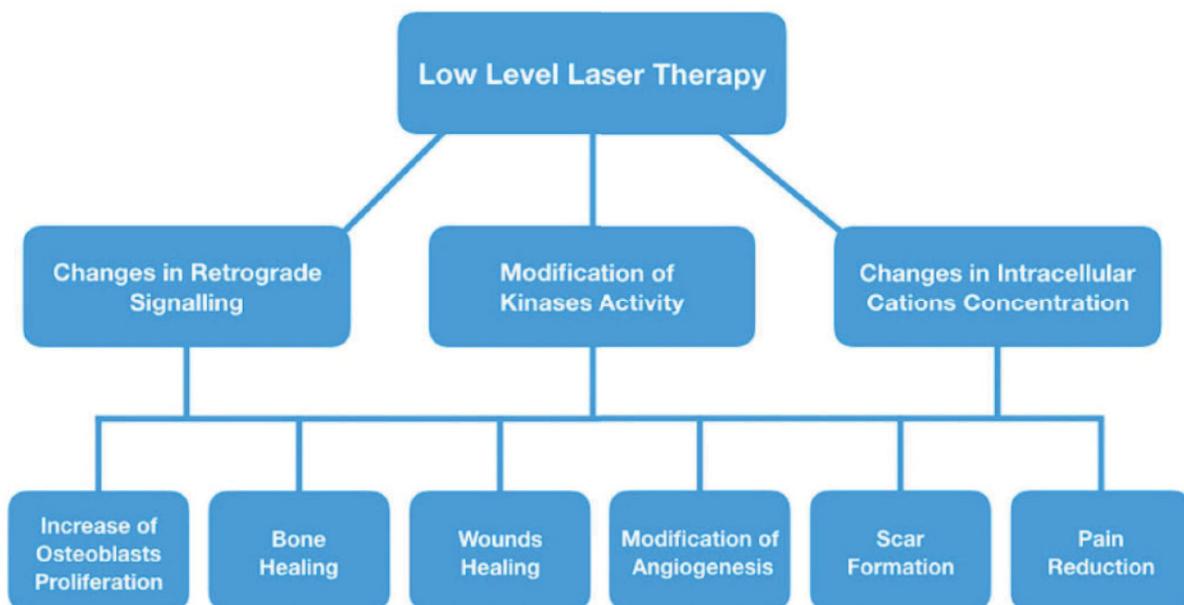
A strong correlation between tinnitus and chronic inflammation

Elite 8 protocols

- 1) 1, 2, 3 laser:
 - Point & shoot
 - Passive movement
 - Active movement
- 2) 5-step treatment for joint surgery/replacement
- 3) Master gut
- 4) Master brain
- 5) Vagus nerve
- 6) Phrenic nerve
- 7) Nerve/nerve mobilization
- 8) Stacking lasers:
 - Mitochondrial complex
 - M/S injuries

Bonus:
GLP-1 stimulation

Changes in cell signaling process and its clinical application



Changes in Cell Biology under the Influence of Low-Level Laser Therapy. *Photonics*. 2022; 9(7):502

5 Reasons...

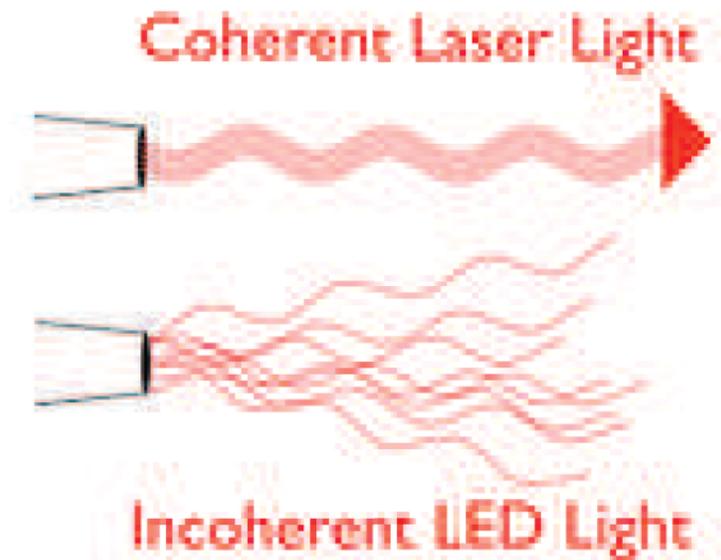
- 1) Effective – “The speed of light”
- 2) Research-driven; empirically studied. FDA-cleared
- 3) Practice building
- 4) Joint health
- 5) Brain health



Laser Focus

- **Laser:** Light Amplification by Stimulated Emission of Radiation
- A focused beam of light that emits photon energy
- All photons travelling same direction at same wavelength = coherent light



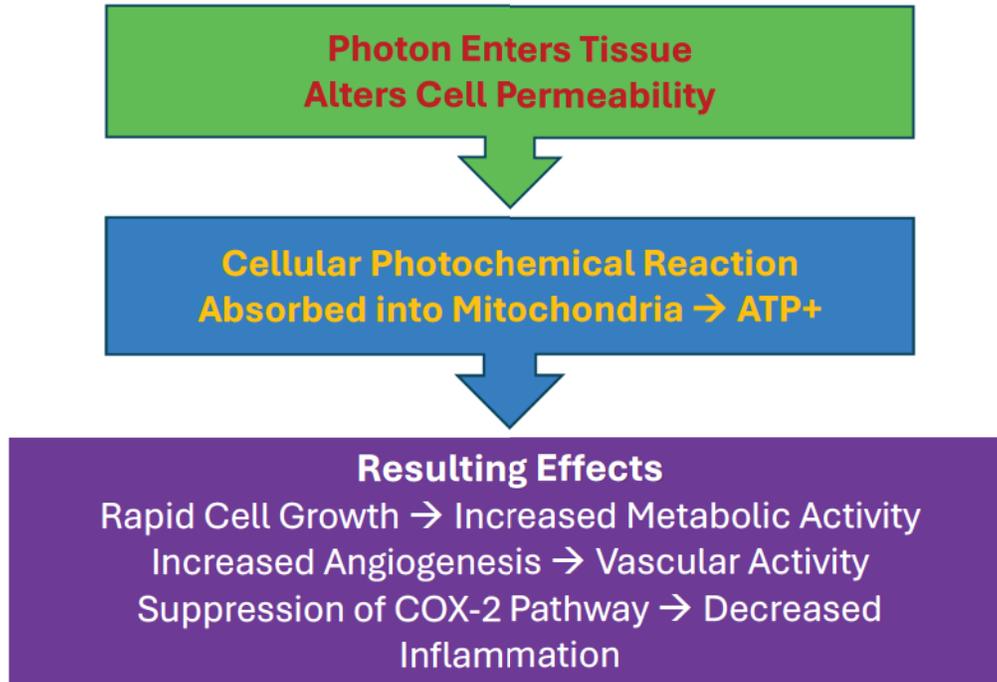


What is LLLT

- AKA photobiomodulation
- Low intensity light therapy
- Effect: photochemical, not thermal
- Light triggers biochemical changes within cells
- Can be compared to photosynthesis in plants
- Photons absorbed by cellular photoreceptors and triggers chemical changes

HB Cother, RT Chow, MR Hamblin, J Carroll. *MOJ Orthop Rheumatol*. 2015;2(5):00068. Published online 2015 Jun 9

Laser directed to affected site



Laser Therapy

5 components integral to beneficial outcome

LASER

1) Active ingredient	Specific wavelength (color) - component responsible for influencing biochemical cascades	4) Movement (advanced)	Turns muscle on and off. Move handheld. Built-in – FX635/405
2) Dosage	Intensity (power of light) determines response. Too little limits response. Too much produces adverse effect	5) Pulsing	Deliver shorter pulses of energy
3) Delivery Mechanism	Manner light is delivered determines proper tissue response and depth of penetration. Coherent, focused light insures deep tissue stimulation and absorption		

Cholesterol markers/LLLT

- 19 patients, treated for 2 weeks
- Blood draw prior to laser (baseline)
- After 2nd week of procedure (3 times per week)

Results:

- 84% demonstrated an overall reduction in total cholesterol levels
- 73% demonstrated LDL reduction
- 63.1% - reduction in triglyceride levels

Jackson RF, Roche GC, Wisler DK . **Reduction in Cholesterol and Triglyceride Serum Levels Following Low-Level Laser Irradiation: A Noncontrolled, Nonrandomized Pilot Study.** The American Journal of Cosmetic Surgery Vol. 27, No. 4, 2010

Effect of LLLT on serum vit. D and mg. levels in patients with diabetic peripheral neuropathy

Result:

Significant increase in vitamin D and magnesium levels after LLLT

Anju M, Chacko L, Chettupalli Y, et al. **Effect of Low Level Laser Therapy on serum vitamin D and magnesium levels in patients with diabetic peripheral neuropathy - A pilot study.** *Diabetes Metab Syndr.* 2019 Mar-Apr;13(2):1087-1091

Impact of red/violet laser therapy on PAD

Conclusion:

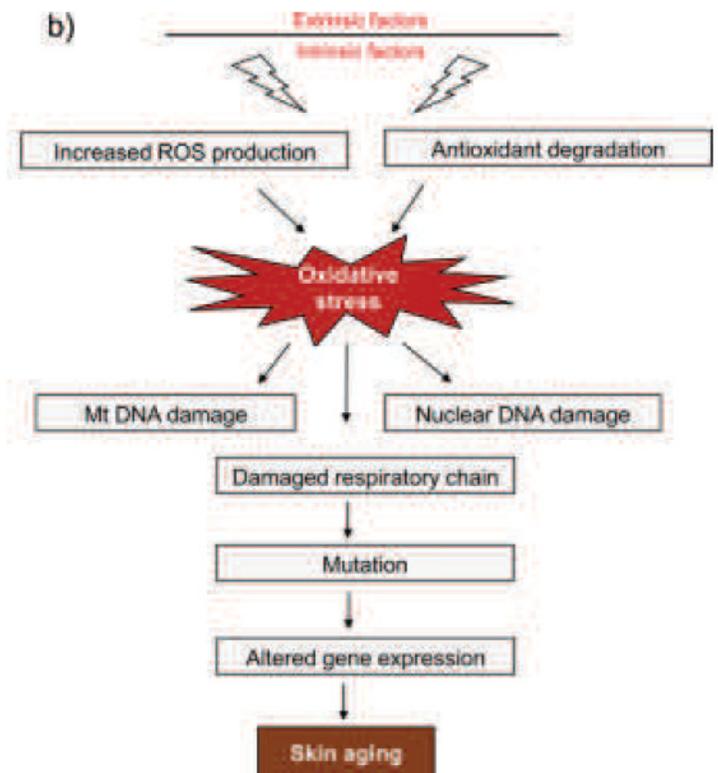
- Results indicate the therapeutic potency of red/violet LLLT in treatment of PAD
- Laser therapy equally effective for women and men
- Smoking did not have statistically significant effect on progression of neo angiogenesis

A Eberhardt, T Sammons. **Impact of red and violet laser therapy on peripheral arterial disease: case series.** *Med Clin Case Rep*, 2 Jan. 2024;4(1):1-4

Mitochondria settings

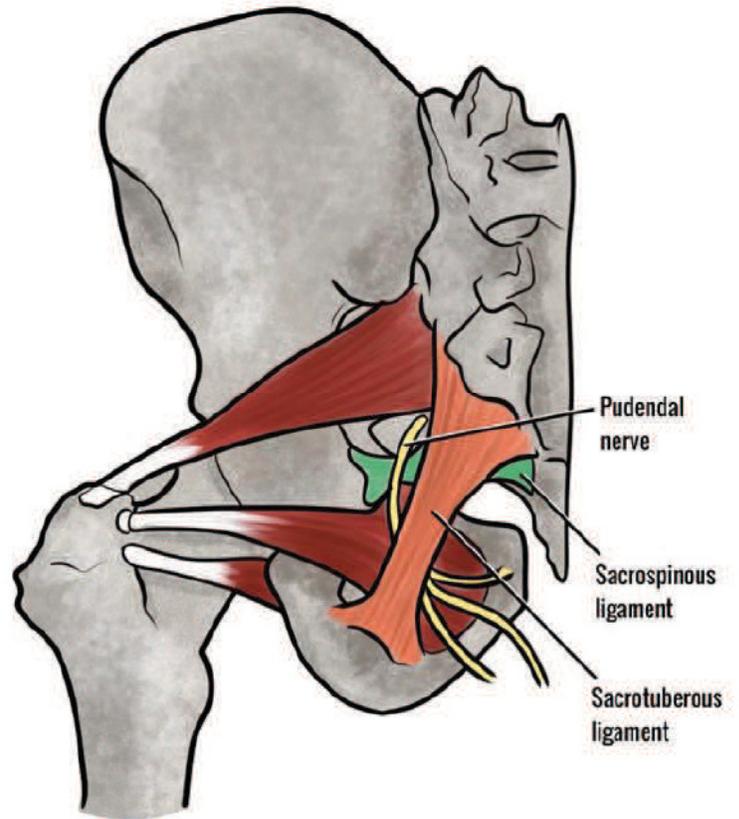
Dr. Rob's **mitochondrial** setting:
4,9,16,32

Dr. Rob's **skin** setting:
5,20,35,112



Mitochondria in skin health, aging, and disease. *Cell Death & Disease*, 11(6), 1-14

Prudental neuralgia & clinical significance of sacrotuberous ligament



Gum/tooth implant

- Apply over gum/implant region for 3 minutes – [my master gum](#) setting: 5,45,5,45
- Apply to area again – 2 minutes: 9,6,42, 272 (inflammation)
- 2-3 times/day – if you own/rent laser
- In-office visits:
 - 1) 3x/week for 2 weeks
 - 2) 2x/week for 2 weeks
 - 3) 1X/week for 2 weeks

Scar

- EVRL: 8,25,42,279
- Simultaneously with:
 - Myofascial release – directional
 - Instrument-assisted soft-tissue mobilization
 - Percussor



Laser for bone fx

Summary:

50 Hz is the optimal frequency to stimulate BMSCs for bone injury repair *in vivo*

Settings: 16,42,50,50

Low-level laser prolong longevity of degenerative knee joints

- 70 elderly patients
- Bilateral tricompartmental knee arthritis
- One knee per patient received laser plus therapy
- Other knee received PT and sham light
- Laser group 1 in 70 needed joint replacement
- Sham light 15 in 70 needed joint replacement

Clin Interv Aging, Aug 5, 2015. 10:1255-8

Each individual has a different
tolerance threshold and need
for variability

EVRL



GVL



FREQUENCY SETTINGS

How to take your patients through acute, sub-acute healing into wellness and performance:

PROTOCOL	LASER A (1)	LASER A (2)	LASER B (1)	LASER B (2)	TIME
1st phase - Acute, for the first 5 days					
Acute1	4	8	25	42	5
Acute2	4	9	33	60	5
Acute3	9	16	42	53	5
2nd phase- sub-acute (repair/remodeling), day 5 through week 8					
Sub-Acute1	8	25	42	48	5
Sub-Acute2	12	30	45	64	5
Sub-Acute3	16	35	48	90	5
3rd phase is wellness and performance.					
Well/Perf1	10	10	10	10	5
Well/Perf2	1	4	9	32	5
Well/Perf3	6	16	26	42	5
Additional Settings					
Chronic	4	40	400	400	5
Nerve Root	4	9	33	60	5
Brain	1	10	13	40	2
Gut	4	4	9	26	2



CDC lists **low-level laser therapy** as recommended alternative for subacute and chronic pain

Common muscular-skeletal settings – add to presets

- **Ligament:** 5, 9, 125, 272
- **Cartilage:** 20, 45, 304, 887
- **Bursitis:** 9,16,142, 656
- **Edema:** 21, 33, 43, 48
- **Inflammation:** 9, 16, 42, 272
- **Tendonitis:** 1, 21, 25, 45
- **Neurogenic inflam.:** 9, 16, 33, 36
- **Wounds:** 3, 16, 24, 111
- **Peripheral nerve:** 2, 2, 2, 2
- **Autism:** 1, 10, 13, 40
- **Nerve:** 4, 9, 33, 60
- **Muscle:** 9, 16, 42, 53
- **Scar tissue:** 8, 25, 42, 279
- **Infection:** 5, 20, 48, 625

Stacking lasers for MS injuries

Laser 1	Scar	}	6-8 mins.
Laser 2	Ligament/tendon		

Laser 1	Muscle	}	5 mins.
Laser 2	Nerve		

Laser 1	Cartilage	}	6 mins.
Laser 2	Tendon/ligament		

Base Station

Desk top unit – 3 handheld independent laser devices - (1) EVRL and (2) XLR8 lasers, wireless charging station and ability to program all lasers individually using easy-to-use touchscreen GUI's

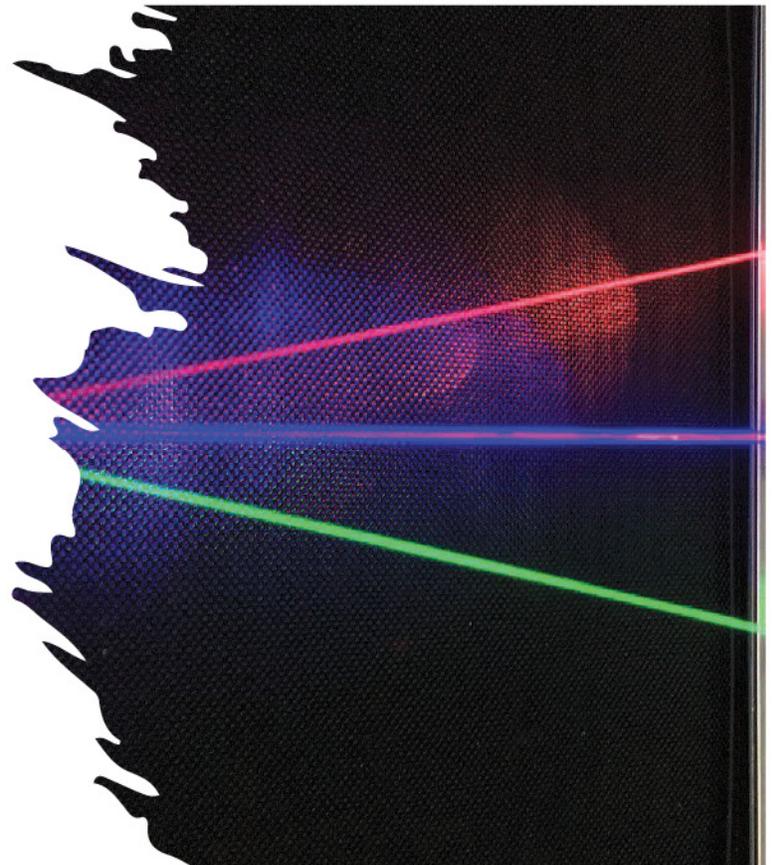
Configuration:

- 2-Handheld Devices with Dual 640nm/7.5mW Output Laser Diodes
- 1-Handheld Device with One 640nm/7.5mW Laser Diode and One 405nm/<5mW Laser Diode
- Wavelength: 635nm/405nm
- Modulation: Constant Wave (CW) & Variable Hz
- Up to 100 Programmable Memory Channels
- Handheld Device Power Source: 3.7 VDC Rechargeable Lithium-ion Polymer Battery
- Weight: Base Unit with Handheld Laser Devices 2.35 lbs. (1.07kgs.)
- Handheld Lasers less 1lbs. (.30 kgs.) Each
- Laser Class: 2 Device Class II (USA); 2a (EU)



The Rainbow Reset

- Where light meets longevity
- 3 colors
- One cellular transformation
- 15 mins. per session
- Tailored to support energy, clarity, and long-term resilience
- Support for graceful, healthy aging, from the inside-out



Dr. Rob's (3R) Rainbow Reset – Step 1 (3 mins)

Vagus Nerve Reset – Neck / Carotid Sinus: 10,10,10,10

Goal: Support calm nervous system tone and cellular repair pathways

Benefit: Reduces stress and creates a foundation for repair

Dr. Rob's (3R) Rainbow Reset – Step 2 (5 mins)

Brain & Cognitive Clarity – Prefrontal Cortex: (1,10,13,40)

Goal: Boost focus, mood, and memory resilience

Benefit: Like plugging your brain back into its natural power source

Dr. Rob's (3R) Rainbow Reset – Step 3 (5 mins)

Energy & Immune Recharge – Gut-Liver & Chest Axis: (4,4,9,26)

Goal: Support gut health, detox, immune balance, and circulation

Benefit: Fuels systemic vitality and strengthens immune readiness

Dr. Rob's (3R) Rainbow Reset – Step 4 (2 mins)

Longevity & Cellular Vitality – Kidneys & Adrenals: (9,16,52,78)

Goal: Recharge cellular batteries, stress resilience, and metabolic balance

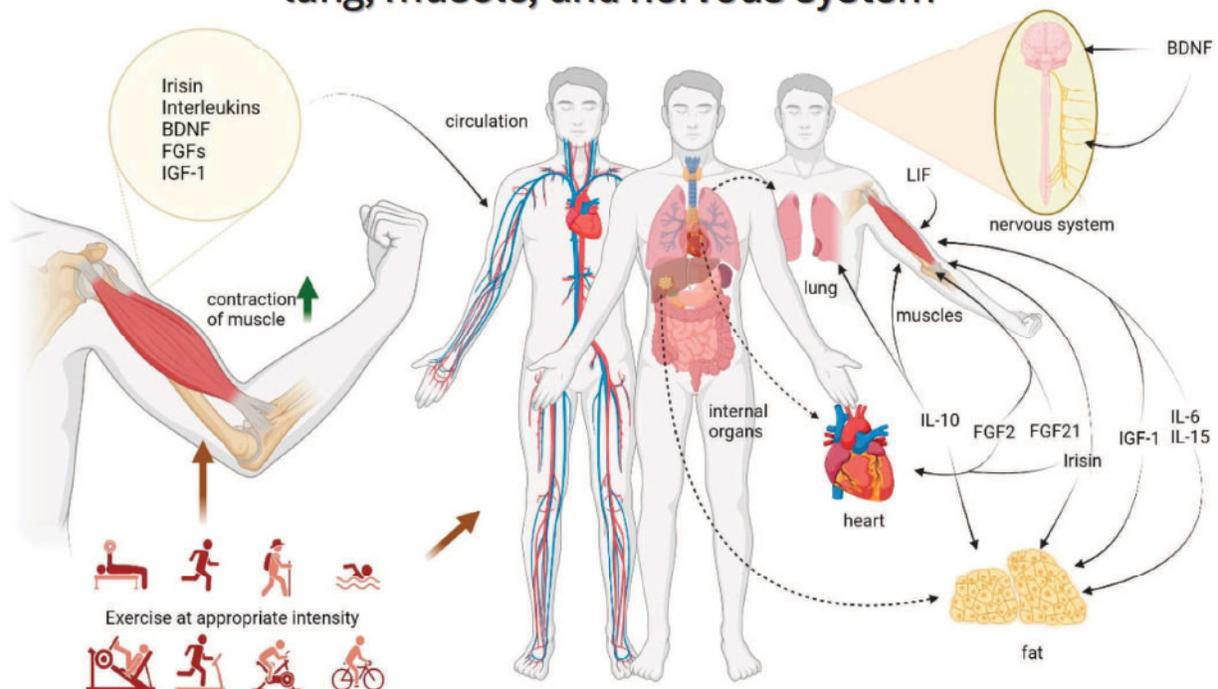
Benefit: Supports graceful ageing and recovery

Myokines

- Skeletal muscle – secretory organ that secretes bioactive substances known as myokines
- Exercise promotes skeletal muscle contraction and expression of myokines including:
 - Irisin
 - IL-6, IL-10, IL-15
 - BDNF
 - FGF2/21
 - LIF
 - IGF-1

Lu Z, Wang Z, Zhang XA, Ning K. **Myokines May Be the Answer to the Beneficial Immunomodulation of Tailored Exercise—A Narrative Review.** *Biomolecules.* 2024 Sep 25;14(10):1205

Exercise-induced myokines positively regulate the circulatory system, heart, lung, muscle, and nervous system



Myokines May Be the Answer to the Beneficial Immunomodulation of Tailored Exercise—A Narrative Review. *Biomolecules.* 2024; 14(10):1205

LLLT/Muscle protein synthesis (MPS)

LLLT helps with MPS:

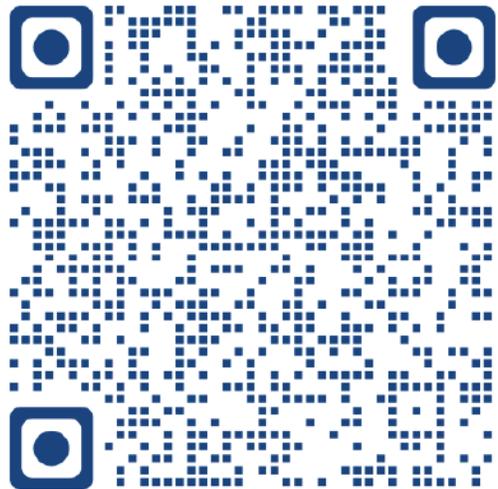
- Stimulates stem cells and progenitor cells
- Reduces inflammation and lessens oxidative stress
- Improves mitochondrial function
- Increases ATP synthesis
- Reduces protein degradation
- Regenerates muscle fibers
- Improves muscle recovery

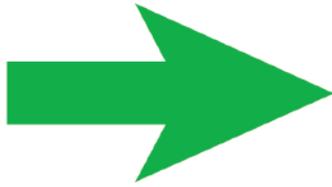
Frequencies:
4, 8, 16, 32

Ferraresi C, Hamblin MR, Parizotto NA. **Low-level laser (light) therapy (LLLT) on muscle tissue: performance, fatigue and repair benefited by the power of light.** *Photonics Lasers Med.* 2012 Nov 1;1(4):267-286

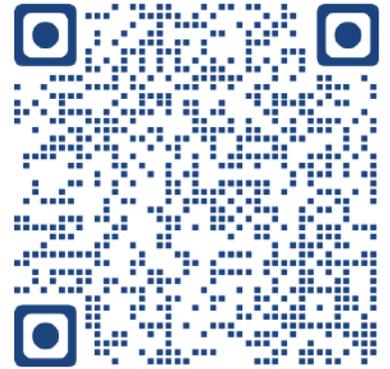
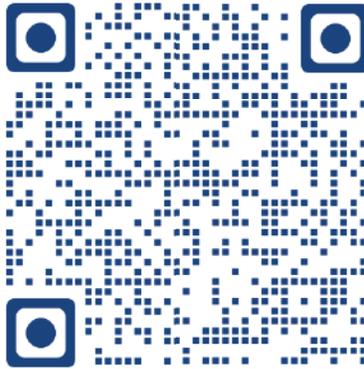
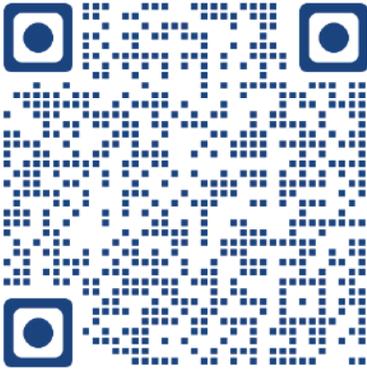
Join

Dr. Rob's
Mastermind
Laser Group
on FB





Follow me...



Vagus nerve

Primary functions

- Parasympathetic: responsible for operation of the digestive tract, heart rate, and respiration
- Special sensory: provides sensations of taste from behind the back of tongue
- Sensory: operating specific mechanisms of the abdomen, heart, lung, throat
- Motor: enabling the movement of neck muscles, enabling speech and swallowing

Biomedicine

Finding:

Favorite site for visible laser blood illumination is in the supraclavicular region

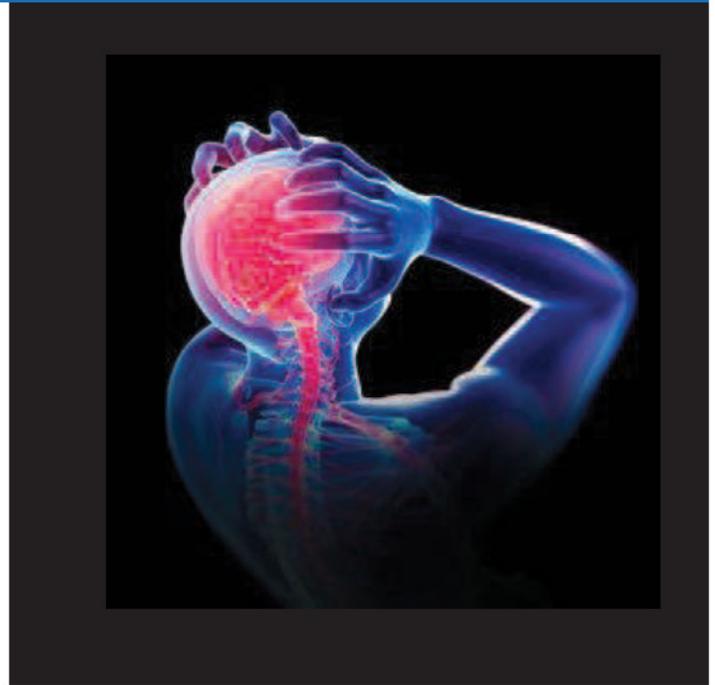


Moskvin SV, Khadartsev AA. **Methods of effective low-level laser therapy in the treatment of patients with bronchial asthma (literature review).** *Biomedicine* (Taipei). 2020 Mar 28;10(1):1-20

TBI - VAGUS

- Vagus nerve “rest and digest”
- PNS and SNS cannot both be dominant at the same time
- Following TBI patients find themselves in sympathetic state dominance:
 - Shutting down PNS
 - Affecting normal functionality of vagus nerve
 - Slowing digestion dramatically through mechanism of **MMC**

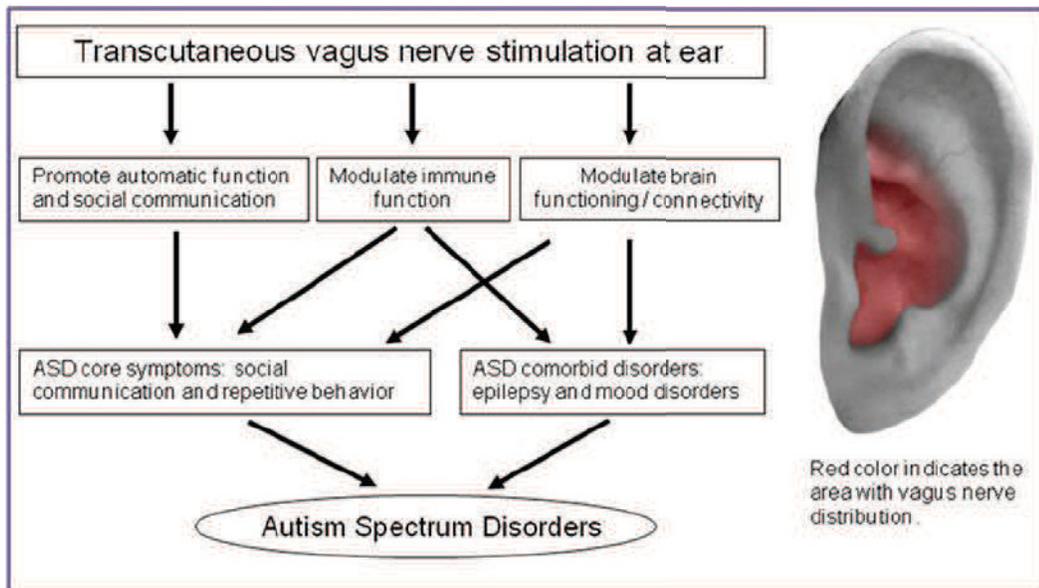
Frontiers in NeuroScience. Feb 7, 2018;12:1-8



A neural circuit for gut-induced reward

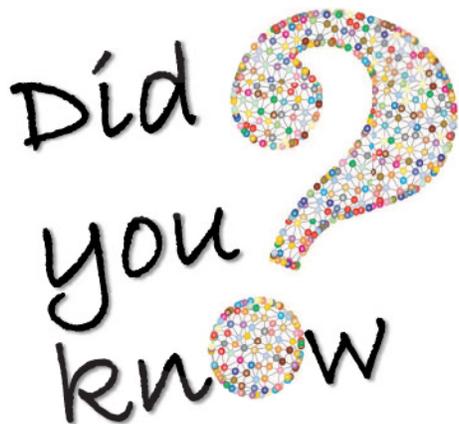
- Critical role for the vagal gut-brain axis in motivation and reward
- Optogenetic stimulation of the vagal gut-brain axis produces reward behaviors (right vagus only)
- Asymmetric brain pathways of vagal origin mediate motivation and dopamine activity (right vagus only)
- Gut-innervating vagal sensory neurons are major components of the reward circuitry (right vagus)
- Left vagus – satiety, not reward

Wenfei H, Luis AT, Matthew HP, et al. *Cell*. Sept. 20, 2018



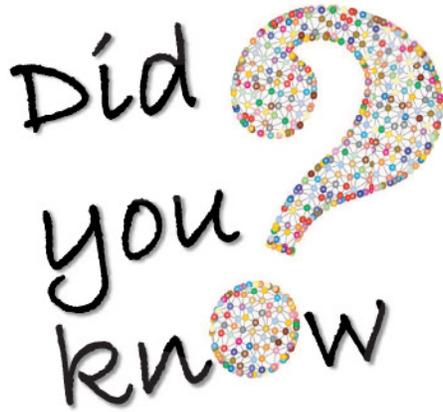
Action mechanism of tVNS on treatment for ASD and the location of vagus nerve distribution in ear

Frontiers in Neuroscience, 20 January 2017



Vagus nerve stimulation provides long-term benefits for PTSD patients in clinical study

Brain Stimulation, May-June 2025



Stimulating the **vagus nerve** (connects the heart and brain) can improve fitness and exercise tolerance

GL Ackland, ABU Patel, S Miller, et al. **Non-invasive vagus nerve stimulation and exercise capacity in healthy volunteers: a randomized trial.** *European Heart Journal*, 1 May 2025;46(17):1634–1644

Vagus nerve stimulation(VNS)/stroke recovery

Human studies indicate brief bursts of VNS in conjunction with rehabilitative training improve recovery of motor function after stroke

- Doubles long-lasting recovery on complex task involving forelimb supination
- Doubles recovery on simple motor task not paired with VNS
- Enhances structural plasticity in motor networks

Teresa JK, David P, Cecilia NP, et al. **Vagus Nerve Stimulation Paired With Upper Limb Rehabilitation After Chronic Stroke.** *Stroke*, 27 Sept 2018;49:2789–2792

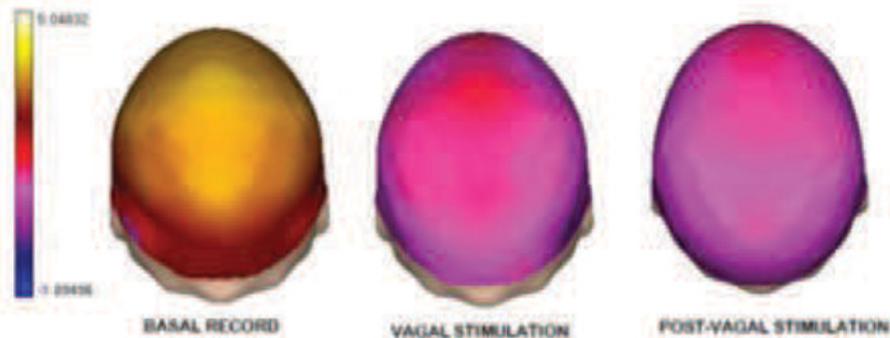
Vagus nerve/Parkinson's

“The vagal nerve might provide a path for the spread of alpha-synuclein pathology from the ENS to the brain through the brainstem, midbrain, basal forebrain and finally the cortical areas”.

Paula PP, Tessa K, Hemraj BD, et al. **The gut-brain axis in Parkinson's disease: Possibilities for food-based therapies.** *European Journal of Pharmacology*, 15 Dec 2017;817:86-95

Non-Thermal Vagal Nerve Stimulation

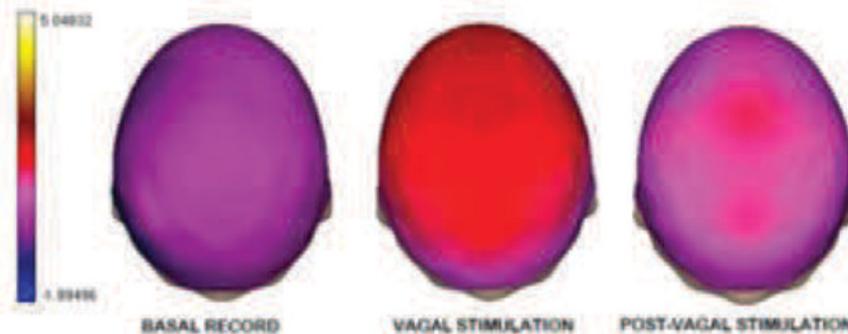
QEEG results from Case 01, using VIOLET LLLT.



Machado, Calixto & Machado, Yanin & Chinchilla, Mauricio & Foyaca-Sibat, Humberto. (2019). *Vagal Nerve Stimulation With Low Level Lasers Of Two Different Frequencies, Assessed By QEEG.* *Internet Journal of Neurology*. 21. 1-9. 10.5580/IJN.54122.

Non-Thermal Vagal Nerve Stimulation

QEEG results from Case 01, using RED/VIOLET LLLT.



Machado, Calixto & Machado, Yanin & Chinchilla, Mauricio & Foyaca-Sibat, Humberto. (2019). Vagal Nerve Stimulation With Low Level Lasers Of Two Different Frequencies, Assessed By QEEG. Internet Journal of Neurology. 21. 1-9. 10.5580/IJN.54122.

Vagal nerve stimulation with low-level lasers of 2 difference frequencies

Conclusion:

- Results using LLLT with violet light – effective in treatment of epilepsy
- Results with red/violet LLLT for VNS useful in conditions where necessary to induce increment of brain activity in conditions:
 - Depression
 - Neurorehabilitation
 - Coma
 - Disorders of consciousness
 - Dementia
 - Autism

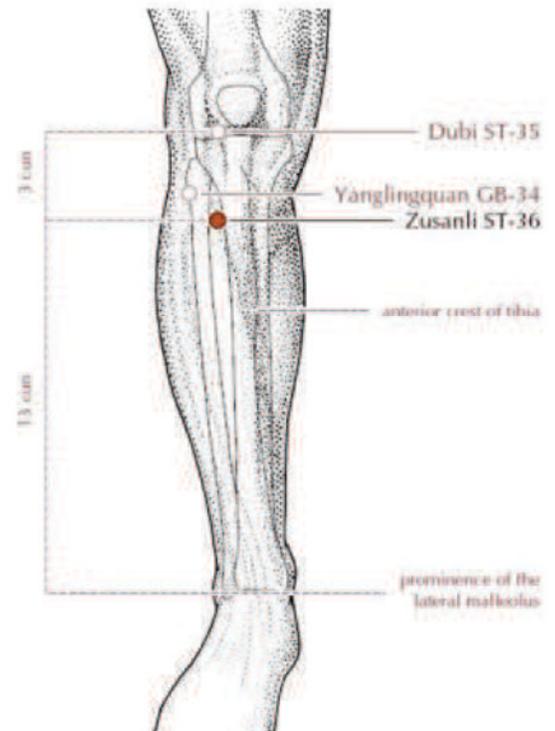
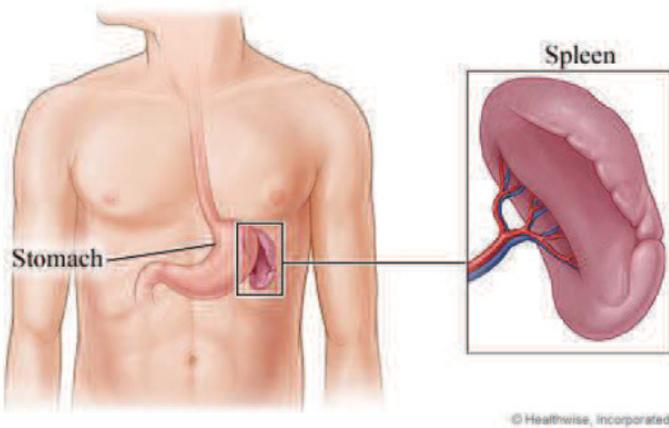
Vagus nerve demo

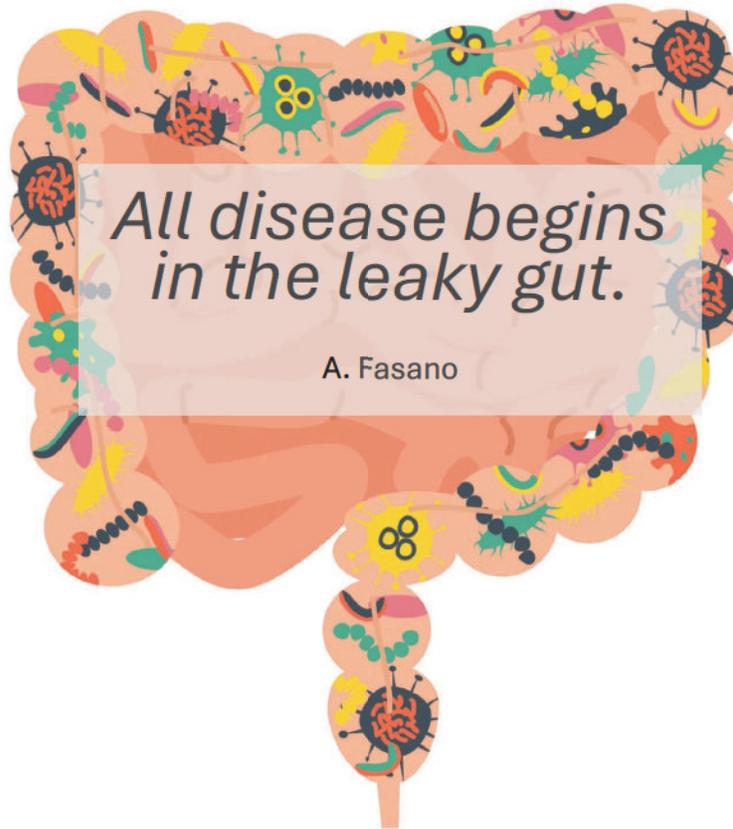
The perfect 10



Spleen: 27, 73, 27, 73

Acupressure point ST-36





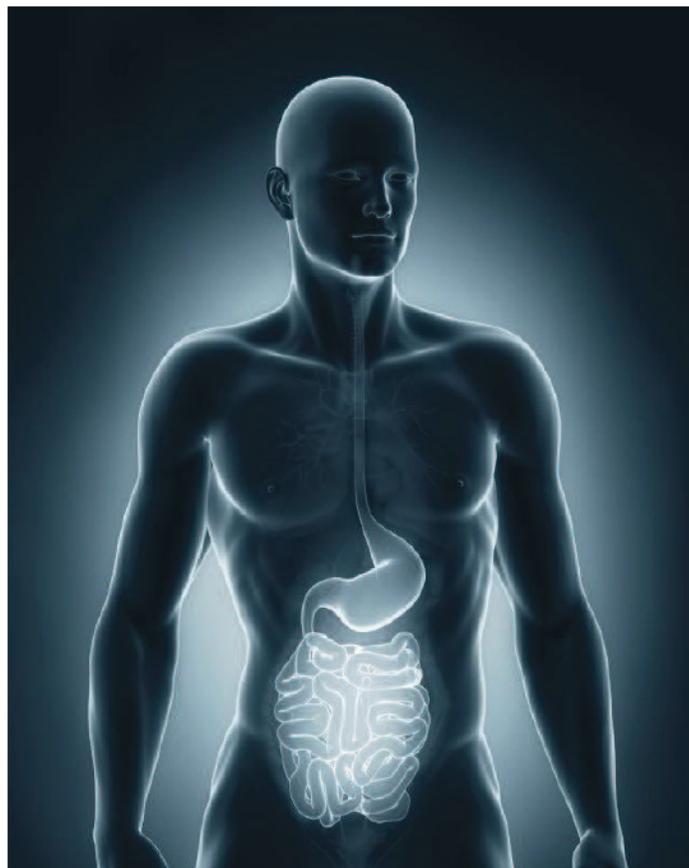
Gut factoids

- 90% of scientific literature describing microbiome published in the last 5 years
- **100 trillion** bacteria cells – outnumber human cells 10:1
- Humans – 90% bacteria at cellular level. Most physicians severely focused on 10% of cells and ignoring 90% of cells in our bodies
- Genetics – 99% of DNA in human body is bacterial
- Genetics typically looks at DNA we inherit and not the 99% in **gut bacteria**

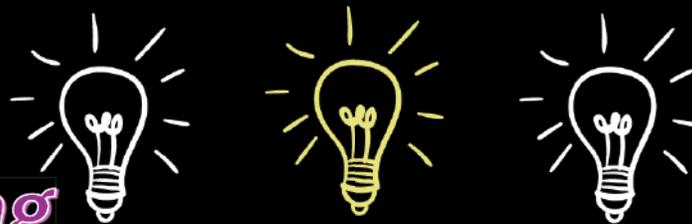
Factoid

72% of US adults say they have experienced GI symptoms a few times a month or more

PR Newswire, Nov. 6th, 2013



Gut feeling



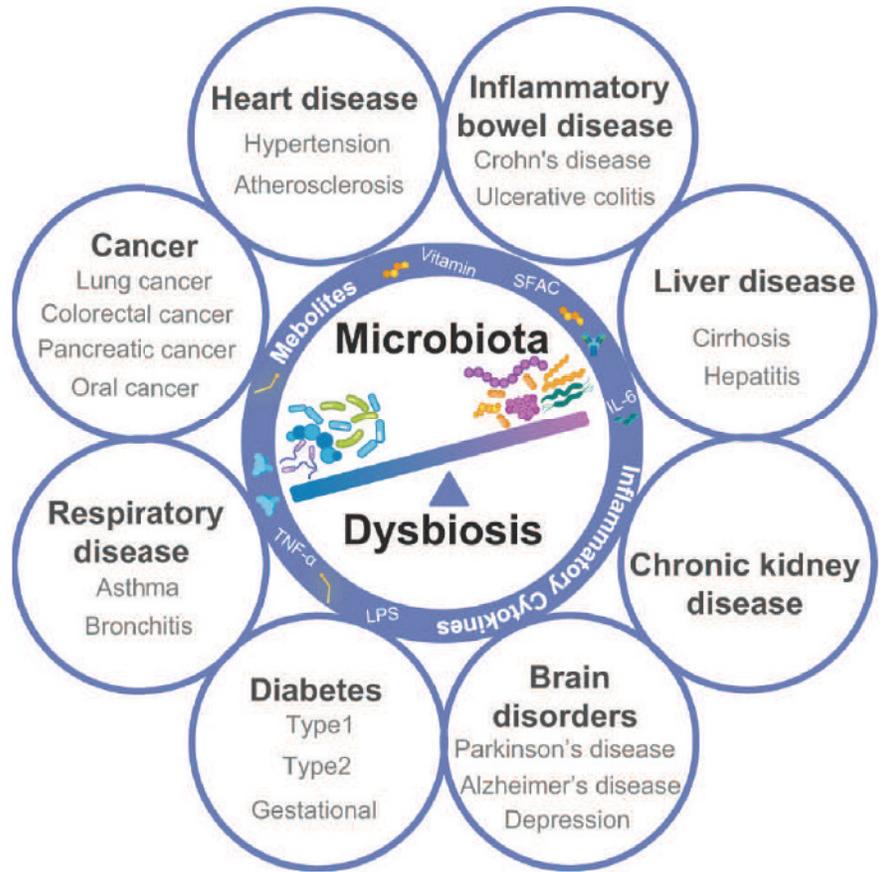
Neuroception

Our unconscious ability to assess for risk, danger, and safety often outside of the realm of our awareness

Intuition


©Space-Between-Counseling

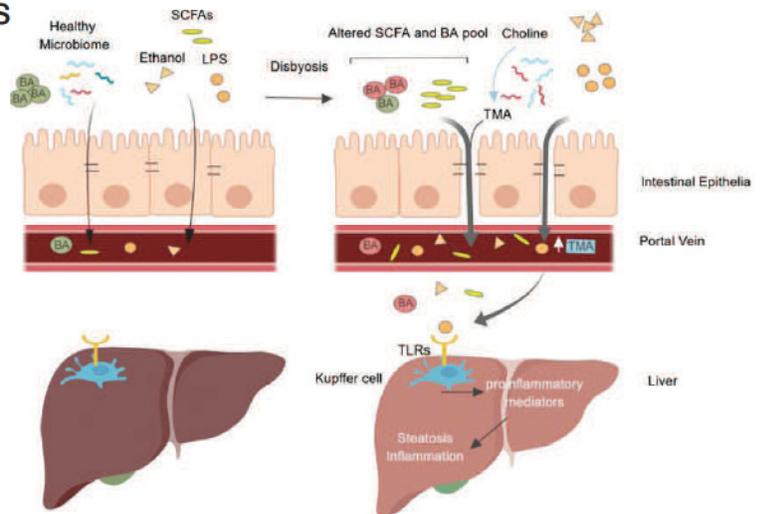
Human microbiota dysbiosis contributes to various diseases



Microbiota in health and diseases. *Sig Transduct Target Ther*, 23 April 2022;7:135

Dysbiosis – source of toxicity

- Blood comes from intestines, contains products produced by microbiome:
 - Phenols
 - Acetaldehyde
 - Ammonia
 - Proinflammatory bacterial components:
 - Peptidoglycan
 - LPS – most potent immune stimulant
- Liver immune cells (lymphocytes, macrophages, dendritic cells, and natural killer cells) respond to DAMPS and PAMPS
- Toll-like receptor binding results in hepatic damage and inflammation



Z Safari, P Gerard. The links between the gut microbiome and non-alcoholic fatty liver disease (NAFLD). *Cellular and Molecular Life Sciences*, April 2019;76(29)

Viral ecosystem

Key points:

- Trillions of viruses in your gut control bacteria and can either protect your health or contribute to diseases like IBD
- Gut's viral ecosystem changes throughout your lifetime based on diet, geography, and aging – with fiber-rich diets promoting healthier viral communities

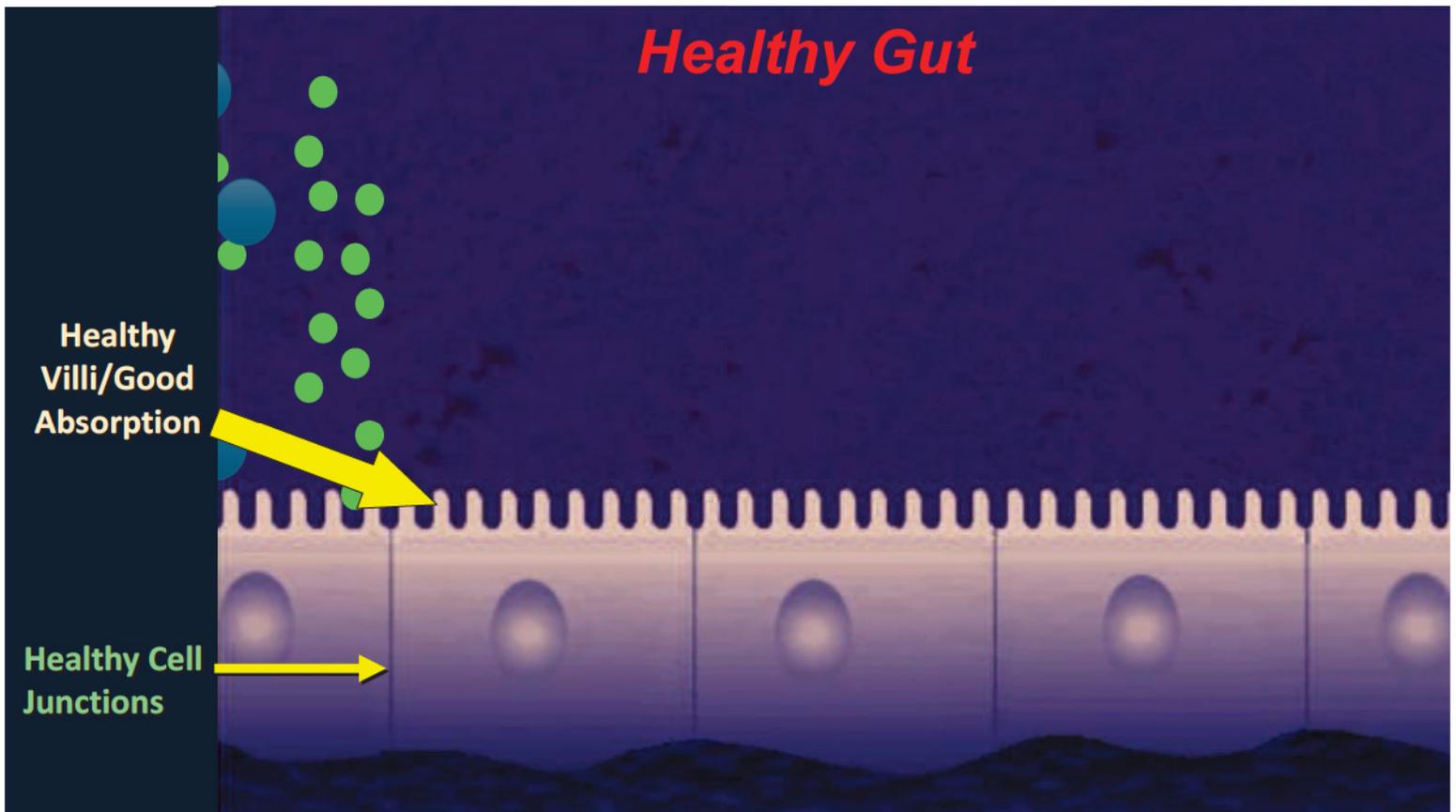
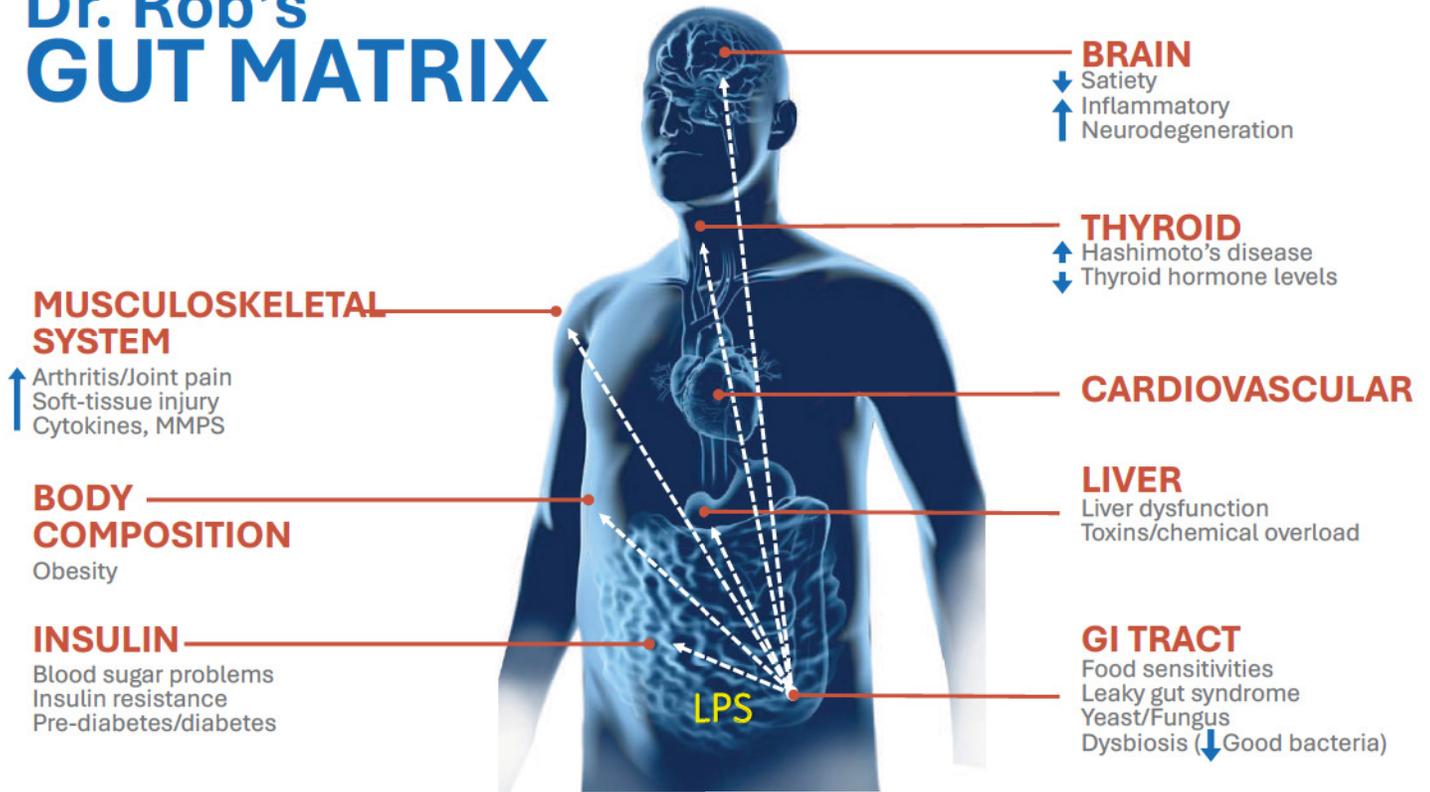
ZY Feng, E Burgermeister, A Philips, et al. **The gut virome in association with the bacteriome in gastrointestinal diseases and beyond: roles, mechanisms, and clinical applications.** *Precision Clinical Medicine*, June 2025;8(2):pbaf010

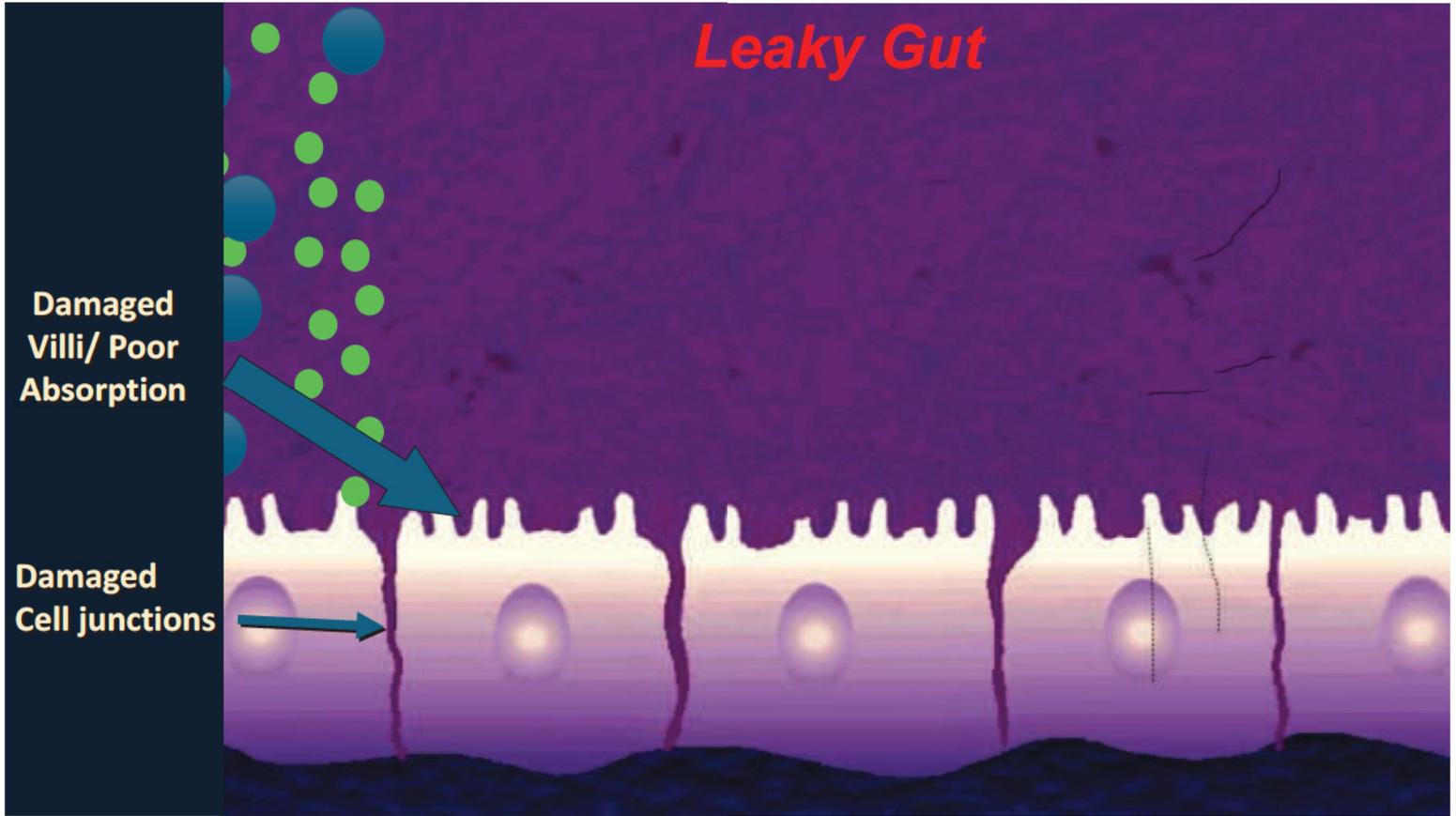
Triggers of increased gut permeability

- Antibiotics
- Acid blocking drugs
- NSAIDs
- Heavy metal exposure
- Environmental toxins
- Concussion
- Caesarian birth
- Liver toxicity
- Gut dysbiosis
- Food sensitivities
- Yeast/bacterial overgrowth
- Chronic stress
- Sleep deprivation
- Chronic inflammation
- Alcohol
- Gluten
- Dairy foods
- Sugar
- Artificial sweeteners
- Food additives/emulsifiers

Dr. Robert Silverman. *Immune Reboot*, 2022

Dr. Rob's GUT MATRIX





“THE GUT IS NOT *VEGAS*.

What happens in the gut,
doesn't stay in *The Gut*”

Dr. Alessio Fasano

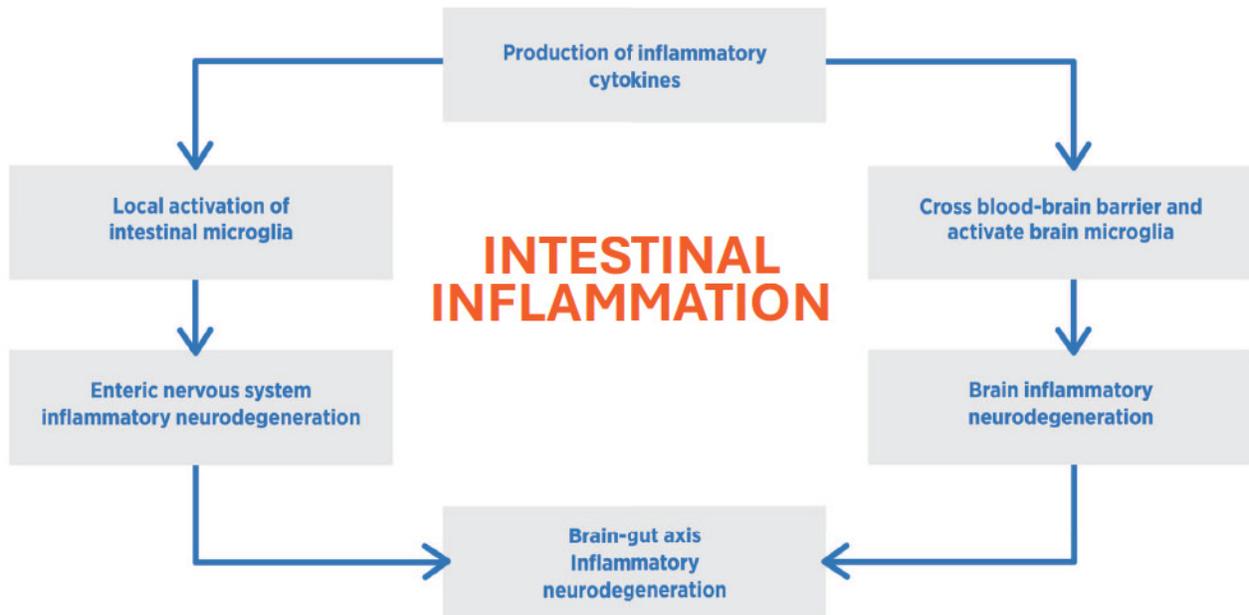


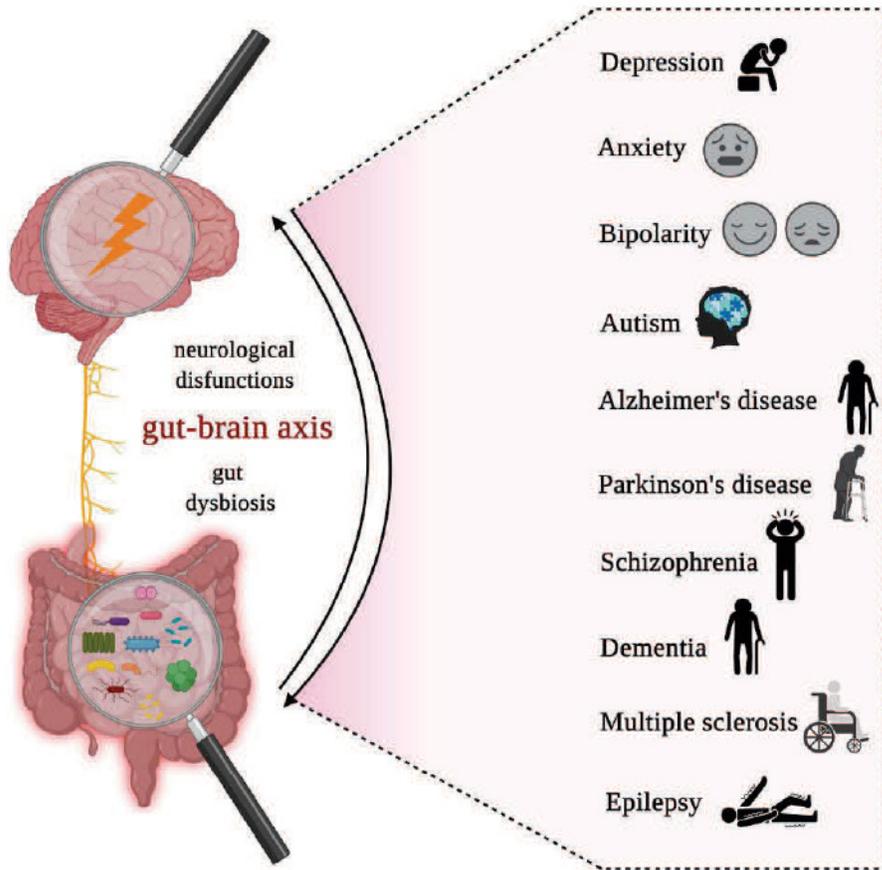
GUT-BRAIN CONNECTION

Getting to the root of the broken brain

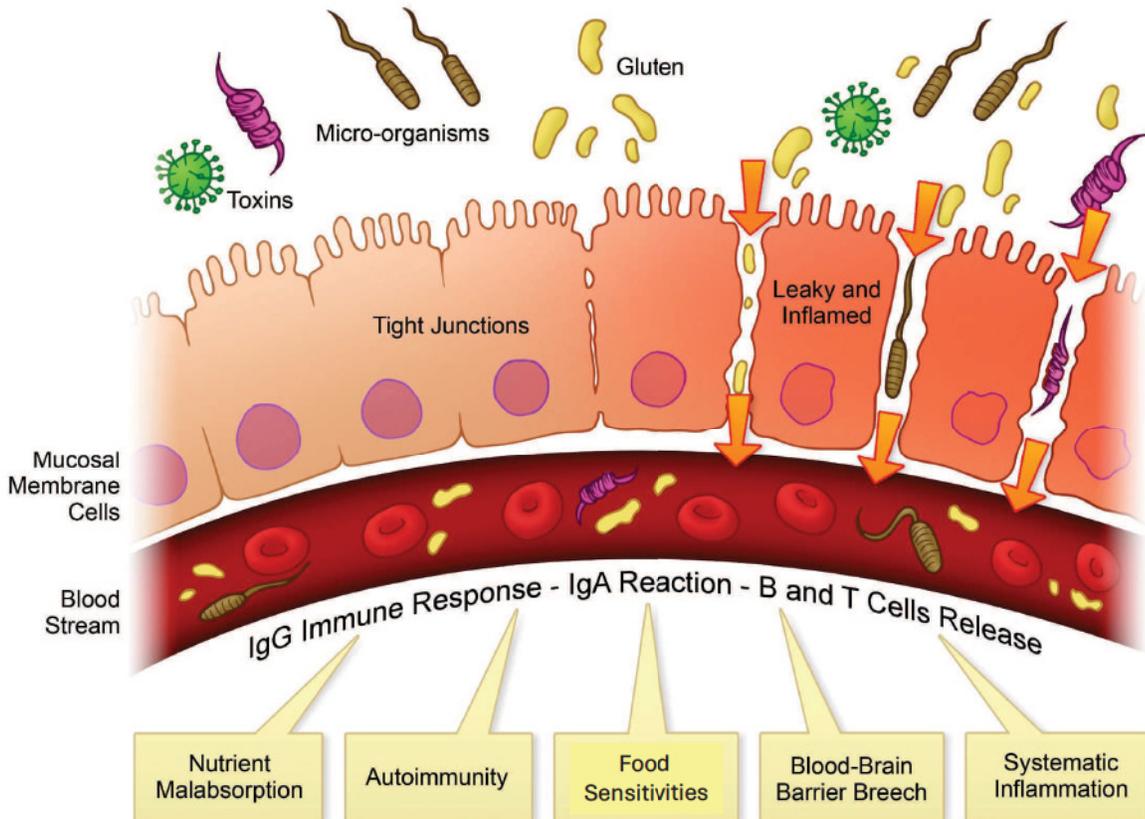
Zhu X, Han Y, Du J, et al. *OncoTarget*. 2017 May 10;8(32):53829-53838

GUT ON FIRE MEANS BRAIN ON FIRE

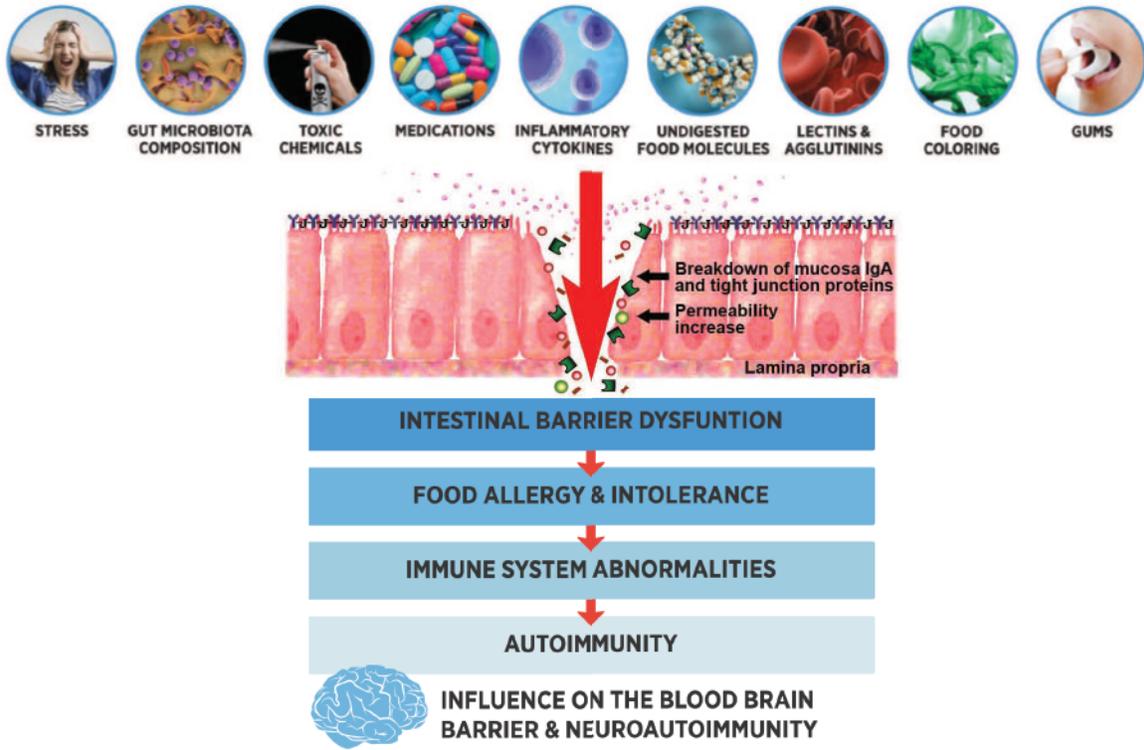




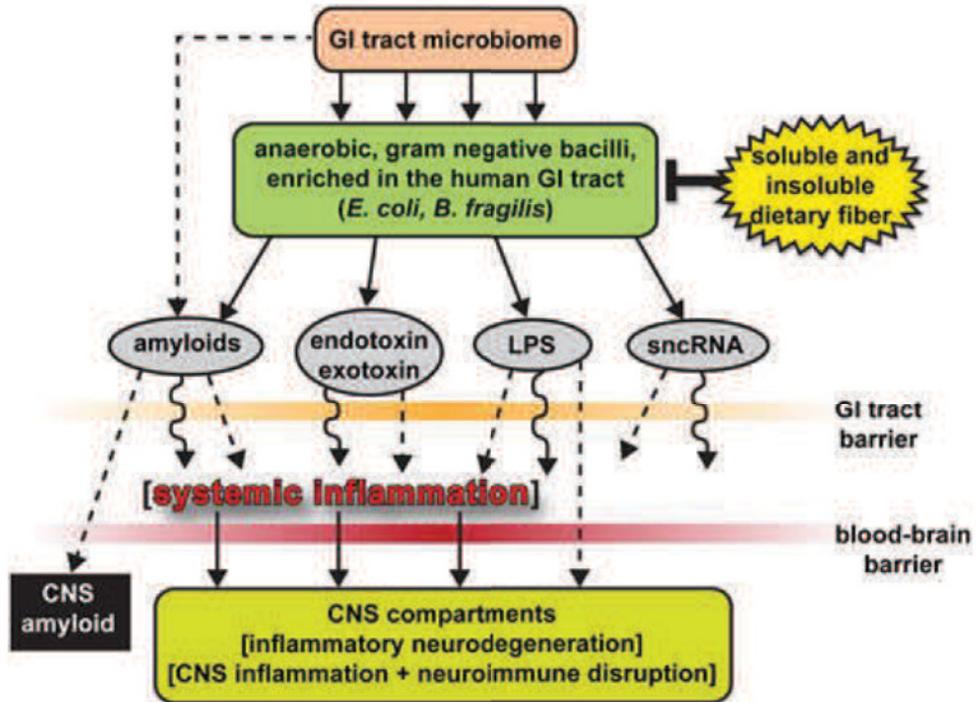
Guts Imbalance Imbalances the Brain: A Review of Gut Microbiota Association With Neurological and Psychiatric Disorders. *Front Med*, 31 March 2022;9 *Sec Gastroenterology*



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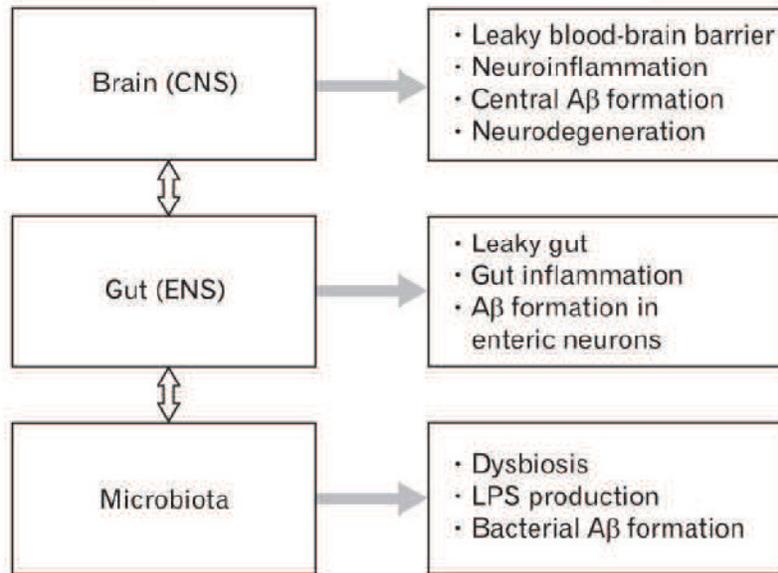
Vojdani A (2016) *Neuroimmunity and the Brain-Gut Connection*. Nova Biomedical: New York.



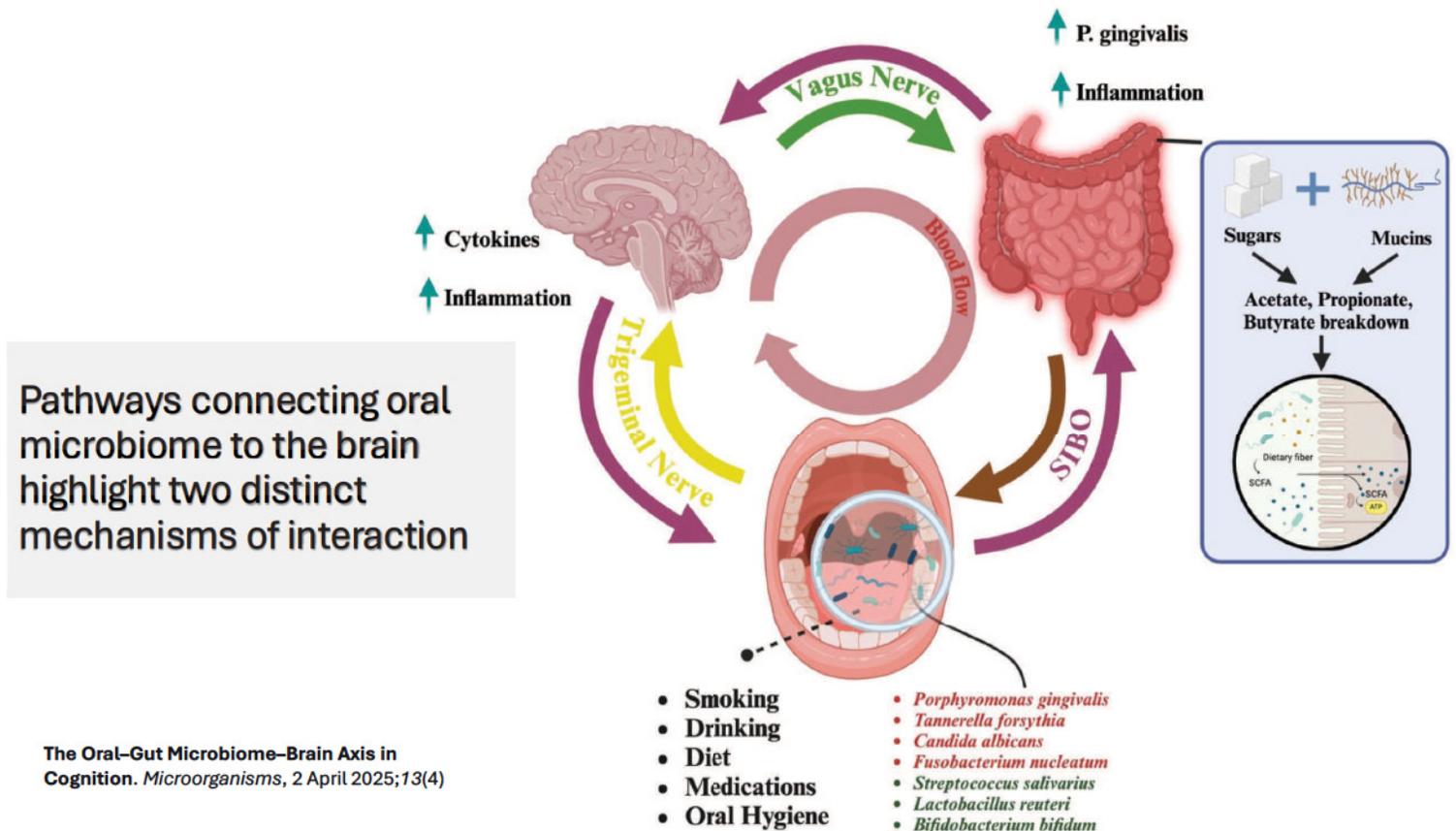
YH Zhao, L. Cong, et al. Microbiome-Derived Lipopolysaccharide Enriched in the Perinuclear Region of Alzheimer's Disease Brain, *Frontiers in Immunology*. Sept 4, 2017

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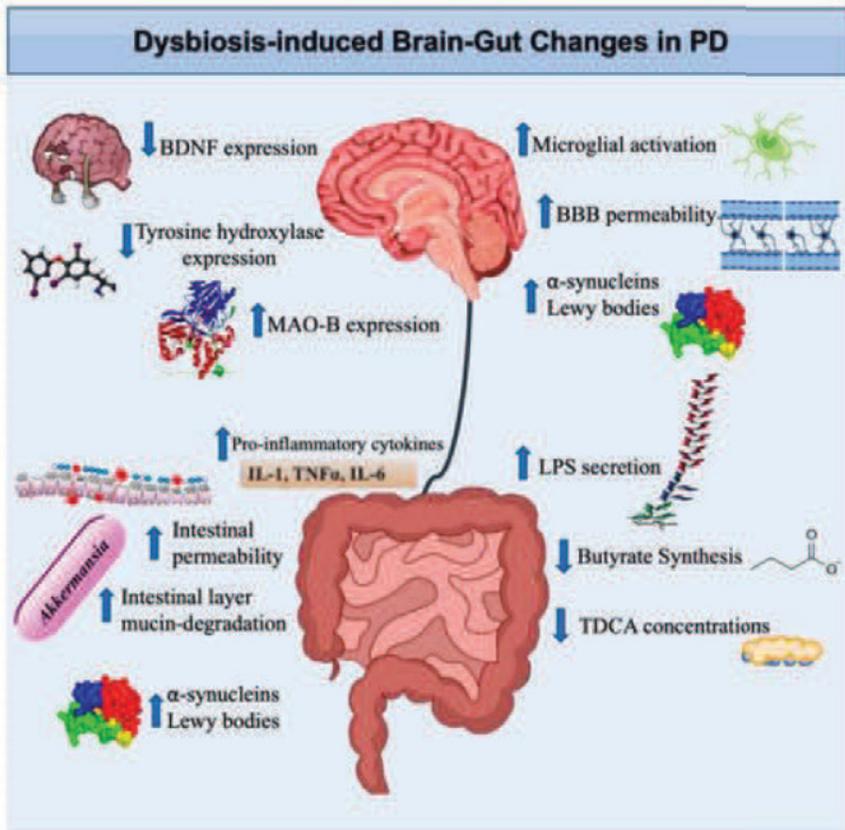
Disturbances of the brain-gut-microbiota axis in Alzheimer's disease



Kowalski K, Mulak A. Brain-Gut-Microbiota Axis in Alzheimer's Disease. *J Neurogastroenterol Motil.* 2019;25(1):48–60. doi:10.5056/jnm18087



The Oral–Gut Microbiome–Brain Axis in Cognition. *Microorganisms*, 2 April 2025;13(4)



Gut microbial dysbiosis in Parkinson's Disorder pathophysiology in the brain and GI tract

Role of Microbiota-Gut-Brain Axis in Regulating Dopaminergic Signaling. *Biomedicines*. 2022; 10(2):436

Toxin from gut bacteria can trigger MS

- MS – chronic condition affecting CNS
- Symptoms, including muscle weakness and vision problems, occur when immune system attacks outer coating of nerve cells
- New research suggests: people with MS more likely to harbor one bacterium - *C. perfringens*, than healthy controls
- *C. perfringens* produces epsilon toxin – opens blood vessels in the brain, allowing inflammatory cells to access the CNS

YH Ma, D Sannino, JR Linden, et al. Epsilon toxin-producing *Clostridium perfringens* colonize the MS gut and epsilon toxin overcomes immune privilege. *J Clin Invest*. 28 Feb 2023

ROLE OF GUT MICROBIOME IN AUTISM

- Gut microbiota associated with Autism
- Gut alters immune system and metabolism
- Higher intestinal permeability with higher antigenic load from GI
- LPS increased in Autism
- Gut microbiome less diverse (ASD)
- Candida twice abundant in Autism
- Up to 90% of people with Autism suffer from gut problems Science Daily, May 30, 2019

Frontiers in Cellular Neuroscience, June 2017. Reviewed over 150 papers

Leaky gut/autism

- Convincing body of evidence suggests relationship between gastrointestinal distress and autism
- Severity of GI symptoms correlated with autism severity, strongly suggesting interaction between gut and brain
- GI distress in ASD may be due to altered intestinal microbiome
- “Leaky gut” and gut-brain axis indicate mechanism by which these altered metabolites can enter the systemic circulation and directly affect neurodevelopment

Fowlie G, Cohen N, Ming X. **The Perturbance of Microbiome and Gut-Brain Axis in Autism Spectrum Disorders.** *Int J Mol Sci.* 2018 Aug 1;19(8):2251

Gut health and testosterone

- Gut health and hormones are connected
- GELDING theory – gut endotoxin leading to a decline in gonadal function
- LPS into circulation is key inflammatory trigger underlying male hypogonadism
- Endotoxin reduces testosterone production by the testis

Tremellen K. Gut Endotoxin Leading to a Decline IN Gonadal function (GELDING) - a novel theory for the development of late onset hypogonadism in obese men. *Basic Clin Androl.* 2016;26:7

Menopause and gut permeability

Summary:

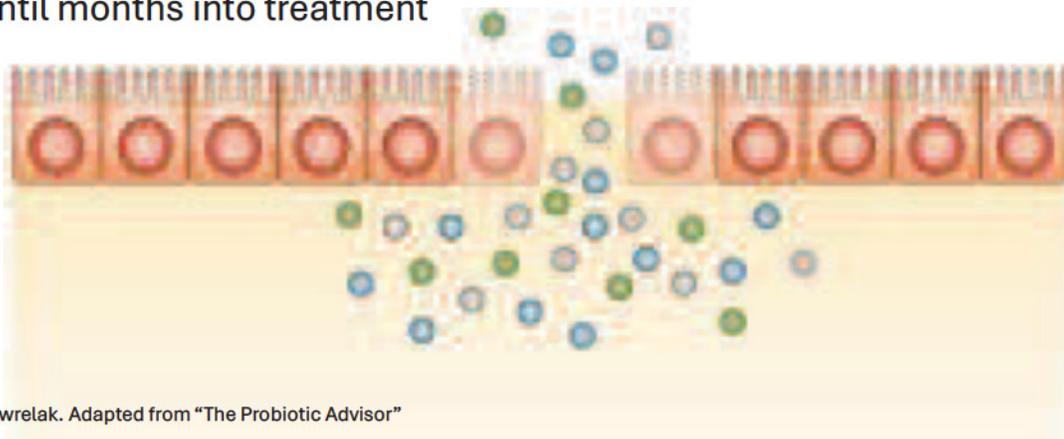
- Gut permeability increases from pre- to post-menopause
- Exploratory results suggest – relation between gut permeability, inflammation, and BMD
- Increased gut permeability during menopausal transition (MT) leads to state of immune activation and inflammation

Key: interventions that target gut physiology during and after MT could lessen inflammation

Shieh A, Epeldegui M, Karlamangla AS, Greendale GA. Gut permeability, inflammation, and bone density across the menopause transition. *JCI Insight.* 2020 Jan 30;5(2):e134092

Why test for increased IP?

- Actual leaky gut report improves patient compliance and motivation:
 - IP treatment takes time and symptomatic improvement may not occur until months into treatment



Dr. Jason Hawrelak. Adapted from "The Probiotic Advisor"

Gut Barrier Panel		
	IgG1-4-C3d	IgA1-2
Candida	Positive	Positive
Zonulin	Negative	Positive
Occludin	Negative	Negative
LPS	Positive	Negative

Gut Barrier Panel		Sample Type:	Bloodspot
Name:	LAST NAME, FIRST NAME	Date Drawn:	01/01/2025
Date of Birth:	01/01/2000	Date Completed:	01/05/2025
Accession Number:	11111	Provider:	Provider's Name

Gut Barrier Panel

KBMO has created a unique Gut Barrier Panel which in recognition that leaky gut occurs across a spectrum we have included the following gatekeeper markers: Candida, Zonulin and Occludin and LPS. For each marker, we measure IgG 1-4 /C3d in addition to IgA 1 and 2.

Gut Barrier Panel					
	IgG1-4+C3d			IgA1-2	
		Cut off		Cut off	
Candida	Negative		Positive		
Zonulin	Negative		Positive		
Occludin	Negative		Negative		
LPS	Negative		Positive		

IgG

- Typically detectable in 7-14 days
- Reach peak levels within 1-2 months
- Can persist for:
 - Several months
 - Several years
 - Even a lifetime
- Average time – 6-9 months

IgM/IgA

- IgM – become detectable 4-5 days after symptom onset (first antibody) generally disappear within 90 days
- IgA – appear within 2 weeks. Typically persists 6-7 months

THE **SUPON!** 7(R) ACTION PLAN

- 1 **Reset** diet/lifestyle/mindset
- 2 **Remove** unwanted pathogens
- 3 **Replace** needed digestive enzymes and stomach acid
- 4 **Regenerate** damaged intestinal mucosa
- 5 **Re-inoculate** with quality pre and probiotics
- 6 **Reintroduce** certain foods removed in step 2
- 7 **Retain** your health and GI integrity

Candida	Zonulin/occludin	LPS
<ul style="list-style-type: none">• Serratiopeptidase• Caprylic acid• Oregano oil• SBI• Probiotics – <i>Lactobacilli</i> strain• Betaine HCl• Vitamin D• Vitamin B6• Calcium EDTA• Black cumin seed oil	<ul style="list-style-type: none">• Probiotics – <i>B. longum</i>, <i>L. rhamnosus</i>, <i>L. reuteri</i>• Vitamin A, D• Zinc carnosine• L-glutamine• Collagen peptides• Curcumin• SCFA butyrate• L. glutathione	<ul style="list-style-type: none">• Probiotics: <i>L. bacillus</i>, <i>Bifidobacterium</i>, <i>S. Boulardii</i>• Prebiotics: XOS• L-glutamine• Polyphenols• Glucosamine HCl• Omega-3 FA• Activated charcoal• SBI• Berberine• Sulforaphane

Photobiomics ability to alter microbiome

- Laser light can affect the microbiome indirectly through the daily circadian rhythm
- Circadian clock regulating levels of metabolites, including those from the microbiome, which in turn can affect metabolome
- Disrupted circadian rhythm on microbiome shows that bacteria responsible for decreased gut integrity and increased LPS occurs
- Favorable improvement in good bacteria (400 fold)
- Significant difference in microbial diversity between PBM and sham

Laser light inhibits biofilm formation in vitro and in vivo by inducing oxidative stress

- Blue (violet) light – efficacy in decreasing viability of various bacterial species:
 - *Pseudomonas aeruginosa*
 - *Porphyromonas gingivalis*
 - *Helicobacter pylori*
 - *Staphylococcus aureus* (MRSA)

Result:

- Blue (violet) laser light exerts direct antimicrobial activity on *P. aeruginosa* grown in planktonic state, on solid surfaces and as biofilms

K Rupel, L Zupin, G Ottaviani, et al. Blue laser light inhibits biofilm formation in vitro and in vivo by inducing oxidative stress. *npj Biofilms Microbiomes*, 9 Oct 2019;5:29

Violet light arrays at 405 Nm exert enhanced antimicrobial activity for photodisinfection of biofilms

- Study reports efficacy of violet light and their antimicrobial activity against biofilms
- Study investigated antibacterial activity range of wavelengths between 375 and 450 nm
- Identified 405 nm as specific wavelength with increased antibacterial activity

Halstead FD, Hadis MA, Marley N, et al. *Applied and Environmental Microbiology*, 16 October 2019;85(21)

Antibacterial/fungal effect of 405 nm

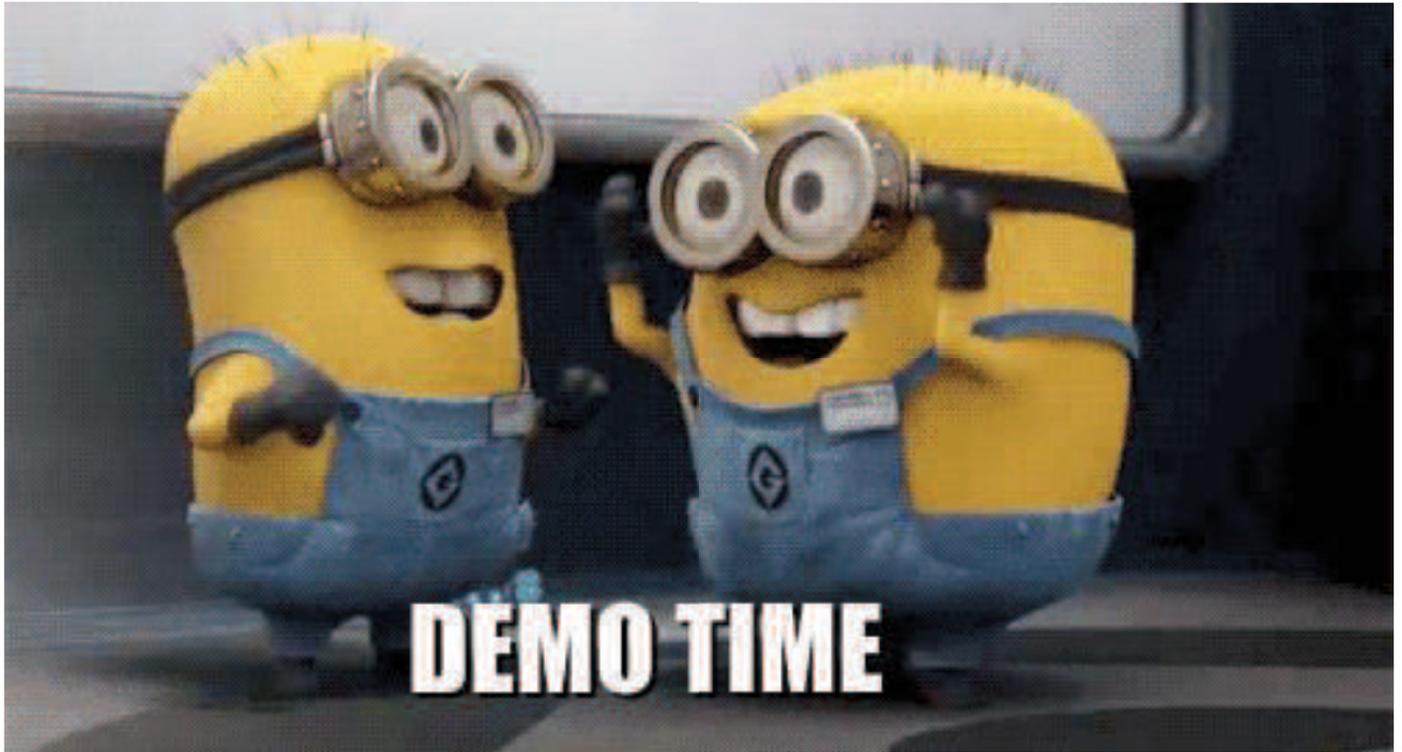
- Irradiation with 405 nm laser has significant bactericidal/fungicidal effect:
 - P. gingivalis – 60% inhibition
 - P. intermedia – 80%
 - C. albicans – 90%
- 5 mins.
- 10 mins.
- 405 nm irradiation – strategy for prevention/treatment of endodontic infections

Takahiro I, Seiko T, Yusuke T, et al. *Int J of Photoenergy* 2014

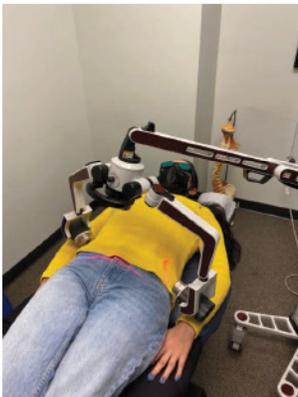
Most susceptible to violet light

- Gram positive/negative bacteria
- LPS
- Mycobacterium
- Mold
- Yeast
- Fungus
- Viruses





Master Gut Protocol 4, 4, 9, 26



Gut-brain reconnection

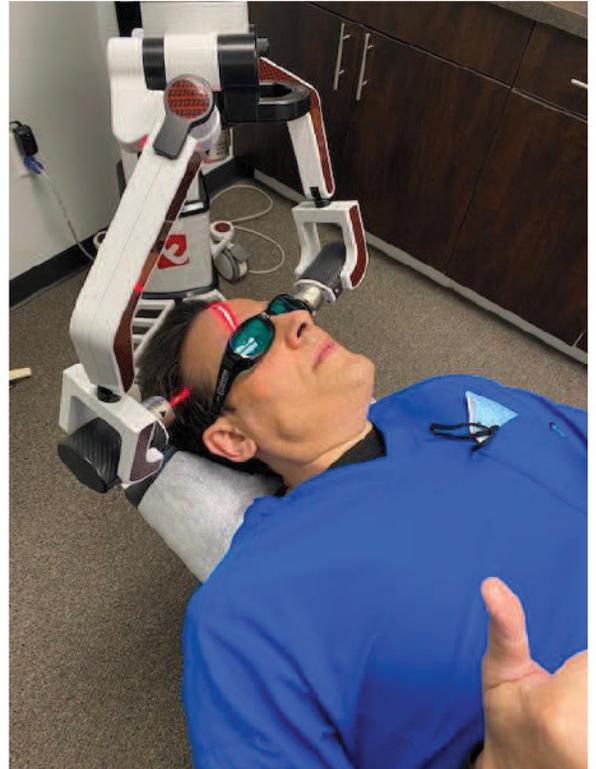
All diodes brain: 1,10,13, 40

Vagus nerve GVL: 10,10,10,10

Preset – 3 sweeps

Linear – 3 sweeps

Non-linear – 3 sweeps



Dr. Rob's SIBO/SIFO protocols

SIBO

- Master Gut: 4, 4, 9, 26 – 5 mins
- Brain: 1, 10, 13, 40 – 3 mins
- Vagus nerve:
 - 10, 10, 10, 10 – trace the nerve
 - SCM region – 1 min
 - Point & shoot MMC/ileocecal valve – 3 mins



SIFO

4, 9, 21, 21



LLLT/liver regeneration

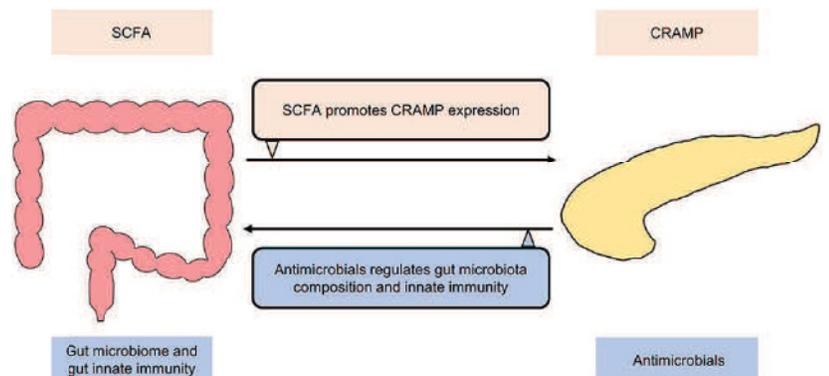
Results:

- Number of proliferating cells per area in regenerating regions of the livers significantly higher in laser-treated rats
- Density of newly formed blood vessels in regenerating area of the laser-treated livers significantly higher than the control non-laser treated livers
- Concluded that LLLT following acute hepatectomy stimulates a significant enhancement of liver regeneration
- Frequencies:
 - Hand-held: 4,10,100,528
 - FX635: 4,10,100,528,4,10
 - FX405: 4,10,100,528,4,10,10,100

Oron U, Maltz L, Tuby H, et al. Enhanced liver regeneration following acute hepatectomy by low-level laser therapy. *Photomed Laser Surg.* 2010 Oct;28(5):675-8

Gut-pancreas (blood sugar) protocol

- Master gut: 4, 4, 9, 26
- Trace from gut to pancreas
- Pancreas: 9, 46, 52, 88
- Laser the spine: 4, 9, 33, 60



Gut Dysbiosis in Pancreatic Diseases: A Causative Factor and a Novel Therapeutic Target. *Frontiers in Nutrition*, 14 February 2022;9:814269

Red light's effect on blood sugar

- Red light applied to the back – 15 minutes
- Stimulated energy production within the mitochondria
- Leads to increased consumption of glucose
- Led to 27.7% reduction in blood glucose levels following glucose intake
- Also reduced max glucose spiking by 7.5%

MB Powner, G Jeffery. **Light stimulation of mitochondria reduces blood glucose levels.** *Journal of Biophotonics*, 20 February 2024;e202300521

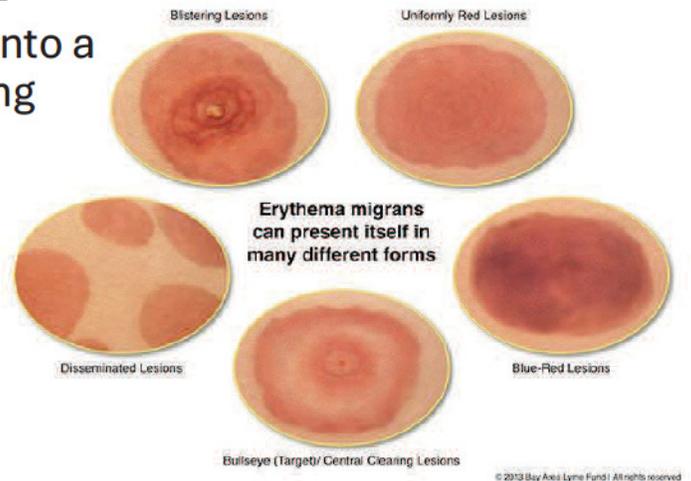
*The most effective clinical outcomes across
all disease spectrums can result from
normalization of gut function*

LONGEVITY

Lyme disease

Early signs: erythema migrans (EM) – commonly small rash that expands into a bulls-eye pattern, with a red outer ring surrounding a clear area

Later signs/symptoms: joint pain, neurological problems



Lyme disease: Test and diagnosis

- *B. burgdorferi* – tough to defeat – only transiently enters bloodstream in small numbers
- Indirect detection through antibody response
- **Western immunoblot:**
 - If symptoms present for < 30 days – both IgM and IgG Western blot are utilized
 - If symptoms present for > 30 days, only IgG Western blot is required
- **ELISA** test: detects antibodies to *B. burgdorferi*
- **Western blot** test: If ELISA is positive, this is used to confirm
- **PCR** test: used for chronic Lyme arthritis

Lyme disease: Nutritional supplementation

- With antibiotics – co-administration of probiotics with antibodies
 - *Lactobacillus spp.*
 - *Bifidobacterium spp.*
 - *Saccharomyces boulardii*
- Biofilm buster – 3 weeks on, 2 weeks off cycle
- Combine with SBI to avoid die-off symptomatology (Herxheimer reaction)

Lyme disease: Nutritional supplementation (cont'd)

- Liquid stevia (1 tsp. BID):
 - Kills persistent cells (highly tolerant to antibodies). Data reveals – stevia kills 94% of Lyme persistent cells
 - Decreases biofilm size by nearly 40%. Data shows stevia kills off Lyme germs living in biofilm
- Pro-resolving mediators:
 - PEA
 - Curcumin
 - Boswelia
 - Ginger
 - Omega-3 FA

Lyme disease: Nutritional supplementation (cont'd)

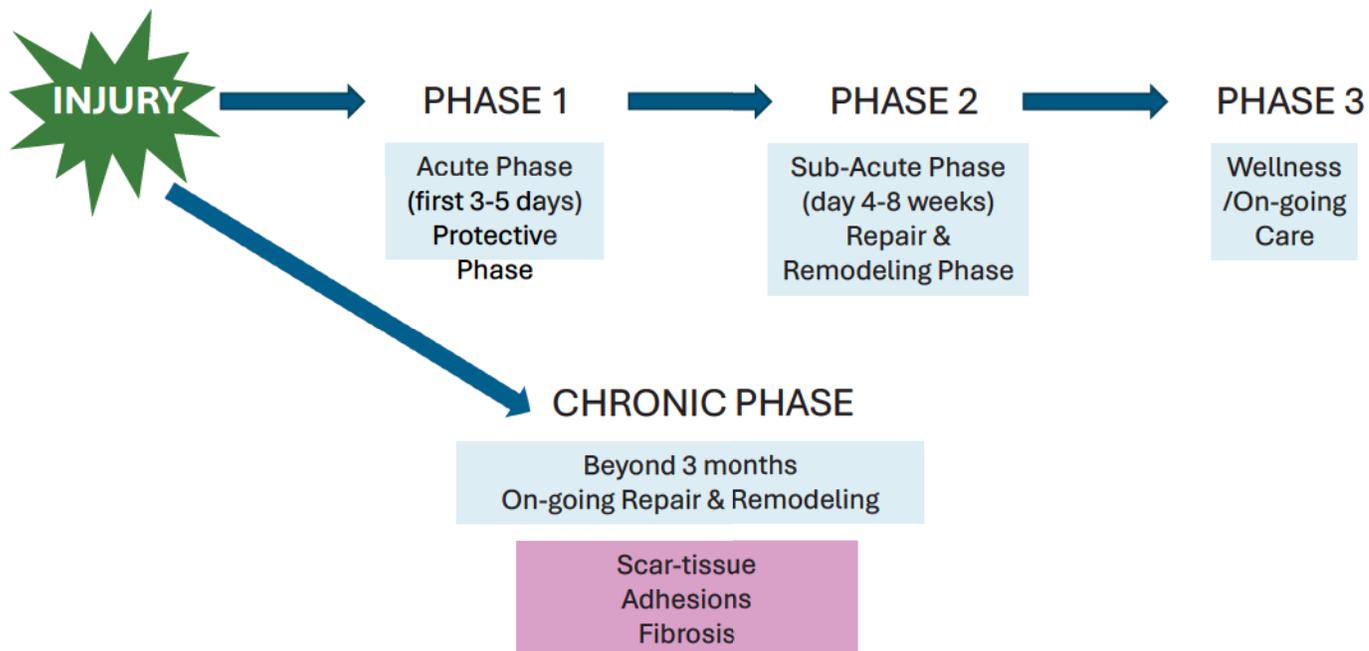
- Continue with pre/probiotic
- D3 10,000 with K2
- Cat's Claw – decreases cytokine production
- Anti-inflammatory diet

Lyme disease: Dr. Rob's laser protocol

- Positive test – no symptoms: 5 mins. each:
 - Master Gut: 4,4,9,26
 - Brain: 1,10,13,40
 - Rash area Master Lyme: 3,8,25,70
- With symptoms – **GVL**/FX635:
 - Joint area 4 mins: 3,8,25,70
 - Heart region 4 mins: 3,8,25,70
 - Spine 4 mins: 3,8,25,70
 - Dr. Rob's mitochondrial setting 2 mins: 4,9,16,32
- Immune 3 min each:
 - Thymus and spleen: 10,20,40,73
 - Master gut: 4,4,9,26



3 Phases of Care



Dr. Rob's Nutritional Take

- Specific nutrients and oxygen required to sustain heavily used muscle
- Overuse soft tissue injuries result when supply of nutrients are unable to match demands of muscle/tendon region
- Healthy nutrient supply through diet and supplementation assists body with natural function and repair processes

FX635/405 – Frequency settings

How to take your patients through acute, sub-acute healing into wellness and performance:

PROTOCOL	Left Hz	Centre Hz	Centre Hz	Right Hz	TIME
1st phase - Acute, for the first 5 days					
Acute1	4, 8	4, 8	8, 25	25, 42	10
Acute2	4, 9	4, 9	9, 33	33, 60	10
Acute3	9, 16	9, 16	16, 42	42, 53	10
2nd phase- sub-acute (repair/remodeling), day 5 through week 8					
Sub-Acute 1	8, 25	8, 25	25, 42	42, 48	10
Sub-Acute2	12, 30	12, 30	30, 45	45, 64	10
Sub-Acute3	16, 35	16, 35	35, 48	48, 90	10
3rd phase is wellness and performance					
Well/Perf1	10, 10	10, 10	10, 10	10, 10	10
Well/Perf2	1, 4	1, 4	4, 9	9, 32	10
Well/Perf3	6, 16	6, 16	16, 26	26, 42	10
Additional Settings					
Chronic	4, 10	4, 10	40, 400	400, 400	10
Nerve Root	4, 9	33, 60	4, 9	33, 60	5
Brain	1, 10	13, 40	1, 10	10, 40	10
Gut	4, 4	4, 4	4, 26	9, 26	10

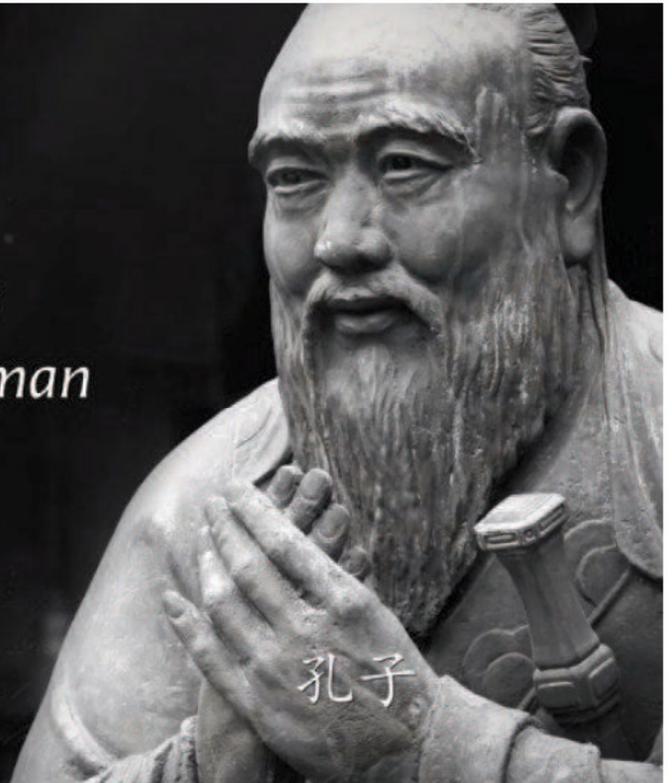
Key Laser Therapy **Protocols** for musculoskeletal Injuries



*“A healthy man wants
a thousand things, a sick man
only wants one.”*

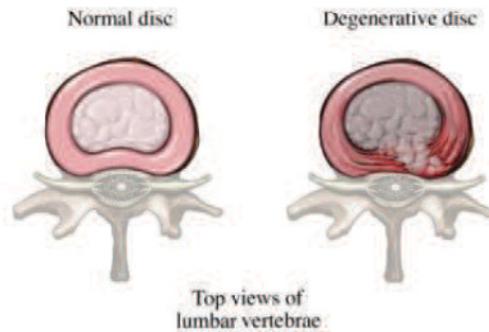
CONFUCIUS

Chinese philosopher, 551 BCE – 479 BCE



Intervertebral Disc Disease

IVD – the largest structure in the body without vascular supply



Healing of disc periphery has potential to relieve discogenic pain by re-establishing a physical barrier between nucleus and nerves, and reducing inflammation.

Intervertebral Disc Treatment Protocol

- Laser at point/point of involvement
- Laser during movement: 30-60 sec.
- Laser “locomotor lock-in”
- Corrective exercise:
 - Bracing
 - McGill big 4
 - Hip flexor stretched
 - KB swings



Intervertebral Disc Treatment Protocol (cont'd)

- Core “lock-in”
- Nutritional protocol
- Myofascial release
- Mobilize, manipulate, flex/distraction, joint restrictions

Pro-inflammatory biomarkers and low-back pain

Conclusion:

- Positive association between CRP and IL-6 and severity of NsLBP
- Positive association between TNF-Alpha and presence of NsLBP



Van den Berg R, Jongbloed EM, de Schepper EIT, et al. **The association between pro-inflammatory biomarkers and nonspecific low back pain: a systematic review.** *Spine J*, 2018 Jun 27

Interleukin-1 β in intervertebral disk degeneration

- Interleukin-1 (IL-1) β has strong pro-inflammatory activity by stimulating the secretion of multiple pro-inflammatory mediators
- IL-1 β is highly expressed in degenerative intervertebral disk (IVD) tissues and cells
- Inhibition of IL-1 β found to promote extracellular matrix (ECM) repair and protect against disk degeneration

Yang W, et al. *Clin Chim Acta* 2015

New approach to diagnosing low back pain

- Findings determined serum levels of IL-6 significantly higher in subjects with low back pain compared with control participants
- Participants with low back pain due to spinal stenosis or degenerative disc disease also had higher levels than those with intervertebral disc herniation and controls
- Findings suggest that patients with low back pain have low-grade systemic inflammation
- Biochemical profiling or circulating cytokines can assist in diagnosing those with low back pain

North Shore-Long Island Jewish (LIJ) Health System-Jan-7-2016

LLLT – spinal cord injury

- LLLT allowed neurons to survive
- LLLT elevated IL-4 and IL-13
- Results show that LLLT:
 - Has potential for reducing inflammation
 - Regulates macrophage/microglial
 - Promoting neuronal survival
- LLLT may be an effective candidate for treatment of spinal cord injury

LLLT facilitates alternatively activated macrophage. *Nature.com*, Apr 4, 2017

Effectiveness of LLLT in patients with discogenic lumbar radiculopathy

- 110 patients
- 55 patients treated with LLLT and conventional PT
- 55 patients treated with conventional PT alone
- Both groups received 18 treatment sessions

Results: LLLT/PT group had significant improvements over PT alone:

- Local trunk movements
- Pain intensity
- Related functional disability
- No side-effects after LLLT use

Ahmed I, Bandpei MAM, Gilani SA, et al. Effectiveness of Low-Level Laser Therapy in Patients with Discogenic Lumbar Radiculopathy: A Double-Blind Randomized Controlled Trial. *J Healthc Eng.* 2022 Feb 27;2022:6437523



LLLT on pain relief and interleukin-6

Conclusion:

Long periods of LLLT have better effects in improving complication of spinal cord injury (SCI). Since LLLT does not cause the side effects of MPSS, long term use of LLLT may be proper alternative for MPSS in decreasing post SCI side effects

Mojarad N, Janzadeh A, et al. *J Chem Neuroanat*, 2018 Jan;87:60-70

Low level light therapy (LLLT) modulates inflammatory mediators secreted by human annulus fibrosus (AF) cells during intervertebral disc degeneration in vitro

Key Takeaway:

- Inflammatory microenvironment in AF cells suppressed by LLLT (IL-6 and 8 levels)
- Results indicate LLLT is potential method of IVD treatment
- 405 NM – most positively affected IL-6

Photochem Photobiol 2015, Mar-Apr;91(2):403-10

Back pain

- Reviewed 301 randomized trials
- Researchers reviewed 56 treatments for acute and chronic pain
- Few were effective
- Found: NSAIDs effective at reducing short-term or acute LBP
- Others considered effective at reducing chronic LBP:
 - Exercise
 - Spinal manipulation
 - Antidepressants
 - Cream-warming sensation
 - Taping the LB

Cashin AG, Furlong BM, Kamper SJ, et al. **Analgesic effects of non-surgical and non-interventional treatments for low back pain: a systematic review and meta-analysis of placebo-controlled randomised trials.** *BMJ Evidence-Based Medicine*, Published Online First: 18 March 2025

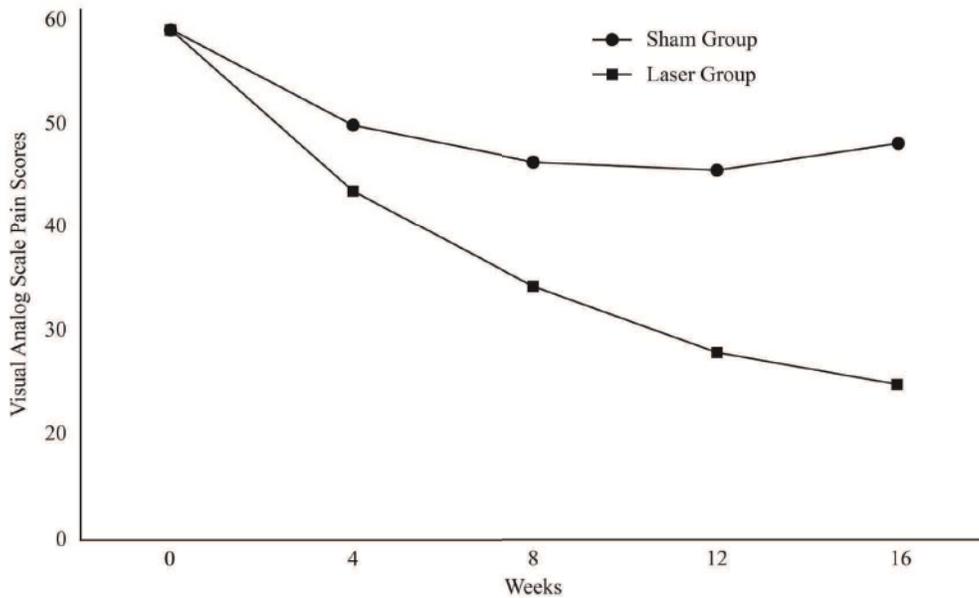
Efficacy of 635nm Red Low-Level Laser on Nociceptive Musculoskeletal Pain Compared to NSAIDs, Opioids, and Other Light Sources

- 635nm shown in multiple studies to be **superior** to:
 - NSAIDs
 - Opioids
 - **Red** light therapy (laser average 6.7X greater result)
- Laser triggered long-term repair of tissues, which created long-term reduction in pain

J Januskewski, C Bromley, et al. **Efficacy of 635nm Red Low-Level Laser on Nociceptive Musculoskeletal Pain Compared to NSAIDs, Opioids, and Other Light Sources** *Orthopedics and Rheumatology*. *Orthopedics and Rheumatology Open Access Journal (OROAJ)*, 2020;17(2): OROAJ.MS.ID.555960

LLLT for
chronic
low-back pain

Changes in visual analog scale low-back pain scores



TS Berry, PJ Quarneri, G. Roche, TM Sammons. A Randomized, Double-blind, Sham-Controlled Study Evaluating the Effectiveness of a Low-level laser Device for Treating Lower-Back Pain. *eMedical Res.* 2:10005

Low-back options

Stand-alone or synergistic with other treatments/modalities

- Stand-alone: set it and forget it
- With:
 - Myofascial release
 - E-stim
 - Exercise rehab
 - Acupuncture/dry-needling
 - Decompression
 - Taping
 - Adjustment
 - Instrument-assisted soft tissue mobilization
 - Modalities

Core Lock-In



4, 9, 33, 60
30 sec. each side

Testing a theory

Laser using FX635 and Violet to Treat Low Back Pain

RESEARCH ARTICLE **Open Access**

Could low grade bacterial infection contribute to low back pain? A systematic review

Donna M Urquhart^{1*}, Yiliang Zheng¹, Allen C Cheng¹, Jeffrey V Rosenfeld^{1,2}, Patrick Chun^{1,3}, Susan Liow^{1,4}, Sultana Morita Hussain¹ and Flavia M Cicuttini¹

Abstract

Background: Recently, there has been both immense interest and controversy regarding a randomised, controlled trial which showed antibiotics to be effective in the treatment of chronic low back pain (disc herniation with Modic Type 1 change). While this research has the potential to result in a paradigm shift in the treatment of low back pain, several questions remain unanswered. This systematic review aims to address these questions by examining the role of bacteria in low back pain and the relationship between bacteria and Modic change.

Methods: We conducted electronic searches of MEDLINE and EMBASE and included studies that examined the relationship between bacteria and back pain or Modic change. Studies were rated based on their methodological quality, a best evidence synthesis was used to summarise the results, and Bradford Hill's criteria were used to assess the evidence for causation.

Results: Eleven studies were identified. The median (range) age and percentage of female participants was 44.7 (41-46.4) years and 41.5% (27-59%), respectively, and in 7 of the 11 studies participants were diagnosed with disc herniation. Nine studies examined the presence of bacteria in spinal disc material and all identified bacteria, with the pooled estimate of the proportion with positive samples being 34%. *Propionibacterium acnes* was the most prevalent bacteria, being present in 7 of the 9 studies, with median (minimum, maximum) 45.0% (0-86.0) of samples positive. The best evidence synthesis found moderate evidence for a relationship between the presence of bacteria and both low back pain with disc herniation and Modic Type 1 change with disc herniation. There was modest evidence for a cause-effect relationship.

Conclusions: We found that bacteria were common in the spinal disc material of people undergoing spinal surgery. There was moderate evidence for a relationship between the presence of bacteria and both low back pain with disc herniation and Modic Type 1 change associated with disc herniation and modest evidence for causation. However, further work is needed to determine whether these organisms are a result of contamination or represent low grade infection of the spine which contributes to chronic low back pain.

Keywords: Bacteria, Disc, Infection, Low back pain, Modic change, Systematic review

Background

There has been both immense interest and controversy regarding a recent randomised, controlled trial (RCT) which showed antibiotic treatment to be effective in the treatment of chronic low back pain in individuals with herniated discs and associated Modic Type 1 changes (bone oedema) on magnetic resonance imaging (MRI) [1]. The RCT was based on the hypothesis that some individuals with a disc herniation develop chronic low back pain due to a secondary infection that occurs in the disc. While this research has the potential to result in a paradigm shift in the treatment of low back pain, it has not currently been translated into clinical practice. These findings have some similarities to the discovery of *Helicobacter pylori* and the shift it led to in the way peptic ulcers are treated. However, a greater understanding of the evidence underlying this RCT is required before a change in practice can be justified. Moreover, full list of author information is available at the end of the article.

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Conclusion:

- Bacteria common in spinal disc material of people undergoing spinal surgery
- Moderate evidence for relationship between presence of bacteria and both low back pain with disc herniation and Modic Type 1 change associated with disc herniation
- Modest evidence for causation

Urquhart, D.M., Zheng, Y., Cheng, A.C. et al. Could low grade bacterial infection contribute to low back pain? A systematic review. *BMC Med* 13, 13 (2015)

HHS Public Access
Author manuscript
Discov Med. Author manuscript, available in PMC 2018 May 11.

Published in final edited form as:
Discov Med. 2015 October ; 20(110): 177-184.

Disc-covery of the Drivers of Inflammation Induced Chronic Low Back Pain: From Bacteria to Diabetes

Deborah J. Gorth, Irving M. Shapiro, and Makarand V. Risbud
Department of Orthopaedic Surgery and Graduate Program in Cell and Developmental Biology,
Thomas Jefferson University, Philadelphia, PA, U.S.A

Abstract

The intervertebral disc is a unique avascular organ that supports axial skeleton flexion and rotation. The high proteoglycan content of the nucleus pulposus tissue, present at the center of the disc, is pivotal for its mechanical function, distribution of compressive loads. Chronic low back pain, a prevalent and costly condition, is strongly associated with disc degeneration. Degenerated discs exhibit high levels of inflammatory cytokines, matrix catabolizing enzymes, and an overall reduction in proteoglycan content. Although the cytokine profile of diseased discs has been widely studied, little is known of what initiates and drives inflammation and subsequent low back pain. Recent studies by Albert and colleagues have shown that anaerobic bacteria are present in a high percentage of painful, herniated discs and long-term treatment with antibiotics resolves symptoms associated with chronic low back pain. It is thought that these anaerobic bacteria in the disc may stimulate inflammation through toll-like receptors to further exacerbate disc degeneration. Despite the promise and novelty of this theory, there are other possible inflammatory mediators that need careful consideration. The metabolic environment associated with diabetes and atypical matrix degrading products also have the ability to activate many of the same inflammatory pathways as seen during microbial infection. It is therefore imperative that the research community must investigate the contribution of all possible drivers of inflammation to address the wide spread problem of discogenic chronic low back pain.

Introduction

Understanding the intervertebral disc (IVD) is necessary to address the serious global health problem of low back pain. Low back pain (LBP) is a profoundly debilitating and increasingly prevalent condition. It is currently the worldwide leading cause of disability. This condition is responsible for 58.2 million years lived with disability in 1990, 83 million in 2010, and an economic burden conservatively estimated at \$1 billion dollars in 2005 alone (Buchbinder et al., 2013; Martin et al., 2008). Although LBP is a complex problem without one clear etiology, there is a strong association between LBP and disc degeneration. A study reviewing the MRIs of patients with persistent LBP showed disc degeneration in 87% of participants (Ambak et al., 2015). Additionally, patients with severely degenerate discs are 3.2 times more likely to suffer from LBP (Livshits et al., 2011). Despite the strong link

*Correspondence to: Dr. Makarand V. Risbud, Department of Orthopaedic Surgery, 1025 Locust Street, Suite 111 College Bldg., Thomas Jefferson University, Philadelphia 19107, PA, 215-955-1043, Fax: 215-955-9150, makarand.risbud@jefferson.edu.

Gorth DJ, Shapiro IM, Risbud MV. Discovery of the drivers of inflammation induced chronic low back pain: from bacteria to diabetes. *Discov Med*. 2015 Oct;20(110):177-84

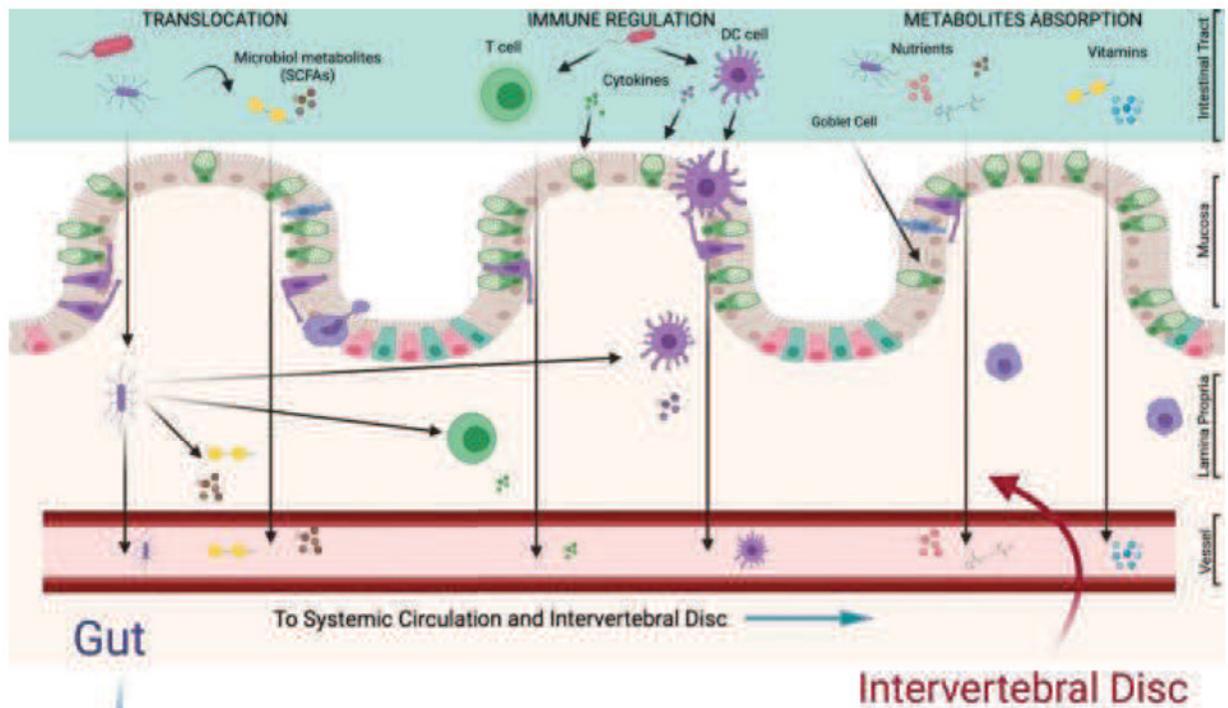
Is infection the possible initiator of disc disease?

Conclusion:

Study demonstrates bacterial specific proteins and host defense proteins to infection which strengthen hypothesis of infection as possible initiator of disc disease

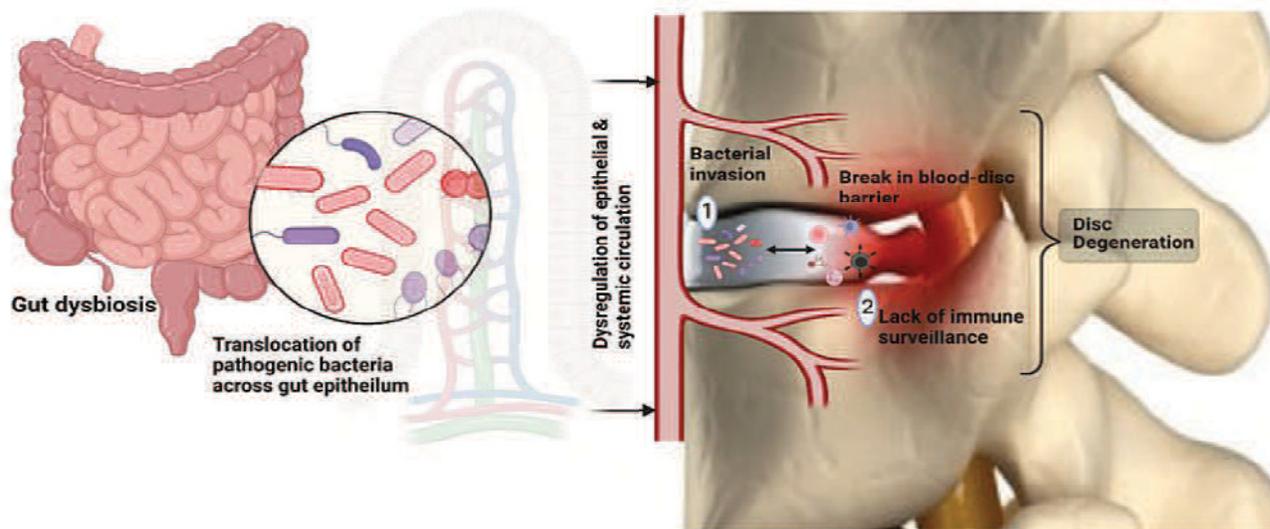
S Rajasekaran, C Tangavel, SN Aiyer, *et al.* ISSLS PRIZE IN CLINICAL SCIENCE 2017: Is infection the possible initiator of disc disease? An insight from proteomic analysis. *Eur Spine J*, 6 Feb 2021;26:1384–1400

Gut-disc axis



Gut-disc axis: A cause of intervertebral disc degeneration and low back pain?. *Eur Spine J* (2022)

Gut-Disc Axis



Is Dysbiotic Gut the Cause of Low Back Pain?. Cureus, July 26, 2023;15(7): e42496

Glucosamine & Chondroitin Sulfate Combined May Support Overall Musculoskeletal Integrity

BMC Complement Altern Med. 2003 Jun 10;3:2. Epub 2003 Jun 10.

Glucosamine and chondroitin sulfate supplementation to treat symptomatic disc degeneration: biochemical rationale and case report.

[van Blitterswijk WJ](#), [van de Nes JC](#), [Wuisman PJ](#).

Division of Cellular Biochemistry, The Netherlands Cancer Institute, Antoni van Leeuwenhoek Hospital, Plesmanlaan 121, 1066CX Amsterdam, The Netherlands. w.v.blitterswijk@nki.nl

BACKGROUND: Glucosamine and chondroitin sulfate preparations are widely used as food supplements against osteoarthritis, but critics are skeptical about their efficacy, because of the lack of convincing clinical trials and a reasonable scientific rationale for the use of these nutraceuticals. Most trials were on osteoarthritis of the knee, while virtually no documentation exists on spinal disc degeneration. The purpose of this article is to highlight the potential of these food additives against cartilage degeneration in general, and against symptomatic spinal disc degeneration in particular, as is illustrated by a case report. The water content of the intervertebral disc is a reliable measure of objectively determined by Magnetic Resonance Imaging (MRI). The purpose of this study was to evaluate the efficacy of glucosamine and chondroitin sulfate for two years associated with MRI in a case of symptomatic spinal disc degeneration. We present the efficacy of these nutraceuticals. They are bioavailable to cartilage, stimulate the biosynthesis and inhibit the breakdown of their extracellular matrix. **CONCLUSION: This study suggests that long-term glucosamine and chondroitin sulfate supplementation may counteract symptomatic spinal disc degeneration, particularly at an early stage.** However, more trials with these food supplements, in which disc degeneration is the primary outcome, are needed. A number of biochemical reasons (that mechanistically need to be investigated) may have cartilage structure- and symptom-modifying effects in general.

“The case suggests that long-term glucosamine and chondroitin sulfate intake may counteract symptomatic spinal disc degeneration.”

BMC Complement Altern Med. 2003 Jun 10;3:2

Omega-3 fatty (n3-FA) acid supplementation reduces intervertebral disc degeneration (IVD)

- EPA/DHA in a 2:1 ratio used
- 4-6 gram needed
- Reduction of blood AA/EPA ratios from 40 to 20 was demonstrated after 1 month of daily supplementation

Conclusion:

- n-3 FA dietary supplementation reduces systemic inflammation by lowering AA/EPA ratios
- Has potential protective effects on the progression of spinal disc degeneration

NaPier Z, Kanim LEA, Arabi Y, et al. *Med Sci Monit*, 2019 Dec 14;25:9531-9537

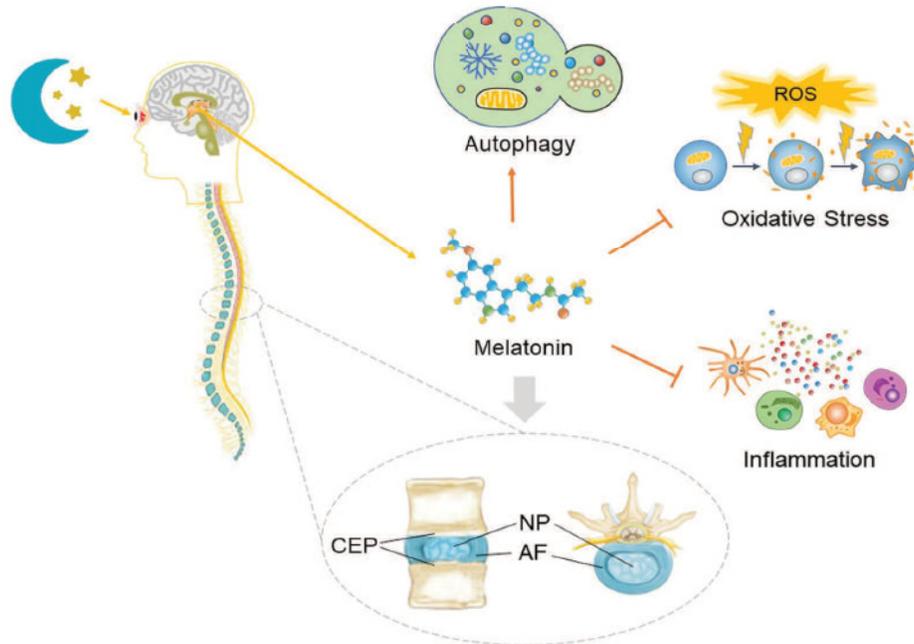
Lower back pain (LBP)

Conclusion: Subjects with vitamin D deficiency or insufficiency were 2.3 times more likely to exhibit LBP than subjects with normal vitamin D3 concentration



BMC research notes. Dec 1, 2019

The effects of melatonin on IVD cells during intervertebral disc ageing and degeneration



The potential role of melatonin in retarding intervertebral disc ageing and degeneration: A systematic review. *Ageing Research Reviews*, 2021;70:101394

Melatonin

Highlights:

- Can effectively alleviate intervertebral disc ageing and degeneration
- Inhibits disc cell apoptosis and degeneration in multiple ways
- Promotes matrix anabolism in intervertebral disc cells
- Resists oxidative stress, regulates autophagy, and inhibits inflammation

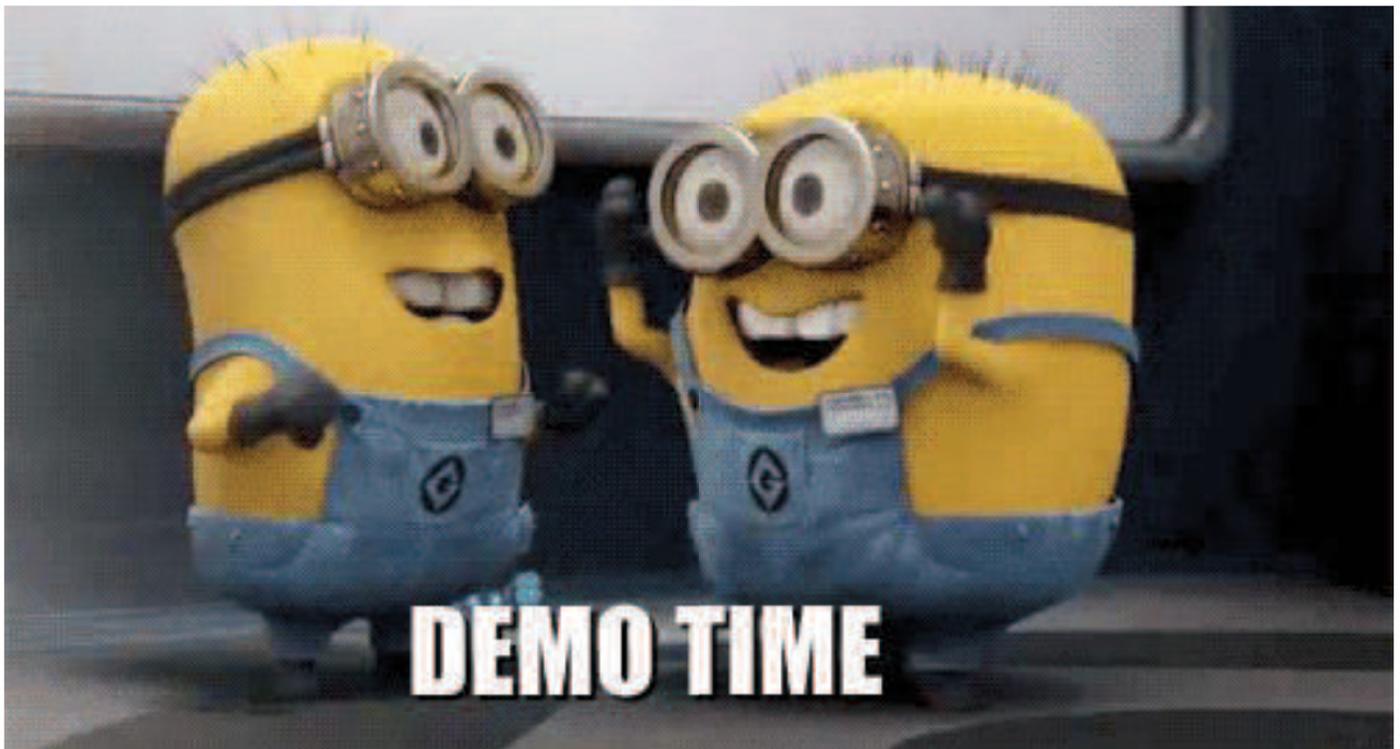
L. Paracasei S16 and lumbar disc herniation

Results:

- *L. paracasei* S16 treatment improved behavior
- Increased cell proliferation
- Decreased apoptosis in LDH mice
- Alleviated aberrant inflammation response
- Decreased serum metabolites involved in linoleic acid metabolism, alanine, aspartate, and glutamate

L. paracasei S16 can improve inflammation response, alter gut microbiota

Wang Z, Wu H, Chen Y, et al. *Lactobacillus paracasei* S16 Alleviates Lumbar Disc Herniation by Modulating Inflammation Response and Gut Microbiota. *Front Nutr.* 2021;8:701644. Published 2021 Aug 10

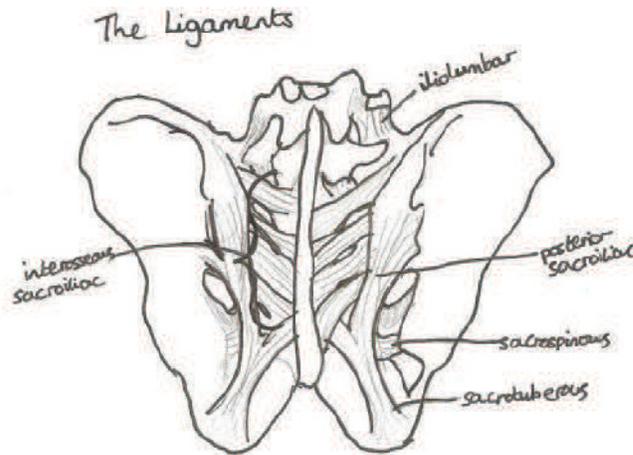


Ligament

- Sacro tuberos
- Dorsal sacroiliac
- Iliolumbar

Role

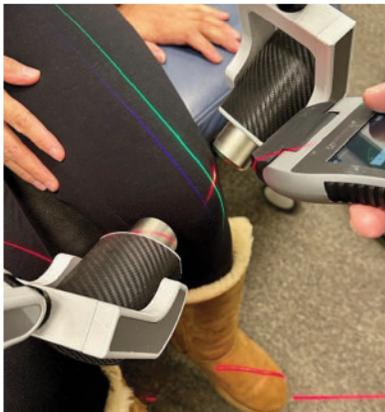
- Restricts rotation
- Restricts counter-rotation
- Restricts rotation and side-bending



5-step treatment for **lower** joint injury

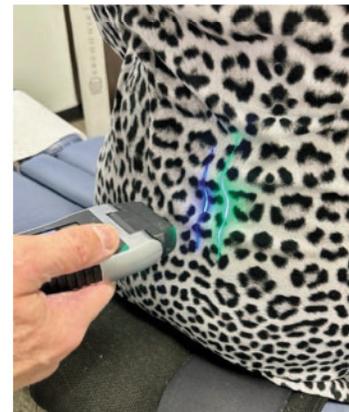
Major surgery or joint replacement

- I. Lower limb (knee) left side:
- Utilize all 3 wavelengths
 - Move limb throughout treatment



- II. Continue laser knee with movement:

- Add laser application to lower-back (spinal nerves)



5-step treatment for **lower** joint injury (cont'd)

III. Laser same side cerebellum:

- Continue laser knee with movement



IV. Laser opposite side of cortex:

- Continue laser knee with movement



V. Upregulate muscle around knee (muscle activation) with laser

5-step treatment for **upper** joint injury

Major surgery or joint replacement

I. Upper limb (shoulder), right side:

- Utilize all 3 wavelengths
- Move limb throughout treatment



II. Continue laser shoulder with movement:

- Add laser application to cervical spine



5-step treatment for **upper** joint injury (cont'd)

III. Laser same side cerebellum:

- Continue laser shoulder with movement



IV. Laser opposite side of cortex:

- Continue laser shoulder with movement



V. Upregulate muscle around shoulder (muscle activation) with laser

Advanced Protocols

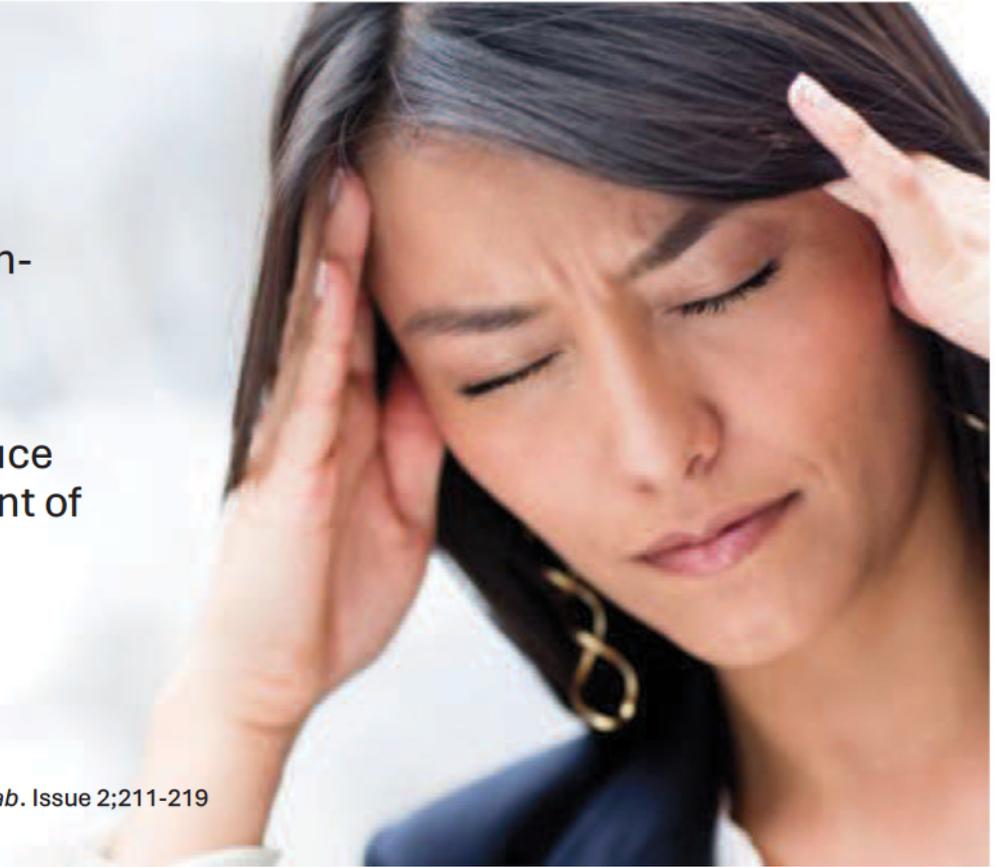
**Piriformis
syndrome
Dural sheath
Headache**



Headaches

In patients with tension-type headache the combination of neural mobilization and soft-tissue techniques induce significant improvement of pain and function

Archives of Physical Medicine and Rehab. Issue 2;211-219



Journal of Orthopaedic & Sports Physical Therapy

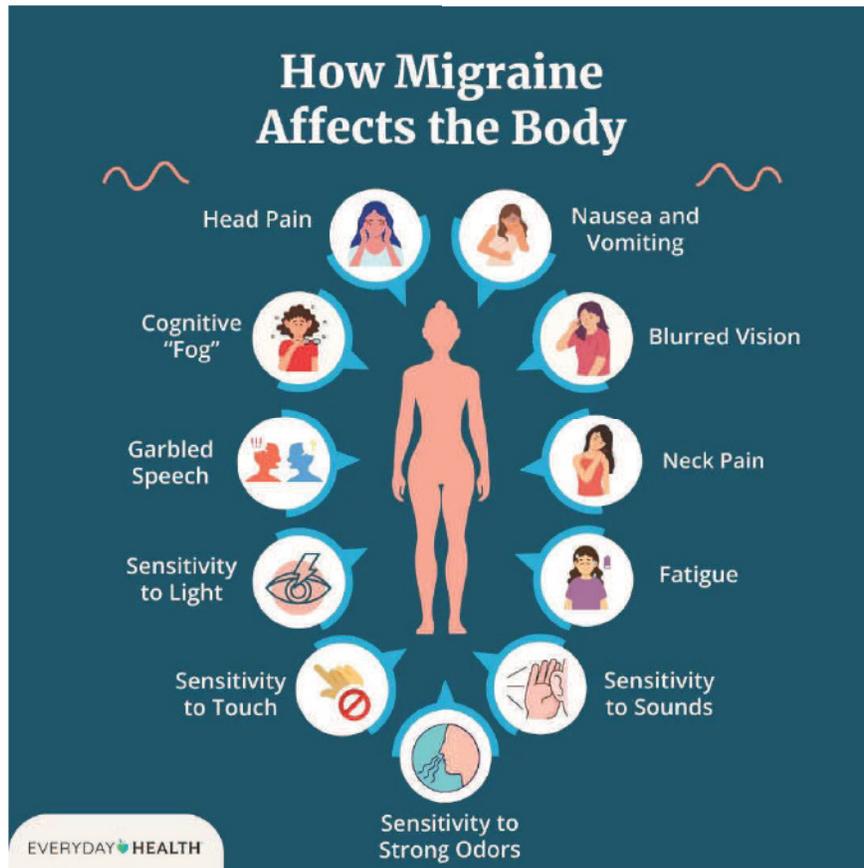
JOSPT

Effectiveness of neural mobilization

Reveals benefits of neural
mobilization for back and
neck pain



JOSPT, Jul 2017



Migraine factoids

- Migraine headaches affect over 1 billion globally – women being 3X more susceptible
- In the US – 42 million adults suffer from migraines – 1 in 6 households
- Third most common neurological disorder globally
- A headache characterized by recurrent episodes of pain
- Typically accompanied by nausea/vomiting, or photophobia and phonophobia

Causes of migraines

- Family history
- Imbalances in neurotransmitters (serotonin and dopamine)
- Inflammation in brain can also contribute to pain
- Vasodilation thought to be key mechanism
- Anxiety, depression

Mayoclinic.org

Triggers of migraines

- Stress
- Hormone fluctuations
- Sleep deprivation
- Foods (chocolate, cheese, caffeine)
- Bright lights
- Physical exertion
- Changes in weather

Mayoclinic.org

Concussion/migraine

- Concussion can be trigger for migraine, particularly in individuals susceptible to developing TTM and future migraines
- Consequently, concussion and migraine can occur from same trauma
- Post-concussive syndrome can include migraine headaches
- Treatments for post-concussive migraine headaches similar to those for regular migraine:
 - Rest
 - Lifestyle adjustments

Lords Q, Greene JP. **Traumatic migraine versus concussion: a case report.** *Sports Health.* 2014 Sep;6(5):406-9

Concussion/migraine (cont'd)

- Mild TBI – risk for chronic migraine
- Data reveals: more than 95% of all who suffer concussion can expect a headache

Lords Q, Greene JP. **Traumatic migraine versus concussion: a case report.** *Sports Health.* 2014 Sep;6(5):406-9

Laser/headaches

- LLLT helps with migraines by improving blood flow to brain, decreasing inflammation, and promoting tissue healing
- LLLT:
 - Improves brain blood flow
 - Reduces inflammation
 - Promotes healing
 - Reduces pain and severity
 - Modulates neurotransmitters (serotonin)
 - Addresses underlying causes:
 - TMJ
 - Whiplash
 - sinus problems

520 NM/headaches

- **520 NM green light** therapy for migraines
- Scientifically shown to reduce headache frequency and intensity – effect especially helpful for migraine sufferers and those with light sensitivity
- Harvard University medical school: exposing migraine sufferers to green light significantly reduces photophobia and can reduce headaches severity

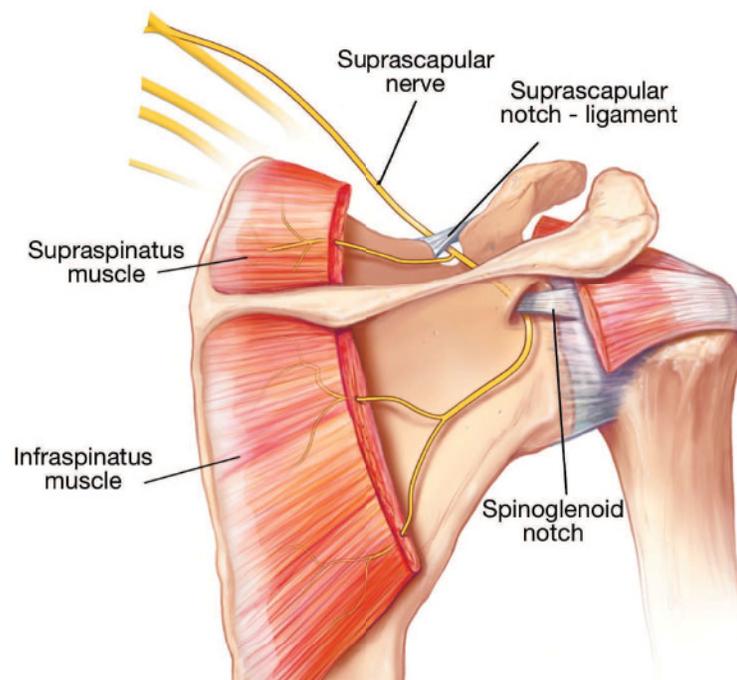
Diet

Decrease inflammation from food, food sensitivities:

- White Willow bark
- Feverfew
- Malic acid
- Ca/Mg
- Multivitamin/mineral
- Pre/probiotics
- BPC-157

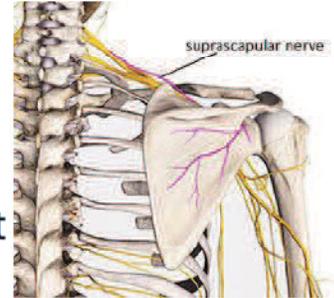
Environmental triggers – detox

Suprascapular nerve



Suprascapular nerve

- Supplies supraspinatus and infraspinatus muscles C5/6
- Eyes straight ahead
- Lateral flexion head contralaterally with eyes straight
- Shoulder blade away from midline
- Pull arm back and over head
- Laser area at superior transverse – scapular ligament
- Then notch-nerve
- Then neck C5/6 - nerve



Rotator Cuff (Impingement Syndrome): Causes

- Tendinopathy
- Wear and tear – collagen breakdown
- Poor posture
- Scapula orientation
- Falling – overstretch arm, bracing with arm
- Repetitive stress
- Heavy lifting activities

Risk Factors

- Age, being an athlete, posture, weak shoulder muscles

Frozen Shoulder: The Effectiveness of Conservative and Surgical Interventions

Conclusion:

Strong evidence for the effectiveness of laser therapy



British Journal of Medicine 2011, Jan. 45(1), p.49-58

LLLT treatment in patients with frozen shoulder

Results: Laser vs. placebo group

- Significant decrease in overall, night, and activity pain scores at end of 4, 8, 16 weeks
- Significant decrease in shoulder pain and disability index (SPADI) scores end of 4, 8, 16 weeks
- Significant decrease in disability of arm, shoulder, and hand questionnaire (DASH) scores at the end of 8 and 16 weeks
- Significant decrease in HAQ scores at end of 4 & 8 weeks

Stergioulas A. Low-power laser treatment in patients with frozen shoulder: preliminary results. *Photomed Laser Surg.* 2008 Apr;26(2):99-105

Efficacy of LLLT for shoulder tendinopathy

Conclusion:

- 17 randomized controlled trials (RCTs)
- Optimal LLLT can offer clinically relevant pain relief and initiate a more rapid course of improvement, both alone and in combination with physiotherapy interventions

Haslerud S, Magnussen LH, Joensen J, et al. **The efficacy of low-level laser therapy for shoulder tendinopathy: a systematic review and meta-analysis of randomized controlled trials.** *Physiother Res Int.* 2015 Jun;20(2):108-25

LLLT combined with exercise for subacromial impingement

Conclusion:

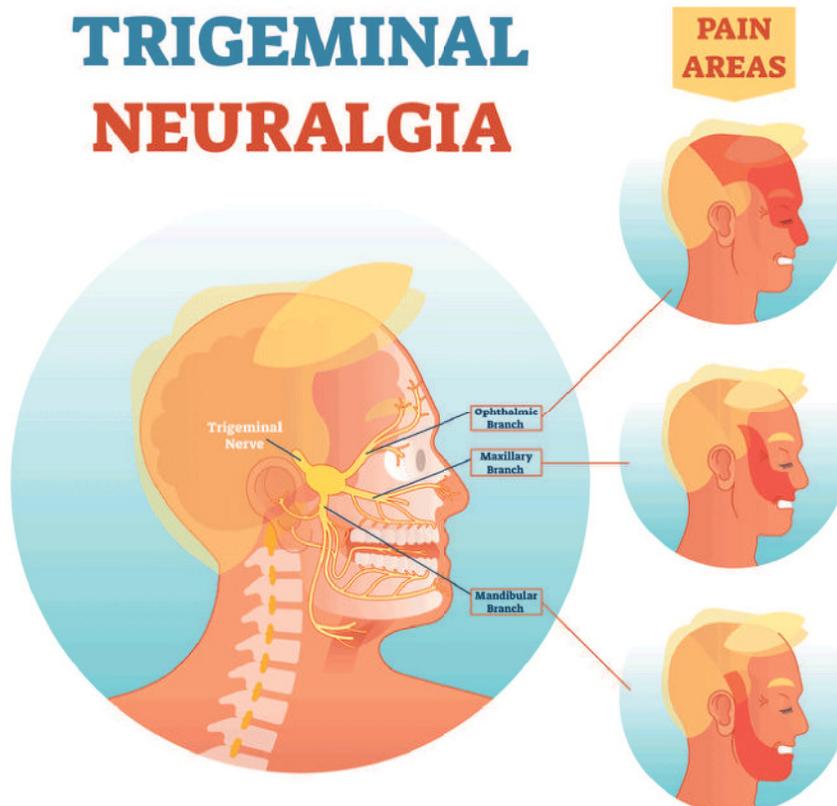
LLLT combined with exercises:

- Reduce pain intensity
- Improve shoulder function
- reduces medication intake over 3 months

Alfredo PP, Bjordal JM, Junior WS, et al. **Efficacy of low-level laser therapy combined with exercise for subacromial impingement syndrome: A randomised controlled trial.** *Clin Rehabil.* 2021 Jun;35(6):851-860

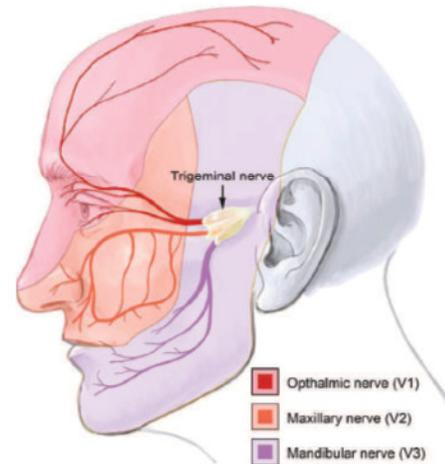
Rotator Cuff Injury Treatment Protocol

- Laser at point/points of involvement:
 - Muscle/joint/scapular (9,16,42,53)
- Laser during movement – 30-60 sec.
- Laser “locomotor lock-in”
- Laser “core lock-in”
- Corrective exercise
- Mobilize, manipulate joint restrictions
- Myofascial release



Trigeminal Nerve

Trigeminal nerve – part of the nervous system responsible for sending pain, touch and temperature sensations from your face to your brain



Journal of Oral and Maxillofacial Surgery 2021

my.clevelandclinic.org

Trigeminal Nerve

- Cranial nerve #5
- Largest of cranial nerve
- Complex due to its extensive anatomic course
- Mixed sensory and motor
- Divides into 3 nerves:
 - Ophthalmic
 - Maxillary
 - Mandibular

Dr. Rob's NEUROPATHY protocol

- Laser distal area of limb – 5 mins. 2,2,2,2 (repeat)
- Laser associated area of spine – 5 mins. 4,9,33,60 (repeat)
- Laser the brain – 5 mins. 1,5,10,13,20,40,13,16

Dr. Rob's NEUROPATHY protocol (cont'd)

- ALA
- PEA
- GLA
- Omega-3 FA

Anti-inflammation

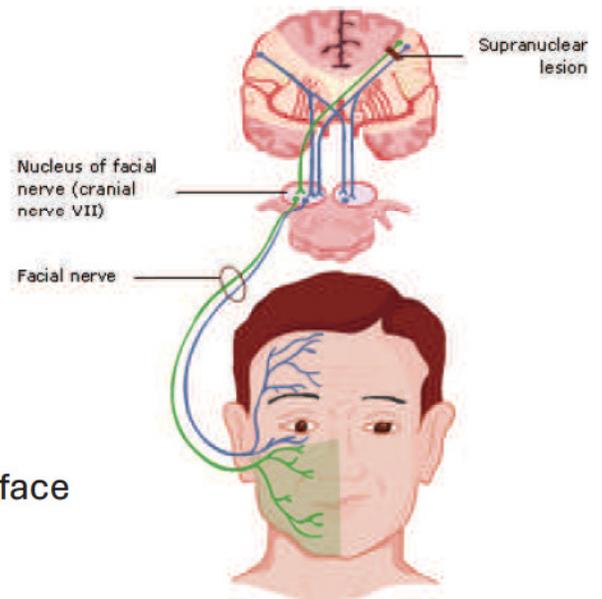
- Pro-resolving mediators
- Turmeric
- Boswelia
- BPC-157
- PEA
- Quercetin

Nitric oxide (NO)

- L-arginine
- L-citrulline
- Magnesium
- Vitamin C
- Beetroot
- Green tea

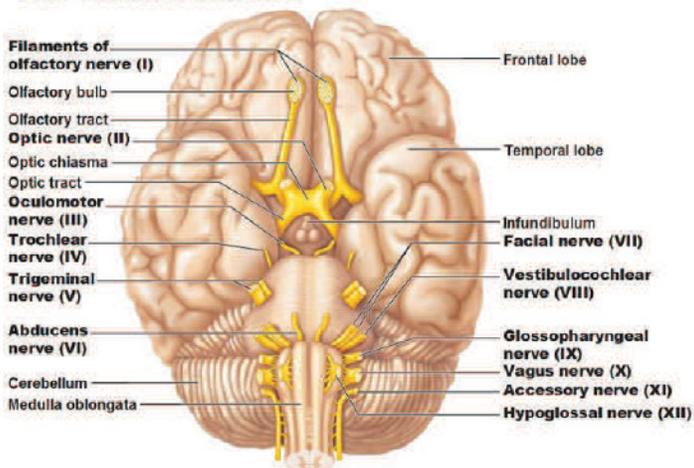
Bells palsy

- Peripheral facial nerve palsy
- Cause:
 - Swelling/inflammation of nerve
 - Reaction to viral infection
 - Cranial nerve 7 (facial nerve)
- Symptoms:
 - Disorder facial movements
 - Tearing, drooling
 - Inability to close eye on affected side of face
 - Loss of anterior 2/3 of tongue sensation



Bells palsy (cont'd)

The Cranial Nerves



Takeaway:

- May be due to inflammation against nerve controlling movement of the face
- Cranial nerve 7 provides:
 - Motor innervation to facial muscles for expression
 - Sensory – anterior 2/3 of tongue
 - Parasympathetic innervation of glands in oral cavity

Effectiveness of LLLT combined with facial expression exercises in patients with moderate-to-severe Bell's palsy

- 120 patients. LLT, ES, corticosteroid/antiviral therapy were compared
- LLLT combined with facial expression exercises (FEE) may fasten functionary recovery
- LLLT combined with FEE may benefit Bell's palsy patients to complete facial functions recovery
- Moderate-to-severe Bell's palsy participants can be prevented from residual facial paralysis
- Facial exercises with mirror-visual feedback used in all groups

Praveen KK, Sukumar S, Shaikh AB, et al. *International J of Surg Protocols*, 2020;24:39-44

Shingles

- Affected area for 3 minutes: 10,20,40,73 (virus)
- Laser the spine - affected level: 2 minutes
- Nerve root: 2 minutes: 4,9,33,60

Nutrients:

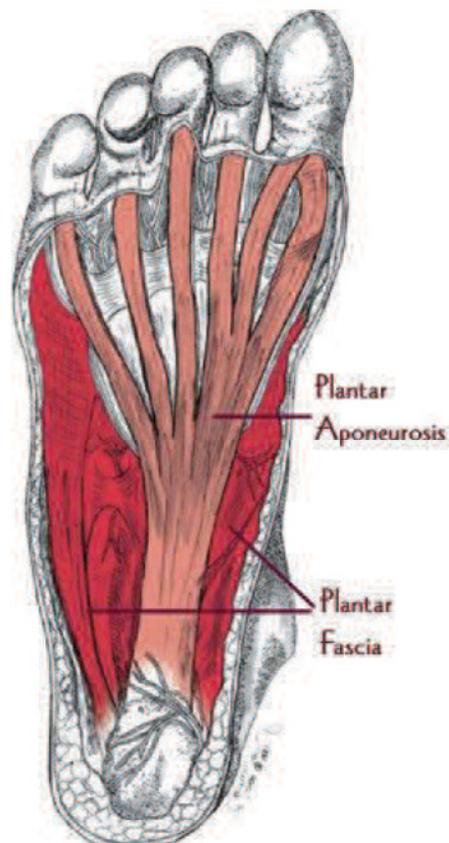
- Lysine
- B12
- Vitamin C
- Zinc
- Turmeric

Anti-inflammation laser for protocols for whole body

1. Over **carotid/jugular arteries**: 9,16,42,2720, 2-3 minutes
2. Over the **liver**: 4,10,100,528, 2-3 minutes
3. **Thymus**: 5,20,48,625, 2-3 minutes
4. Finish with the **gut**: Dr. Rob's master gut protocol, 4,4,9,26

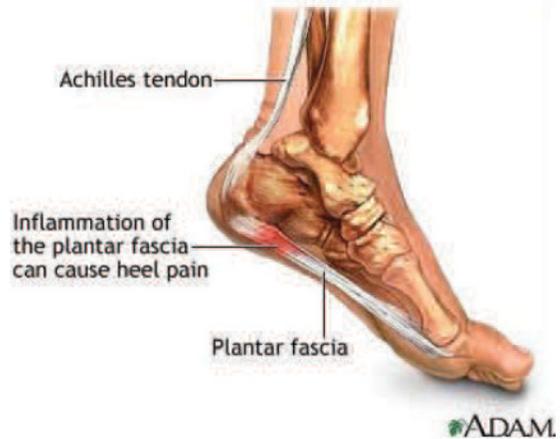
Plantar Fasciitis

- Facts
- Symptoms
- What it is
- What causes it
- Clinical assessment
- Treatment

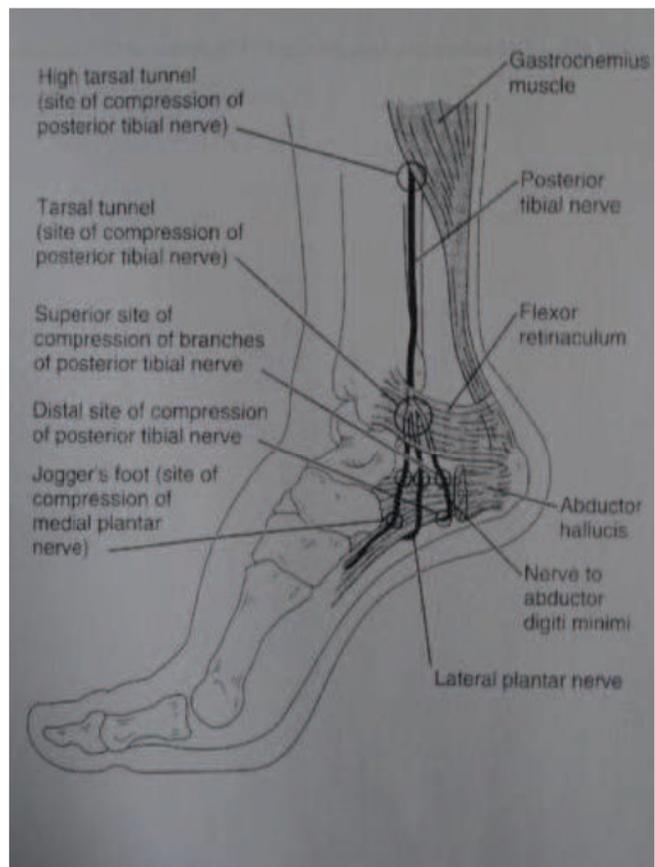


Plantar Fasciitis Update (cont'd)

- Plantar fasciitis vs. heel spur/stress fracture
 - Walk on your toes
 - Heel spurs/stress fracture – feel better on toes
 - Plantar fasciitis feels worse on toes

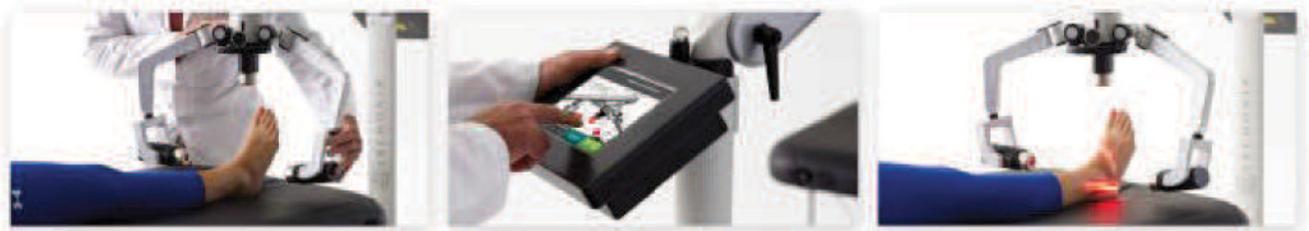


Tarsal Tunnel Syndrome

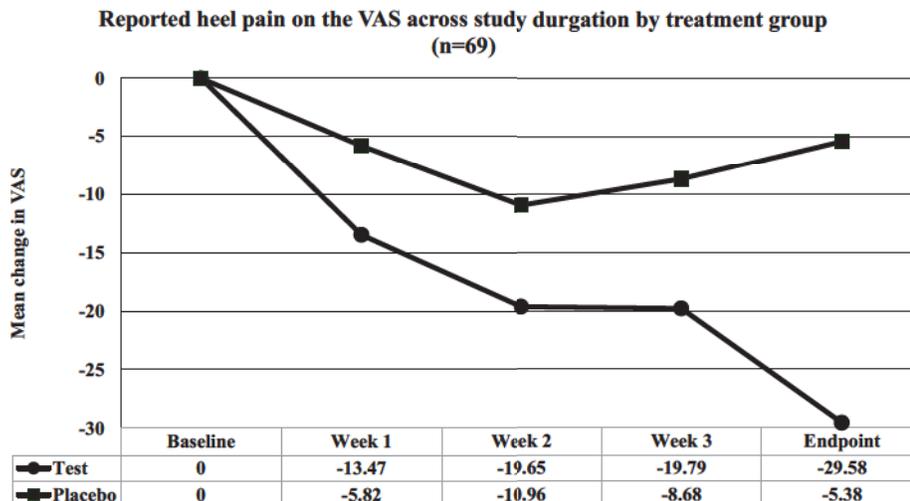


Plantar Fasciitis Laser Protocol

- 2 treatments a week for 3 weeks
- Area- top of foot (Dorsal Aspect), the myofascial junction of the heel and the plantar aspect of the heel
- All treated simultaneously. 10 minutes per area



Chronic Heel Pain Plantar Fasciitis



Chronic Heel Pain Plantar Fasciitis

Low-Level Laser Therapy for the Treatment of Chronic Plantar Fasciitis A Prospective Study

James R. Jastifer, MD¹, Fernanda Catena, MD², Jesse F. Doty, MD³, Faustin Stevens, MD⁴, Michael J. Coughlin, MD¹

Abstract

Background: Plantar fasciitis affects nearly 1 million people annually in the United States. Traditional nonoperative management is successful in about 90% of patients, usually within 10 months. Chronic plantar fasciitis develops in about 10% of patients and is a difficult clinical problem to treat. A newly emerging technology, low-level laser therapy (LLLT), has demonstrated promising results for the treatment of acute and chronic pain.

Methods: Thirty patients were administered LLLT and completed 12 months of follow-up. Patients were treated twice a week for 3 weeks for a total of 6 treatments and were evaluated at baseline, 2 weeks post procedure, and 6 and 12 months post procedure. Patients completed the Visual Analog Scale (VAS) and Foot Function Index (FFI) at study follow-up periods.

Results: Patients demonstrated a mean improvement in heel pain VAS from 67.8 out of 100 at baseline to 6.9 out of 100 at the 12-month follow-up period. Total FFI score improved from a mean of 106.2 at baseline to 32.3 at 12 months post procedure.

Conclusion: Although further studies are warranted, this study shows that LLLT is a promising treatment of chronic plantar fasciitis.

Level of Evidence: Level 4, case series.



Plantar heel pain is one of the most common pathologies of the foot, accounting for up to 15% of foot-related symptoms presenting to physicians and 1% of all visits to orthopedic surgeons.¹⁻³ The clinical manifestations can be disabling, and despite its high incidence, the specific cause of plantar fasciitis is poorly understood. It is likely multifactorial and may be associated with systemic disease, local changes to the plantar fascia tissue, or altered foot and ankle biomechanics.^{1,4,5,6,7}

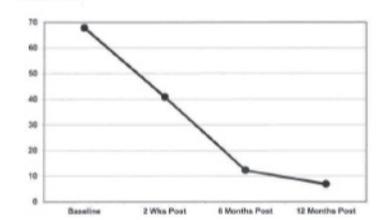
The choice of nonoperative treatment is largely up to the physician. Numerous treatment options exist, including stretching, night splints, orthotics, casting, steroid injections, and anti-inflammatory medications. There is limited high-level evidence to support one treatment over another.¹¹ The treatment of plantar fasciitis can be frustrating, yet about 90% of patients will respond favorably to nonoperative treatment, usually within 10 months.^{14,15}

Failure of these measures occurs in about 10% of patients, resulting in chronic plantar fasciitis and a difficult clinical problem. There is also limited high-level evidence guiding the treatment of this group of patients. A recent study showed that up to 55% of foot and ankle surgeons would consider surgery for the treatment of plantar fasciitis refractory to 10 months of nonoperative management.¹⁶

Short of surgery, a new treatment for chronic plantar fasciitis is low-level laser therapy (LLLT), which has been used extensively in other areas of the body. It has become increasingly popular because it is painless, is noninvasive, and has shown short-term efficacy in the treatment of plantar fasciitis.^{14,17} The purpose of this clinical study was to determine the effectiveness of LLLT in the treatment of chronic plantar fasciitis. Thirty of the 34 patients elected to enroll and completed 12 months of follow-up. The original 16 treatment group participants had already received treatment and so were followed to the 12-month endpoint. The 14 from the original placebo group were converted to a treatment group, administered treatment, and followed to the 12-month endpoint.



Chart 2: VAS Averages Across Baseline, Endpoint, 6 Months and 12 Months Post-Procedure Evaluation Points



Publication

ASLMS abstract

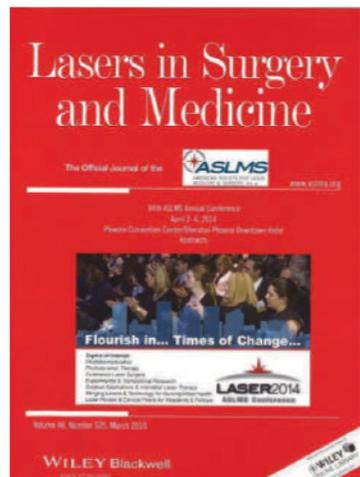
EVALUATION OF LOW-LEVEL LASER THERAPY AT 635 nm FOR THE TREATMENT OF CHRONIC PLANTAR FASCIITIS: A PLACEBO-CONTROLLED, RANDOMIZED STUDY

Mike Coughlin, Faustin Stevens, Jesse Doty, Kerry Zang, Ryan Maloney

Alphonsus Coughlin Foot and Ankle Clinic, Boise, ID; Arizona Institute of Footcare Physicians, Mesa, AZ; Phoenix, AZ

Background: Plantar fasciitis affects close to one million people in the United States. A majority of cases are successfully treated with conservative therapies; however, roughly 10% of cases require surgical intervention. A newly emerging technology, low-level laser therapy (LLLT), has demonstrated promising results for the treatment of acute and chronic plantar fasciitis. LLLT modulates cell function, yielding analgesic and regenerative effects.

Study: Sixty-nine subjects qualified and were enrolled, from 09/2011 to 06/2013, in a placebo-controlled, randomized, double-blind, multi-center study evaluating LLLT for the treatment of unilateral chronic fasciitis. Volunteer participants were treated twice weekly for three weeks, for a total of six treatments and were evaluated at five separate time points: pre-procedure; procedure weeks 1, 2, and 3; and, on post-procedure days 21 and 35. Degree of pain was recorded using a visual analog scale (VAS), with zero representing "no pain" and 100 representing the "worst pain imaginable". Doppler ultrasound was performed on the



Results: Plantar fascia thickness was significantly reduced in test group subjects, but not in sham participants

Low-Level Laser Therapy

- Achilles tendinosis patients who underwent eccentric exercises together with low level laser therapy showed decreased pain intensity, morning stiffness, tenderness to palpation, active dorsiflexion, and crepitus with no side effects as compared to those who underwent eccentric exercises only

Stergioulas A, Stergioula M, et al. **Effects of low-level laser therapy and eccentric exercises in the treatment of recreational athletes with chronic Achilles tendinopathy.** *Am J Sports Med.* 2008;36 95 0:881-887

Nutritional Support for Neurogenic Plantar Fasciitis

- A formula with unique combination of nutrients that support healthy nerve tissue integrity, nutritive blood flow, and nerve conduction:
 - Vitamin B5
 - Vitamin B6
 - Vitamin B12
 - Folate
 - Niacinamide
 - PABA
 - Inositol
- Muscle relaxation formula: supplies minerals involved in muscular contraction and relaxation responses:
 - Calcium, magnesium, passion flower extract, valerian root, lemon balm, hops extract
- Omega 3 fatty acids to reduce inflammation



Did
you
know



The inner membrane of
mitochondria is where
steroid hormones are
made

Low-level laser therapy (LLLT)

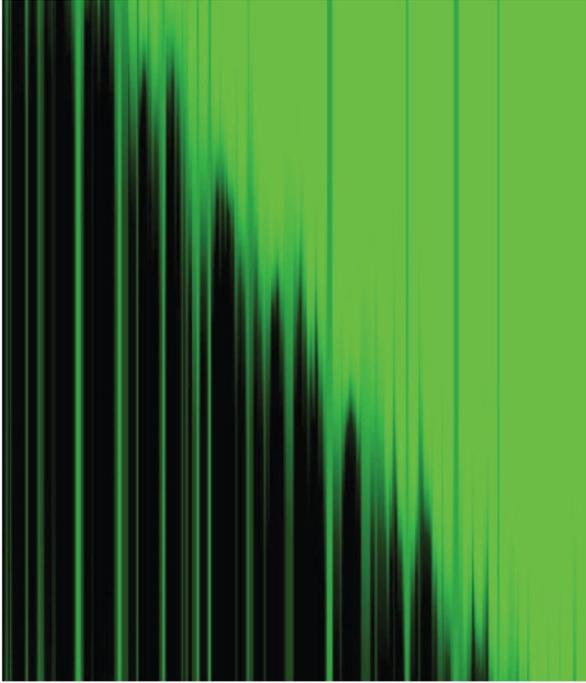
- Treatment method unique in its universality and efficacy, particularly for neurodegenerative diseases
- Russian researchers – first to report use of LLLT for neurodegenerative diseases and to demonstrate high effectiveness of this method
- Acts as universal regulator capable of restoring regulatory processes at all levels, from cellular level to entire organism, eliminating the basis for developing autoimmune, metabolic, neurodegenerative, and other diseases

Moskvin SV. A brief literature review of low-level laser therapy for treating amyotrophic lateral sclerosis and confirmation of its effectiveness. *Biomedicine (Taipei)*. 2024 Mar 1;14(1):1-9

Positive action of LLLT in literature

- Improving interaction between astrocytes and neurons
- Protecting motor neurons from negative effects of reactive oxygen forms and neurotoxicity caused by oxygen-glucose deprivation through inhibition of neuronal nitric oxide synthase (nNOS) activity
- Stimulating ATP synthesis and energy metabolism
- Preventing oxidative stress and inflammation reduction
- Reducing muscle fatigue
- Increasing muscle performance
- Reducing muscle soreness after physical activities
- Eliminating distress syndrome and restoring normal breathing

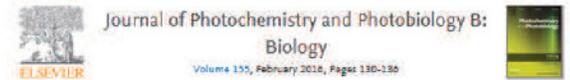
Moskvin SV. A brief literature review of low-level laser therapy for treating amyotrophic lateral sclerosis and confirmation of its effectiveness. *Biomedicine (Taipei)*. 2024 Mar 1;14(1):1-9



Green Wavelength

Bone tissue healing

- Merigo et al – 532nm green laser has positive effect on osteogenic differentiation of murine bone marrow stromal cells (BMSC)²²
- Production of BMSC facilitates bone repair. BMSCs also facilitate nerve regeneration²³



Green laser light irradiation enhances differentiation and matrix mineralization of osteogenic cells ☆, ☆☆

Elisabetta Merigo^{1,2,3,4,5,6,7,8,9,10}, Sébastien Bouvet-Gerbetz^{1,2,3,4,5,6,7,8,9,10}, Florian Boukhechba^{1,2,3,4,5,6,7,8,9,10}, Jean-Paul Rocca^{1,2,3,4,5,6,7,8,9,10}, Carlo Fornaini^{1,2,3,4,5,6,7,8,9,10}, Nathalie Rochet^{1,2,3,4,5,6,7,8,9,10}

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<https://doi.org/10.1016/j.jphotobiol.2015.12.005>

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Highlights

- KTP LLLT may enhance the osteogenic differentiation of bone marrow stromal cells.
- KTP LLLT may enhance the mineralization of the extracellular matrix.
- KTP laser may be useful on bone tissue engineering models *in vivo* and *in vitro*.

Abstract

Background and objective

Low level laser therapy (LLLT) in both infrared and visible light is a therapeutic tool ever more proposed in clinical practice in different fields. The effect of near infrared LLLT has been described in a growing number of scientific publications related to bone tissue healing, both *in vivo* and *in vitro*. More recently, green visible light using potassium-titanyl-phosphate (KTP) laser (KTP 532 nm) began to be used

- Kassak et al – exposure of 532nm low power green laser led to significant increase in mitochondrial transmembrane potential of 13%
- Changes in mitochondrial transmembrane potential integral to cell life and in normal cell function is essential for ATP synthesis.

Mitochondrial Alterations Induced by 532 nm Laser Irradiation

P. KASSAK¹, T. PRZYGOON², D. HARBODÁKOVÁ¹, M. HAVRANEK² AND L. ŠKUBOVÁ¹

¹ Division of Biomedical Physics, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia

² Department of General Biophysics, University of Lódz, Lódz, Poland

Abstract. Mitochondrial alterations were monitored after low power green laser (532 nm, 30 mW) irradiation in the case of whole cells (B-14) and isolated mitochondria (from Wistar rat heart): 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium-bromide (MTT) assay products were significantly higher (by 8%) in irradiated B-14 cells as compared to non-irradiated controls. Mitochondrial transmembrane potential of B-14 cells, measured by means of a fluorescent probe 3,3'-diethyl-carbazocyanine iodide (DiOC₂(3)), significantly increased (by 13%) after exposure to green laser irradiation. Another MTT assay was used for isolated mitochondria suspensions in order to examine the effect of green laser irradiation on stimulation of processes related to oxidative phosphorylation. It revealed 21.2% increase in MTT assay products in irradiated mitochondria as compared to controls. Laser irradiation of isolated mitochondria suspension did not significantly change 1,6-diphenyl-1,3,5-hexatriene (DPH) fluorescence anisotropy, indicating that mitochondrial membrane fluidity was not affected by laser light. Fluorescence emission spectra of irradiated as well as non-irradiated mitochondria suspensions showed fluorescence maximum at 635 nm, corresponding to emission of Protoporphyrin IX, which was significantly lower (by 20.7%) in irradiated sample.

Key words: Mitochondria — Transmembrane potential — Oxidative phosphorylation — Membrane fluidity — Laser irradiation — Protoporphyrin IX

Introduction

The first publication about low-level laser therapy (LLLT) appeared more than 30 years ago (Kovacic et al. 1974). Since then, the effectiveness and applicability of a variety of light sources, in the treatment of a wide range of medical conditions

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A LIGHT SOURCE FOR PHOTOTHERAPY

R. LABART¹, S. BUCKFIELD¹, U. SCHARZI² AND M. NISARD²

¹Department of Physics, Brunel University, Uxley, Uxbridge, Middlesex, U.K. ²Department of Physics, Brunel University, Uxley, Uxbridge, Middlesex, U.K.

The effects of red (632 nm), green (540 nm) and infrared (904 nm) light sources on the peripheral nervous system (PNS) of rats were investigated. The effect of light on the Compound Action Potential (CAP) of the nerve. This paper reports the development of a light source for phototherapy. A light source which meets the requirements and specifications of our research is being built.

Key words: Low power light source (LPLS) — Peripheral nervous system (PNS) — Compound action potential (CAP) — Phototherapy

Introduction

Low power laser and other irradiation sources of low power light are used both clinically and experimentally throughout the world, but there are still no conclusive results as to the beneficial effects of these light sources.¹ The effect of light upon the peripheral nerves has been dealt with by various investigators. De Ron *et al.*² sectioned and sutured back the sciatic nerve in rats and found HeNe laser delivering 100 mJ to the point of suture increased the degeneration of damaged fibres. Walker^{3,4} reported temporary suppression of axons in humans and the appearance of laser-induced somatosensory evoked potentials, using 1 mW HeNe pulsed laser delivering 0.5 J cm² transcutaneously. We⁵ reported a failure in confirming Walker's report. Also Walker⁶ did not find 1 mW HeNe laser to alter dental sensory latencies action potentials. Graesshove and Currier⁷ used pulsed T.R. laser (94 nm) and were unable to detect any change in the nerve conduction.

Our group is working on the effects of low power light on the nervous system. We performed most of our previous tests using HeNe laser (632.8 nm) as reported in detail in our previous papers.^{8,9} We found that a 1 mW HeNe laser cannot reach the nerve when irradiated transcutaneously. A more powerful laser is needed to cause the (CAP) of an injured nerve to reach values above the normal pre-crash ones.⁸ We also reported on direct irradiation of exposed sciatic nerve in rats.⁹ We have recently found¹⁰ that at low radiation doses, single oxygen (¹O₂) is produced by energy transfer from a photosensitizer, most probably bacteriochlorophyll which is known to be present in every cell.

Address for correspondence: Dr R. Labart, Physics Department, Brunel University, Brunel-Gate 253B, Uxley, Uxbridge, Middlesex, U.K.

The present work represents results which relate to the effect of different wavelengths on injured nerves. According to these results and those resulting from our understanding of laser-tissue mechanisms, we propose a new light source for light therapy.

Materials and Methods

The present study was carried out on 87 rats of the Sprague-Dawley kind. The rats were anaesthetized and the sciatic nerve was exposed surgically. CAP was measured from the base nerve for 10 min using specially designed electrodes in order to establish the normal CAP. The nerve was then crushed and CAP measured for another 10 min, allowing the nerve to reach steady-state post-crash value. Up to this point, all rats were treated according to the same protocol. Following the crush, the rats were divided into five groups, A to E. Group A (10 rats) served as control. This group did not receive irradiation or any other treatment following the crush. CAP was recorded for 45 min, during which it reached a stable constant value. In group B, 22 rats, the CAP was recorded for 10 min following the crush, reaching a constant value. The nerve was then irradiated for different intervals of time using a green HeNe laser (0.5 mW 540 nm, Lasertronik Switzerland) and the CAP was recorded again. The optimal time for irradiating with this laser was found to be 30 min (300 mJ). Similar protocol was used in the next two groups C and D, using a 0.5 mW pulsed T.R. laser (904 nm, Lasertronik Switzerland) instead of the green HeNe one. In group C the laser was pulsed at 900 Hz and in group D pulsed at 1500 Hz. In the last group E, a 0.3 mW red HeNe CW laser (632.8 nm, Spectra-Physics) was used. The optimal time for irradiating with the red laser was 7 min (126 mJ).

- Lubart et al examined effects of red (632 nm), green (540 nm) and infrared (904 nm) light sources on peripheral nervous system¹⁸
- No significant difference found for the action potential of the nerve with infrared and control group
- Only red and green wavelengths had effect on the compound action potential (CAP) of the nerve
- Green light much more effective than red

Green light/fibromyalgia

Fibromyalgia patients exposed to green light had significant improvements in their pain, sleep, and quality of life



L Martin, F Porreca, El Mata, et al. **Green Light Exposure Improves Pain and Quality of Life in Fibromyalgia Patients: A Preliminary One-Way Crossover Clinical Trial.** *Pain Medicine*, January 2021;22(1):118-130

Green light and immunity

- Results indicate – exposure to low-intensity green light accelerates the antioxidant system and immune system
- Green light conditions effectively reduces oxidative stress and promotes immune function

YJ Choi, JY Choi, SG Yang, et al. **The effect of green and red light spectra and their intensity on the oxidative stress and non-specific immune responses in gold-striped amberjack, *Seriola lalandi*, Marine and Freshwater.** *Behaviour and Physiology*, 2016;49:4, 223-234
Choi JY, Kim TH, Choi YJ, et al. **Effects of various LED light spectra on antioxidant and immune response in juvenile rock bream, *Oplegnathus fasciatus* exposed to bisphenol A.** *Environ Toxicol Pharmacol*, 2016 Jul;45:140-9

Green light/headache

Results:

- Green light emitting diodes resulted in significant reduction in headache-days/month in both episodic and chronic migraine
- Significantly improved multiple secondary outcome measures including quality of life and intensity and duration of headache attacks
- No adverse events reported

Martin LF, Patwardhan AM, Jain SV, et al. Evaluation of green light exposure on headache frequency and quality of life in migraine patients: A preliminary one-way cross-over clinical trial. *Cephalalgia*. 2021;41(2):135-147

FDA clinical trials

	Red Only	Red & Violet	Green & Violet
Subjects (n)	N=43	N=44	N=43
Duration of pain (months)	61.7	76.58	89.19
Subjects meeting study success criteria, \geq 30% pain reduction	65%	75%	81%
(%) Improvement in Pain from baseline to immediately after treatment	48%	45%	52%
(%) Improvement in Pain from study endpoint to 48 hrs. post-treatment	43%	50%	65%
(°) Improvement in Range of Motion	14°	29°	32°

Low-level laser therapy in Russia: history, science, and practice

Key takeaway:

If you combine laser and LED together, you get diminished results

Moskvin SV. **Low-Level Laser Therapy in Russia: History, Science and Practice.** *J Lasers Med Sci.* 2017 Spring;8(2):56-65

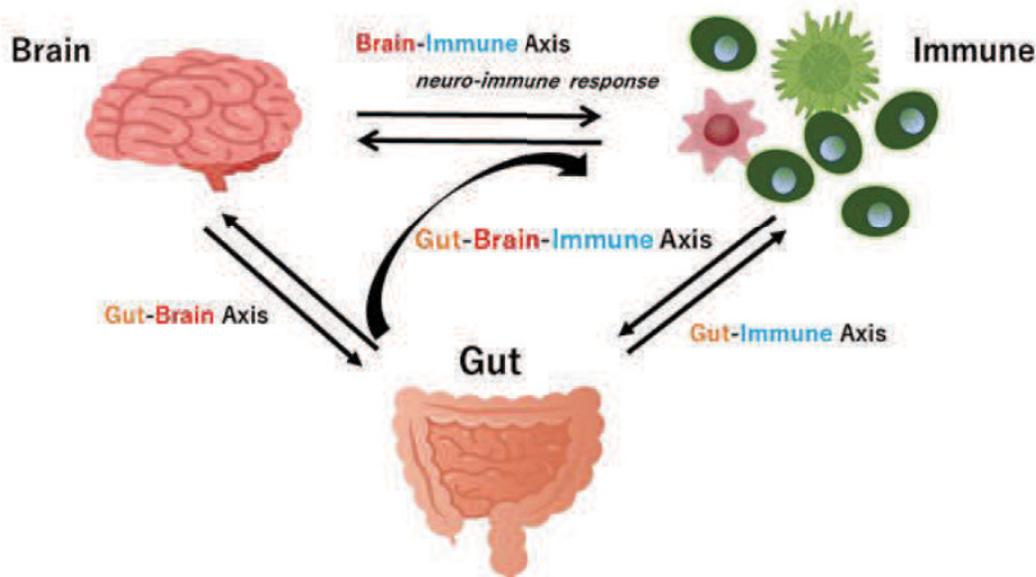


Answer:
Photon Energy

”The key to longevity is turning on the health switches; the MASTER switch is a robust and resilient immune system”.

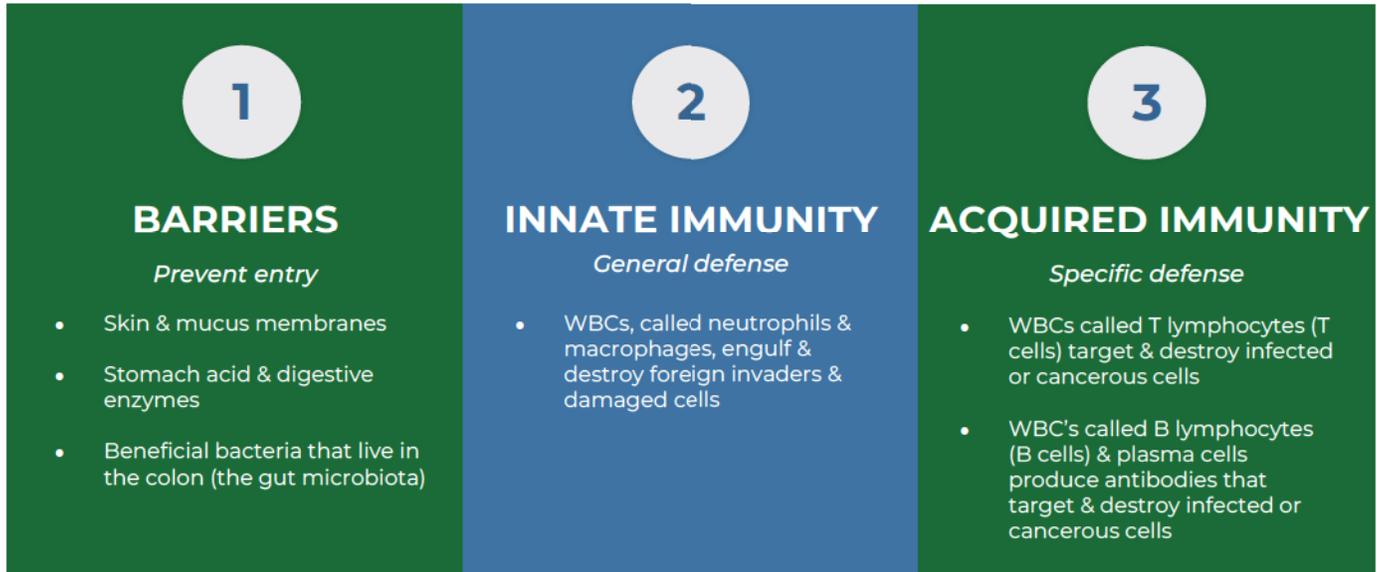
Dr. Rob Silverman

Hypothetical schematic overview and appearance of gut-brain axis cross-talk between the brain and the gut (intestine/colon) in addition to the brain-immune axis and the gut-immune axis

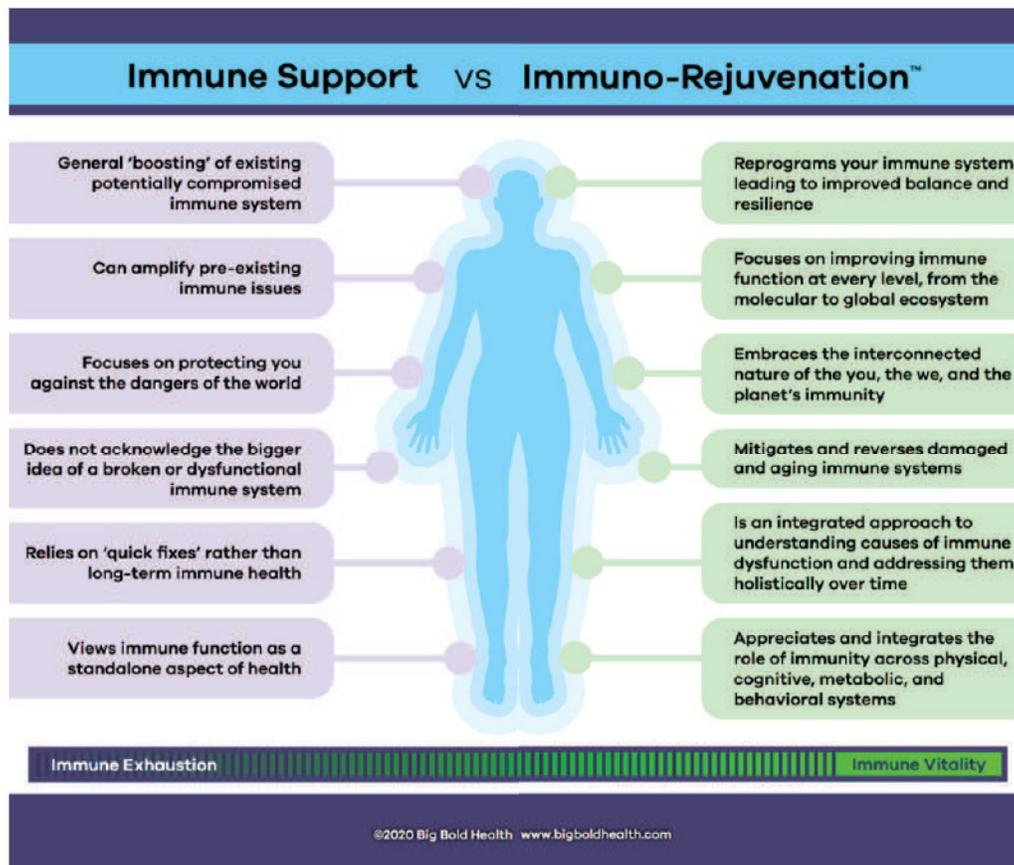


Gut microbiota could modulate the effects of neuro-immune responses and memory traces via the gut-brain-immune axis in schizophrenia. *Explor Neuroprot Ther.* 2022;2:74–86

The immune system provides 3 levels of defense against disease-causing organisms



Innate vs. acquired immunity



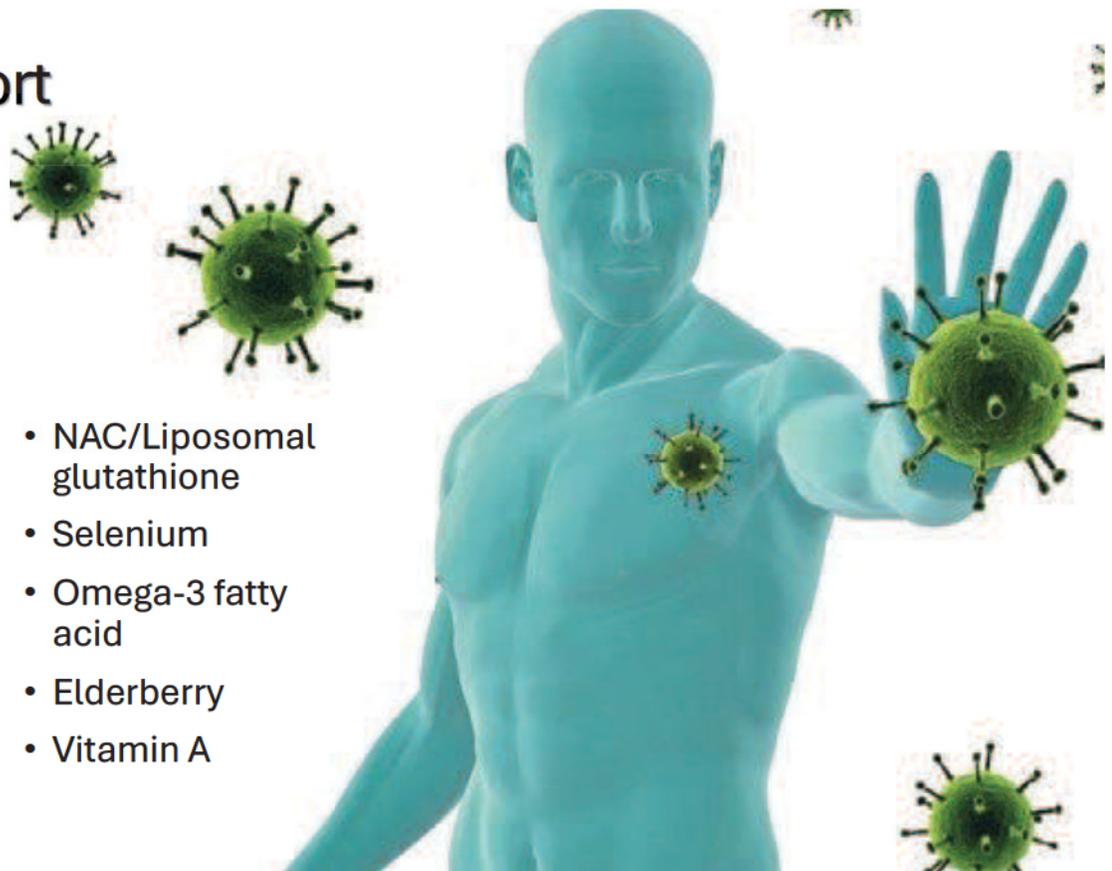
*Extending our life spans is important to humans, but maintaining one's **health span** is even more crucial for a high quality of life.*

*The **immune system** is one of the most important determinants that influence not only how long we live but also how well we feel as we reach octogenarian status and beyond.*

Evi Wollscheid-Lengeling et al. **Maintaining Your Immune System--One Method for Enhanced Longevity.** *Sci. Aging Knowl. Environ.* 7 January 2004;2004(1):p.pe2

Immune support supplements

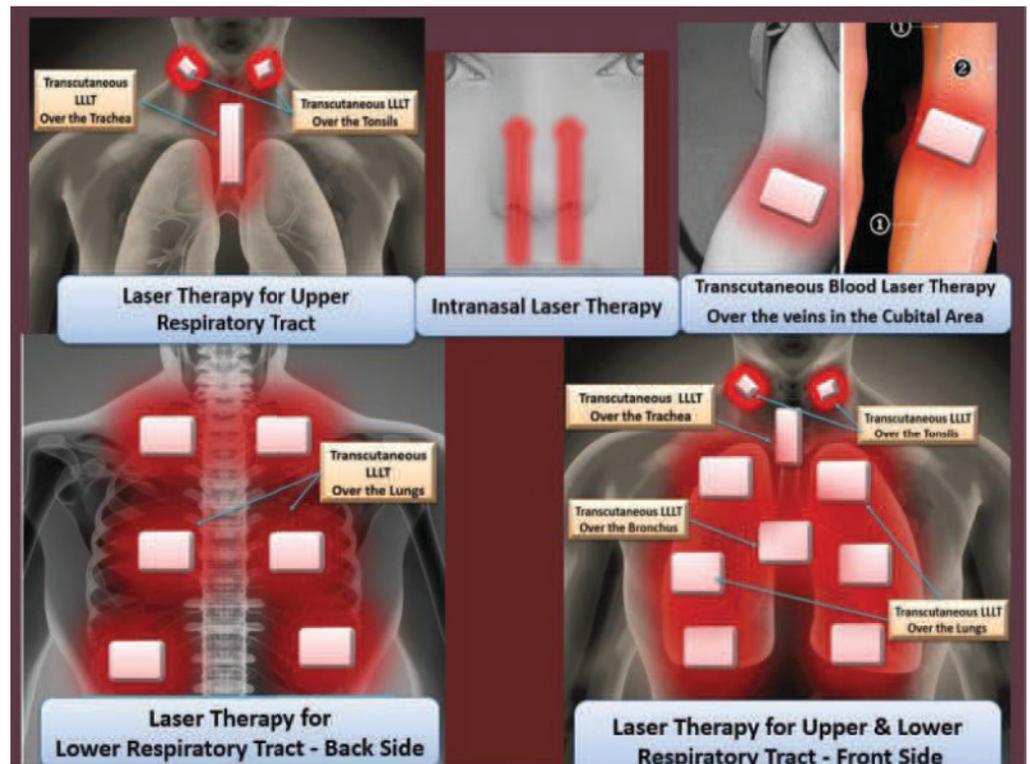
- Vitamin C
- Zinc
- Mixed mushroom complex
- Vitamin D3 with K2
- Probiotics
- NAC/Liposomal glutathione
- Selenium
- Omega-3 fatty acid
- Elderberry
- Vitamin A



Long COVID Protocol

- Improve mitochondrial function (decrease fatigue)
 - NMN makes NAD: 200 mg/day
 - B vitamins: 60 mg/day
 - CO-Q 10: 300 mg/day
 - Acetyl-L-Carnitine: 1000 mg/day
 - ALA: 600 mg/day
 - Creatine: 5 g/day
 - Taurine: 2 g/day
 - Glutathione: 500 mg/day
 - Magnesium: 200 mg/day
 - Zinc: 40 mg/day
 - Selenium: 200 mcg/day
 - Vitamin C: 2000 mg/day
 - SBI: 1 g/day
- Immune activation – mushrooms: reishi, maitake, lion’s mane, chaga, shiitake

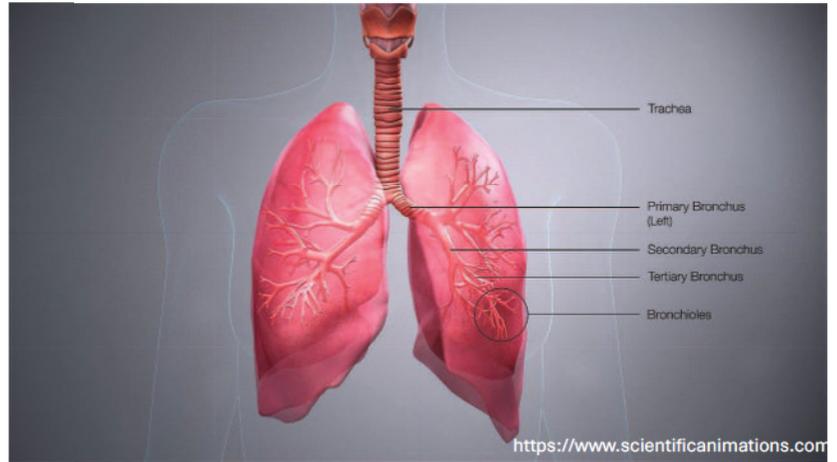
Long COVID Demo



Mokmeli S, Vetrici M. Low level laser therapy as a modality to attenuate cytokine storm at multiple levels, enhance recovery, and reduce the use of ventilators in COVID-19. *Can J Respir Ther.* 23 July 2020;56:25-31

Omicron Eris protocol – EVRL/GVL 1,30,1,30

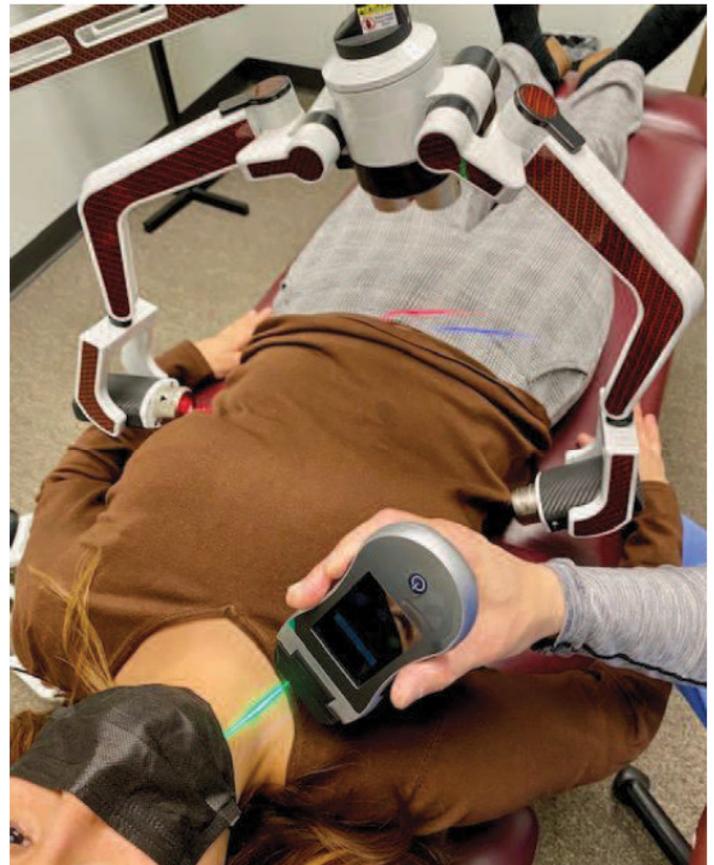
- Nasal sinus (L & R)
- In mouth (L & R)
- Trachea region
- Upper primary bronchus (L & R)
- Mid-secondary bronchus (L & R)
- Lower tertiary bronchus (L & R)
- Bronchioles (L & R)
- Vagus nerve (L & R)
- Phrenic nerve
- Full gut sweep



Immune rejuvenation/resilience

- FX635/405 – gut
- Gut positioning – middle arm
- Outside arms in lung field
- GVL – cervical region

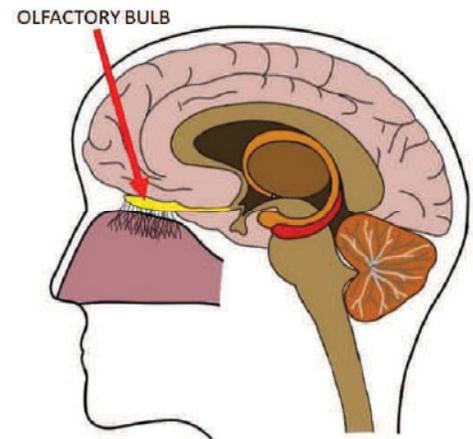
Immune setting: 10-20-40-73
(465-728)



COVID – loss of smell/taste

Laser

- FX635/405
- 5 mins
- Essential oils/foods
- EVRL at olfactory bulb level (laser option)
- Nutritional protocol:
 - ALA: 600 mg
 - Zinc: 60 mg
- 30-day treatment protocol



<https://neuroscientificallychallenged.com/posts/know-your-brain-olfactory-bulb>

The chief function of
the body is to carry the
brain around.

-Thomas A. Edison



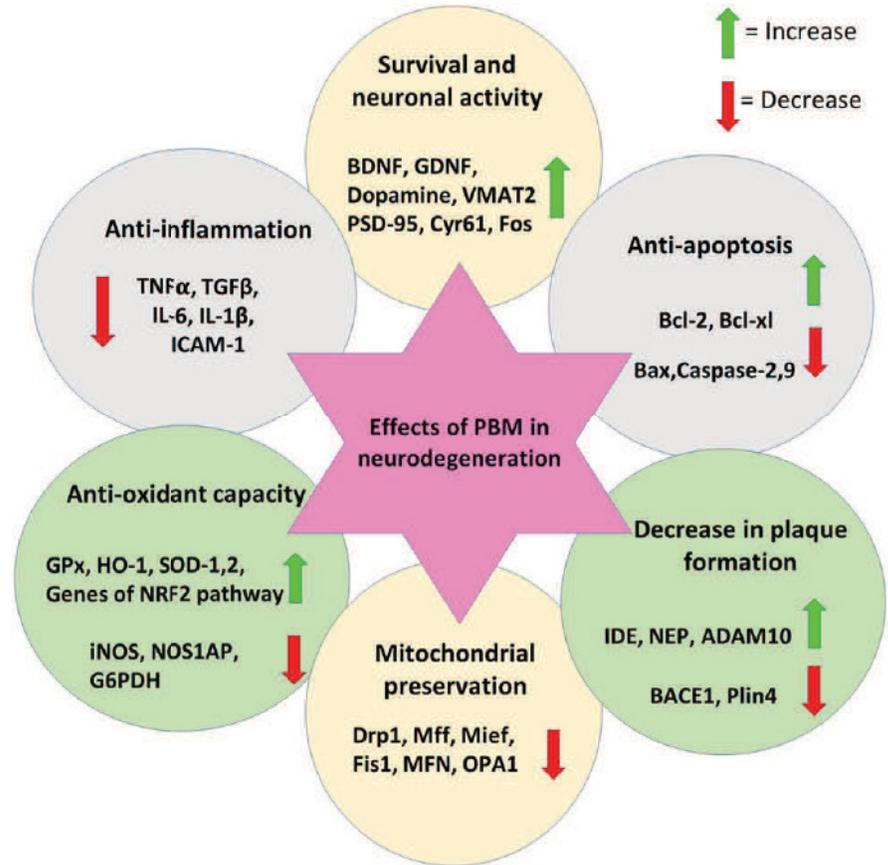
Neurological conditions

- New research – over 3.4 billion people throughout the world have neurological condition
- Conditions include:
 - Autism
 - Alzheimer's
 - Parkinson's
- Concerning aspect – disability and deaths related to these conditions increased by 18% since 1990
- Researchers encouraging public health officials world-wide to invest in brain health

GBD 2021 Demographics Collaborators. **Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021.** *The Lancet.* 11 March 2024

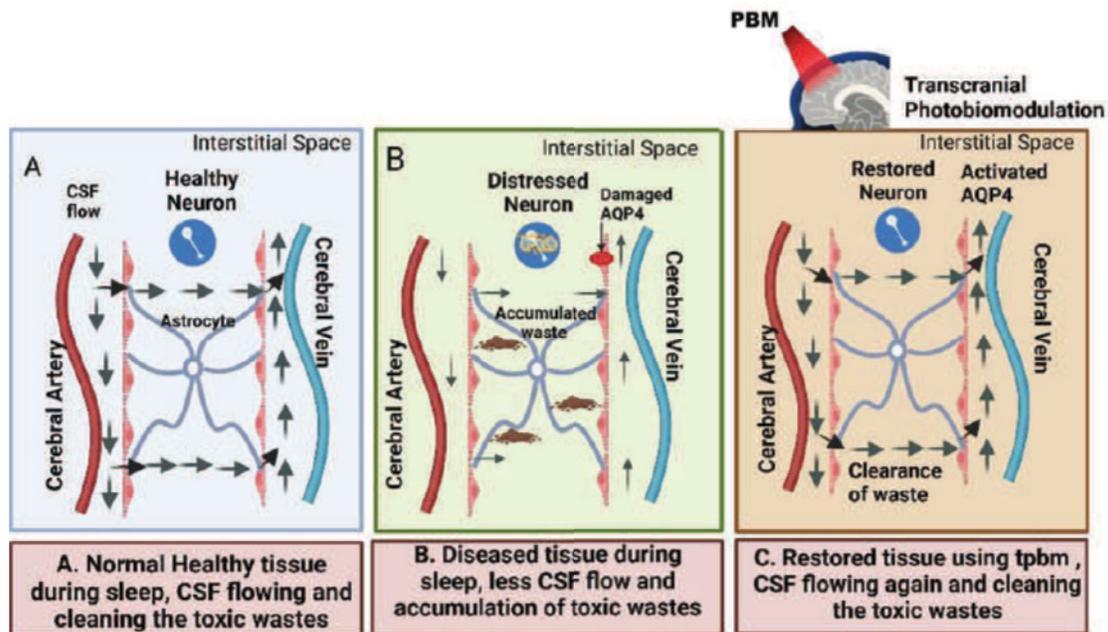
Left hemisphere	Right hemisphere
<ul style="list-style-type: none">• Learning disabilities• Mental health• All about details• Control motor planning• Verbal language• Expressions• Pride• Sympathetic• Immune activation (after first 3 years)	<ul style="list-style-type: none">• More sensory based• Attention• Controls proprioception, posture• Non-verbal communication• Socialization• Gut feeling• PNS: digestion, leaky gut• “Brake” of the brain• Suppresses immune system• Anxiety (first 3 years)

Overall effects of PBM on genes and proteins playing different roles in neurodegeneration



M Bathini, CR Raghushaker, KK Mahato. The Molecular Mechanisms of Action of Photobiomodulation Against Neurodegenerative Diseases: A Systematic Review. *Cell Mol Neurobiol* (2020)

Glymphatic system and the effects of tPBM



F Saeed, KL Siepker, Soeun Jang et al. Quantification and stimulation of human glymphatic dynamics: New features of Alzheimer's disease and effects of brain photobiomodulation, 05 March 2025

Parkinson's disease (PD) - factoids

- Those who live within 1 mile of golf course had 126% increased risk of developing PD
- PD – whole body disease
- Gut to vagus nerve to basal ganglia
- Parasympathetic damage
- 2022 study by Parkinson's foundation: new diagnoses in the US – nearly 50% higher than previous estimates
- Death rate in PD jumped 63% in last 2 decades
- Globally – total number of those living with PD projected to increase by 76% from 2021-2050

Mark Hyman Podcast, ep. 1079

Parkinson's disease (PD) – factoids (cont'd)

- World's fastest-growing neurological disease
- Paraquat – widely used herbicide – linked to increased risk of developing PD
- 2019 review of 14 studies: Paraquat exposure increased risk of PD by 2.5 X
- Paraquat damages nerve cells in the brain that produce dopamine

Mark Hyman Podcast, ep. 1079

New cause of Parkinson's

Finding:

“For the first time, we can show that mitochondria, the vital energy producers within brain cells, particularly neurons, undergo damage, leading to disruptions in mitochondrial DNA. This initiates and spreads the disease like a wildfire through the brain”.

E Tresse, J Marturia-Navarro, WQG Sew, *et al.* **Mitochondrial DNA damage triggers spread of Parkinson's disease-like pathology.** *Mol Psychiatry*, 2 October 2023
https://www.eurekalert.org/news-releases/1003348#_msocom_2

WOW!

Mitochondrial complex I deficiency stratifies idiopathic Parkinson's disease

IH Flønes, L Toker, DA Sandnes, *et al.* **Mitochondrial complex I deficiency stratifies idiopathic Parkinson's disease.** *Nature Communications*, 29 April 2024;15(1):1-18

LLLT/Parkinson's disease

Results:

- Statistical significant reduction in VAS for gait and cognitive function were observed
- Gait – 30% improvement
- Cognitive – 38% improvement
- Difficulty with speech lowered by study end

Conclusion:

Data suggest laser therapy may serve as non-invasive instrument for symptom reduction of PD

Erchonia Medical. **The Application of Low-Level Laser Therapy for the Symptomatic Care of Late Stage Parkinson's Disease: A Non-Controlled, Non-Randomized Study.** *Lasers Surg Med*, 22 Sept 2022;185

Frequency for oligodendrocytes

Myelin sheath – multiple sclerosis

3¹, 4², 8², 40

¹ Zhao X, Zhang M, Liu Y, et al. **Terahertz exposure enhances neuronal synaptic transmission and oligodendrocyte differentiation *in vitro*.** *iScience*. 2021 Nov 22;24(12):103485

² DM Piscopo, AP Weible, et al. **Changes in white matter in mice resulting from low-frequency brain stimulation.** *Proc Natl Acad Sci USA*, 18 June 2018;115(27):E6339-E6346

Brain protocol

Timing:

- GVL – 2 mins
- EVRL – 3 mins
- XLR8 – 4 mins

Frequencies:
1, 10, 13, 40

Areas of application:

- Prefrontal
- Apical/parietal
- Brainstem/cerebellum

Courtesy of Drs. Berry and Murphy

Brain facts – don't use hot laser!

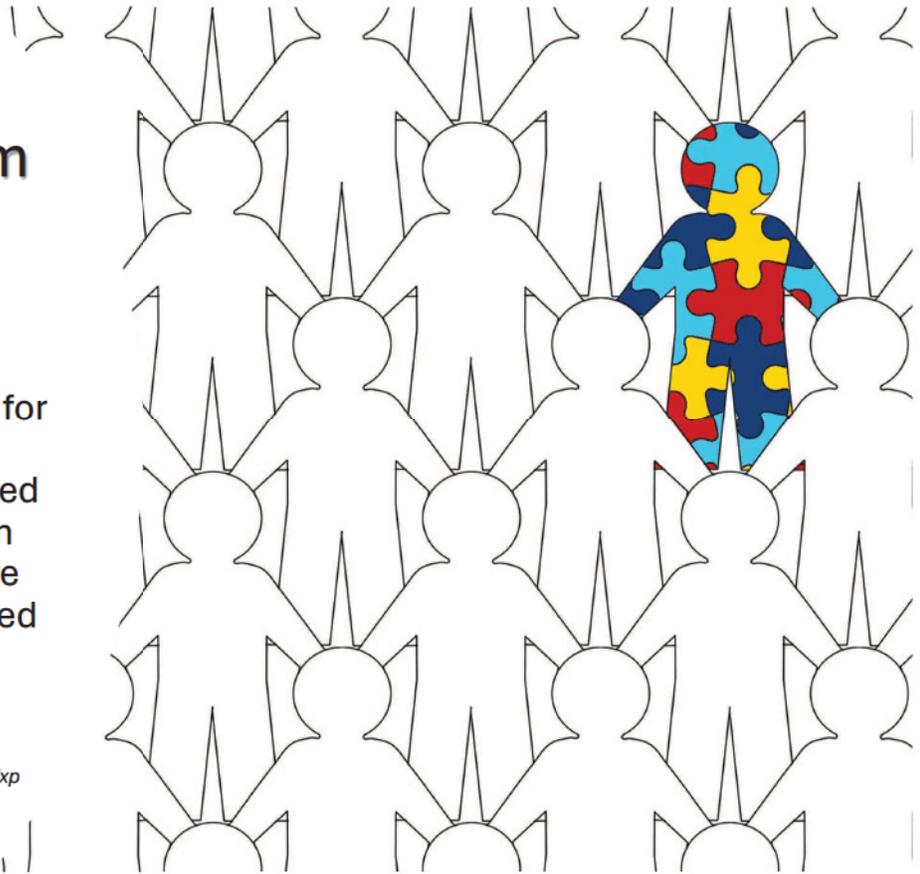
- 2% of human body mass
- 25% of body's total glucose utilization
- 20% of O₂ consumption
- Most cerebral processes are sensitive to temperature fluctuations
- Temperature fluctuations intrinsically modulate behavioral changes and reflexively generate autonomic responses
- Hypothermia shown to protect against excitotoxicity

Effects of LLLT in autism spectrum disorder

Conclusion:

Study: LLLT could be effective tool for reducing irritability and other symptoms and behaviors associated with **autistic spectrum disorder** in children/adolescence, with positive changes maintained and augmented over time

Leisman G, Machado C, Machado Y, Chinchilla-Acosta M. *Adv Exp Med Biol*, 2018;1116:111-130



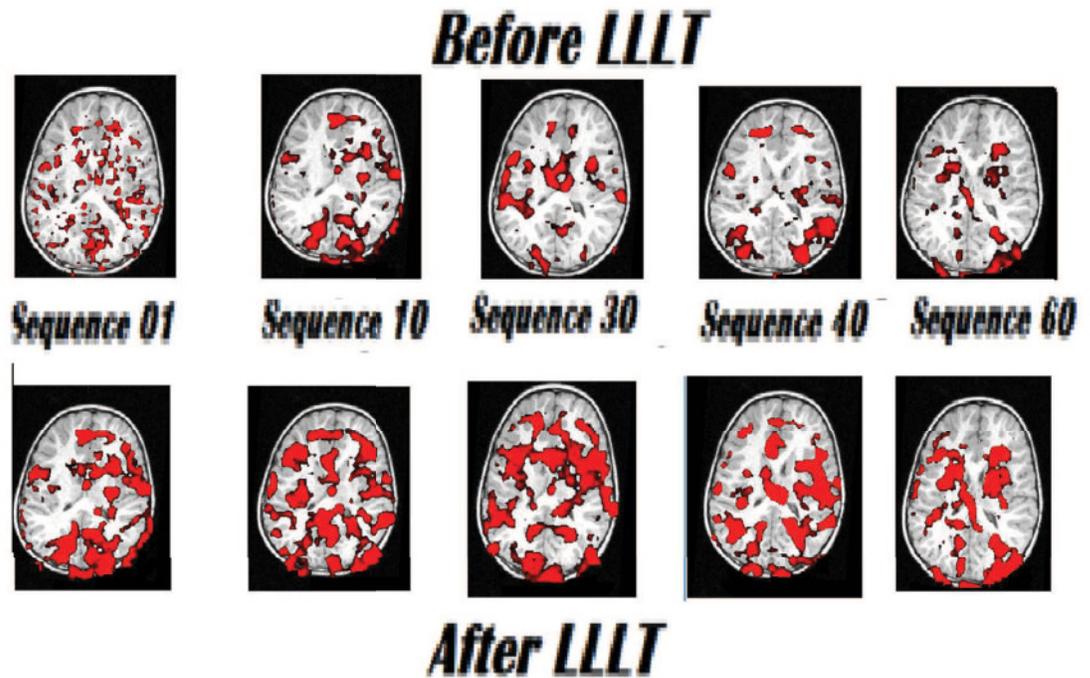
MRI – fMRI

Autistic Children

Functional magnetic resonance imaging or fMRI

measures brain activity by detecting changes associated with blood flow.

This technique relies on the fact that cerebral blood flow and neuronal activation are coupled. When an area of the brain is in use, blood flow to that region also increases.



Follow up assessment of autistic children 6 months after LLLT

- 40 patients
- 21 active, 19 placebo
- 5-minute treatment to base of skull and temporal area, 2 x 4 weeks
- Aberrant Behavior Checklist (ABC) – irritability subscale score:
 - Test vs. placebo – 15.17 in favor of test
 - Improvement in symptoms continued 6 months after assessment

Conclusion:

Study: LLLT progressively rearranges neural networks related to complex systems in autism

C Machado, Y Machado, M Chincilla, Y Machado. *The Internet Journal of Neurology*, 2019;21(1)

Follow-up assessment of autistic children 12 months after finishing LLLT

Results:

- 12-month follow-up after completion of LLLT
- Improvement in symptoms continued in patients in test group

Conclusion:

Reaffirmed that clinical improvement maybe patho-physiologically explained because LLLT progressively rearranges anatomical functional and effective connectivity, modifying those neural networks related to complex systems found in autism

C Machado, Y Machado, M Chincilla, Y Machado. *The Internet Journal of Neurology*, 2019;21(2)

Transcranial LLLT for cognitive function in the elderly

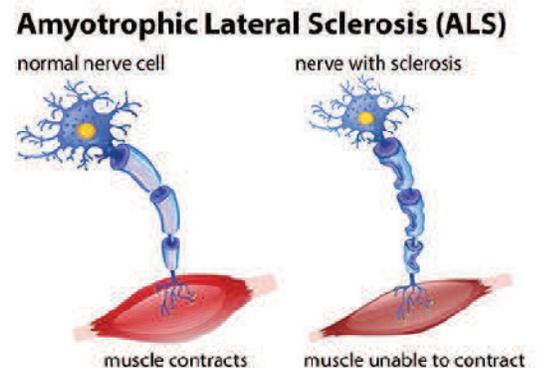
Results: Only older adults who received real PBM exhibited significant improvements in their action selection, inhibition ability, and mental flexibility after vs. mental flexibility after vs. before PBM

Conclusion: PBM may enhance frontal brain functions of older adults in safe and cost-effective manner

Torre, Jack. (2017). **Treating cognitive impairment with transcranial low-level laser therapy.** *Journal of Photochemistry and Photobiology B: Biology.* 168. 10.1016/j.jphotobiol.2017.02.008.

ALS

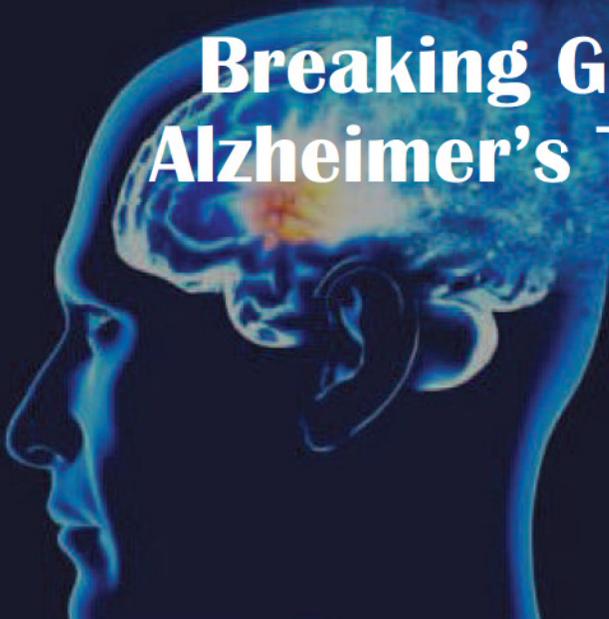
- Affects both upper and lower motor neurons
- Benefits from all 3 wavelengths applied
- FX405/GVL
- 1,10,13,40 (repeat)
- Laser brainstem, primary motor cortex
- Full-spine to brain stem: 9,16,33,36
- Affected muscles: 9,16,42,53
- Gut: 4,4,9,26
- Vagus nerve: 10,10,10,10



ALS

Supplements:

- CoQ10
- Creatine
- Vitamin E
- Melatonin
- Theanine
- Vitamin C
- Lipoic acid
- Lutein
- Vitamin B12
- Vitamin D
- L-serine (30 g.)
- L. rhamnosus HA 114



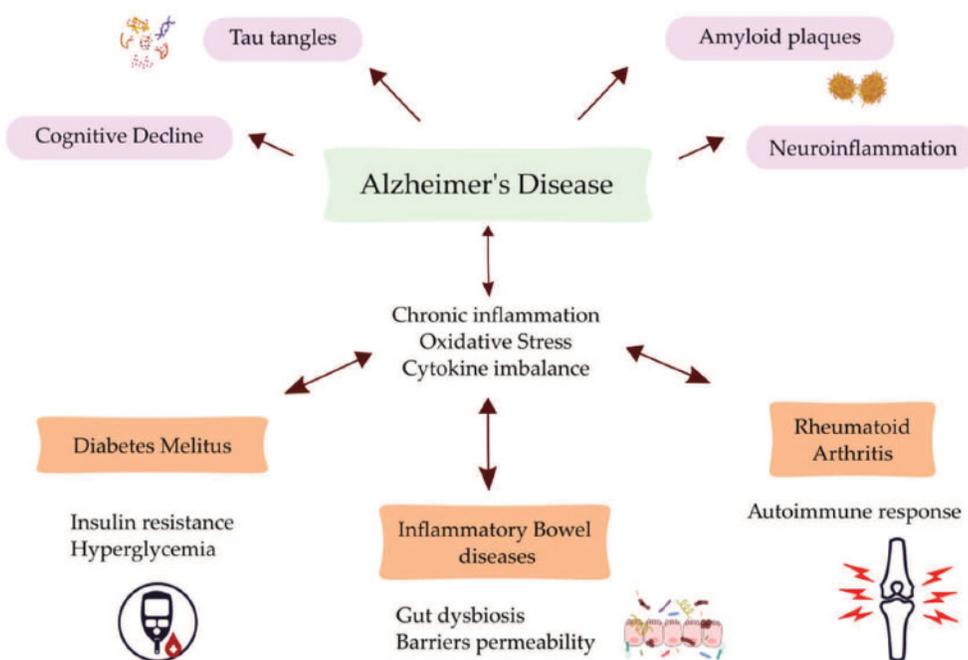
Research to Reality Breaking Ground in Alzheimer's Treatment



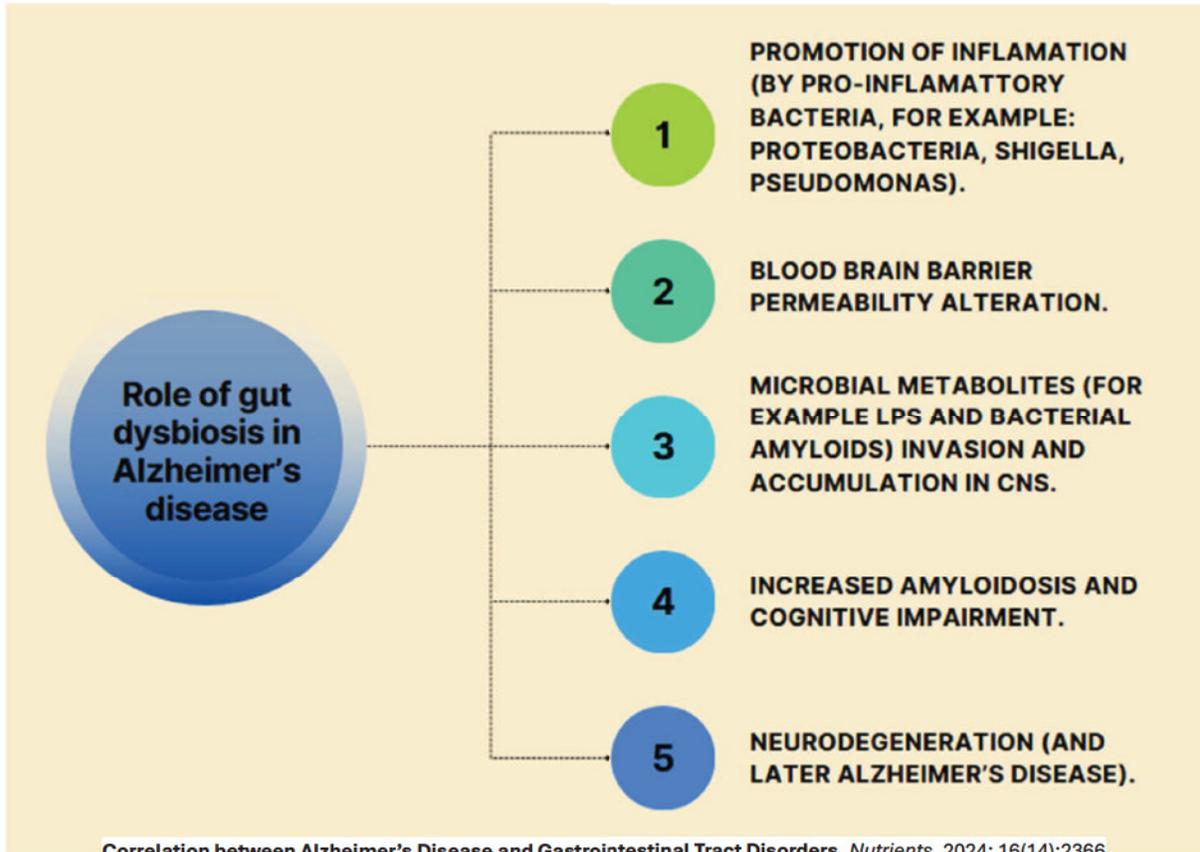
The thing about Alzheimer's is that it's sort of like all these little, small deaths along the way, before they actually physically die.

Lucinda Williams, Musician (daughter of Alzheimer's parent)

Common aspects of diseases with additional aspects specific to each disease

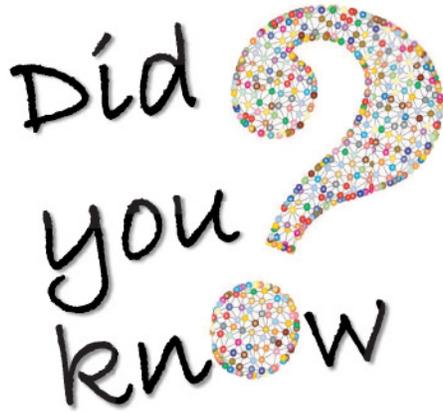


Metabolic and Immune System Dysregulation: Unraveling the Connections between Alzheimer's Disease, Diabetes, Inflammatory Bowel Diseases, and Rheumatoid Arthritis. *Journal of Clinical Medicine*. 2024; 13(17):5057



Alzheimer's Disease – new theory

- AD – no longer thought of as primarily disease of the brain
- Rather, a disorder of the immune system within the brain
- Dementia - immune system cannot differentiate between pathogen and brain cells



Alzheimer's – a network insufficiency
driven by inflammation in the brain
caused by infection or autoimmune
response

Kinney JW, Bemiller SM, Murtishaw AS, et al. **Inflammation as a central mechanism in Alzheimer's disease.** *Alzheimers Dement* (NY). 2018 Sep 6;4:575-590

Alzheimer's disease (AD) by the numbers

- 7,000,000 Americans 65 years-old and older – living with AD
- Projected in the US:
 - 8.5 million by 2030
 - 14 million by 2060
- Worldwide:
 - 55 million now
 - 82 million by 2030 and after

Mark Hyman podcast, 31 July 2024

AD by the numbers (cont'd)

Direct costs:

- \$360 B - \$1 B per day
- By 2050 - \$1 trillion

Note: direct to indirect costs makes it most expensive health condition in the world

Mark Hyman podcast, 31 July 2024

AD by the numbers (cont'd)

Medical approach

Single pathway, single lane provides miracle cure

Answer:

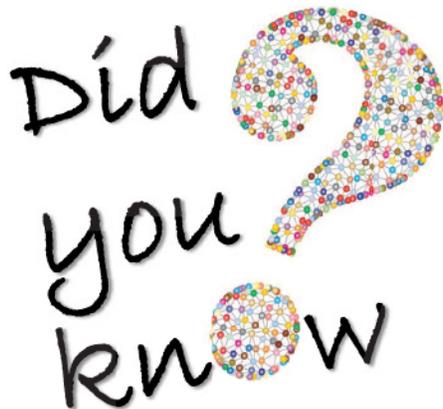
Multi-modal

Mark Hyman podcast, 31 July 2024

Early onset dementia/AD

- Vast majority of cases found in Americans over age 65
- Between 2013 & 2017, researchers found:
 - 143% increase in diagnosis ages 55-64
 - 311% increase in diagnosis ages 45-54
 - 373% increase in diagnosis ages 30-44

<https://www.bcbs.com/news-and-insights/report/early-onset-dementia-alzheimers-disease-affecting-younger-american-adults>



Cognitive function
associated with
established risk factors
and biomarkers as early as
age 24

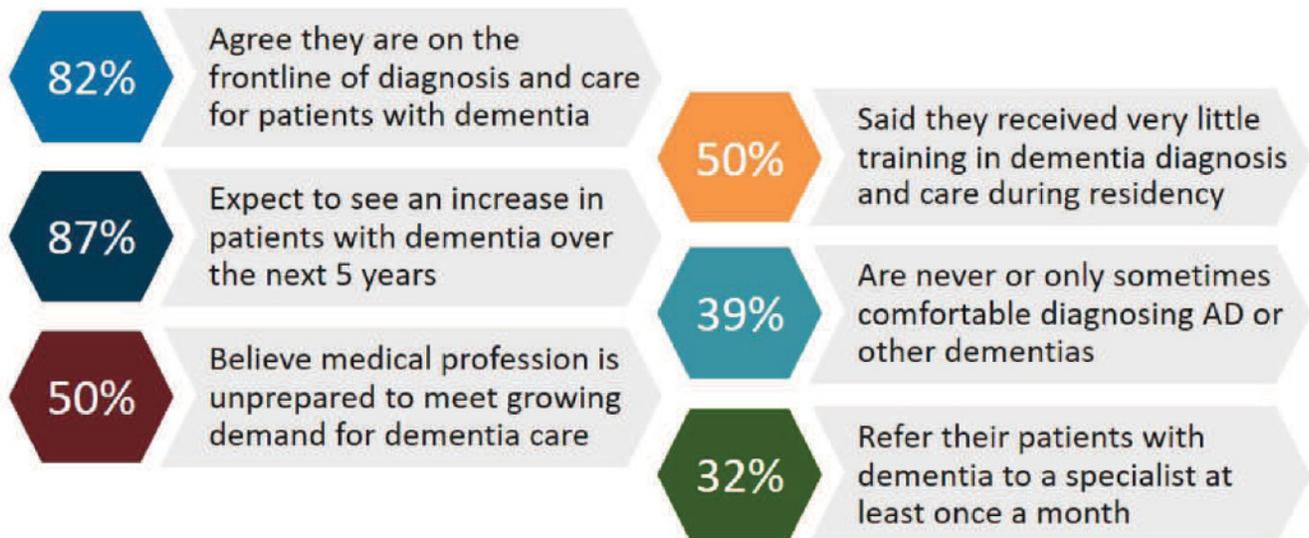
Women's brains in Alzheimer's Disease

- 60-70% of Alzheimer's sufferers are women
- Women with MCI found to decline faster than men with similar diagnosis
- Similar levels of biomarkers might have different prognostic values for men and women
- Potential female risk factors:
 - Ovariectomy
 - Hypertensive complications during pregnancy
 - Number of pregnancies
- Mounting evidence indicating microglial cells are different in women than men

Nature Reviews Neurology, 9 July 2018:457-69

Perspectives of PCPs on AD and Dementia Care

Survey of 1000 PCPs Practicing in the United States



Alzheimer's Association. AD facts and figures. 2020.

Alzheimer's disease

Findings:

- Survival switch stuck in “on” position in our modern day due to abundance
- Leads to overeating – high fat, sugary, salty foods
- Prompts excess fructose production

Conclusion:

Fructose produced in the brain could possibly lead to inflammation and ultimately Alzheimer's disease

RJ Johnson, DR Tolan, D Bredesen, et al. **Could Alzheimer's disease be a maladaptation of an evolutionary survival pathway mediated by intracerebral fructose and uric acid metabolism?** *The American Journal of Clinical Nutrition*, March 2023;117(3):455-66

P. gingivalis in Alzheimer's disease

- *P. gingivalis* found in brains of Alzheimer's patients
- Bacteria creates destructive enzymes – gingipains
- Infiltrates brain and causes inflamed damage
- Over 90% of Alzheimer's disease samples had gingipains
- Also identified in CSF

Science Advances. 23 Jan 2019;5(1)

P. gingivalis

- Alters gut microbiome
- Leads to insulin resistance and metabolic endotoxemia
- Can undermine the integrity of intestinal barrier
- Promotes systemic inflammation

Hakimiha N, Jahani Sherafat S, Laakso EL, Fekrazad R. **Photobiomodulation and the oral-gut microbiome axis: therapeutic potential and challenges.** *Front Med (Lausanne)*. 2025 Apr 9;12:1555704

Association of intestinal disorders with Parkinson's and Alzheimer's Diseases

Findings:

- Suggest PD and AD – significantly associated with intestinal disorders
- The negative roles of *H. pylori* in development of PD or AD should be evaluated to shed new light on diagnosis and treatment

Fu P, Gao M, Yung KKL. **Association of Intestinal Disorders with Parkinson's Disease and Alzheimer's Disease: A Systematic Review and Meta-Analysis.** *ACS Chem Neurosci*. 2020 Feb 5;11(3):395-405

Link between herpes and Alzheimer's discovered

Key facts:

- HSV-1 and tau: HSV-1 infection influences tau protein levels, initially protecting neurons but later contributing to damage
- Alzheimer's link: viral proteins co-localize with tau tangles in brain regions vulnerable to Alzheimer's
- Therapeutic potential: targeting viral proteins or fine-tuning immune response could inform Alzheimer's treatments

VR Hyde, Cm Zhou, *et al.* **Anti-herpetic tau preserves neurons via the cGAS-STING-TBK1 pathway in Alzheimer's disease.** *Cell Reports*, 2 January 2025;115109

Common virus can trigger AD

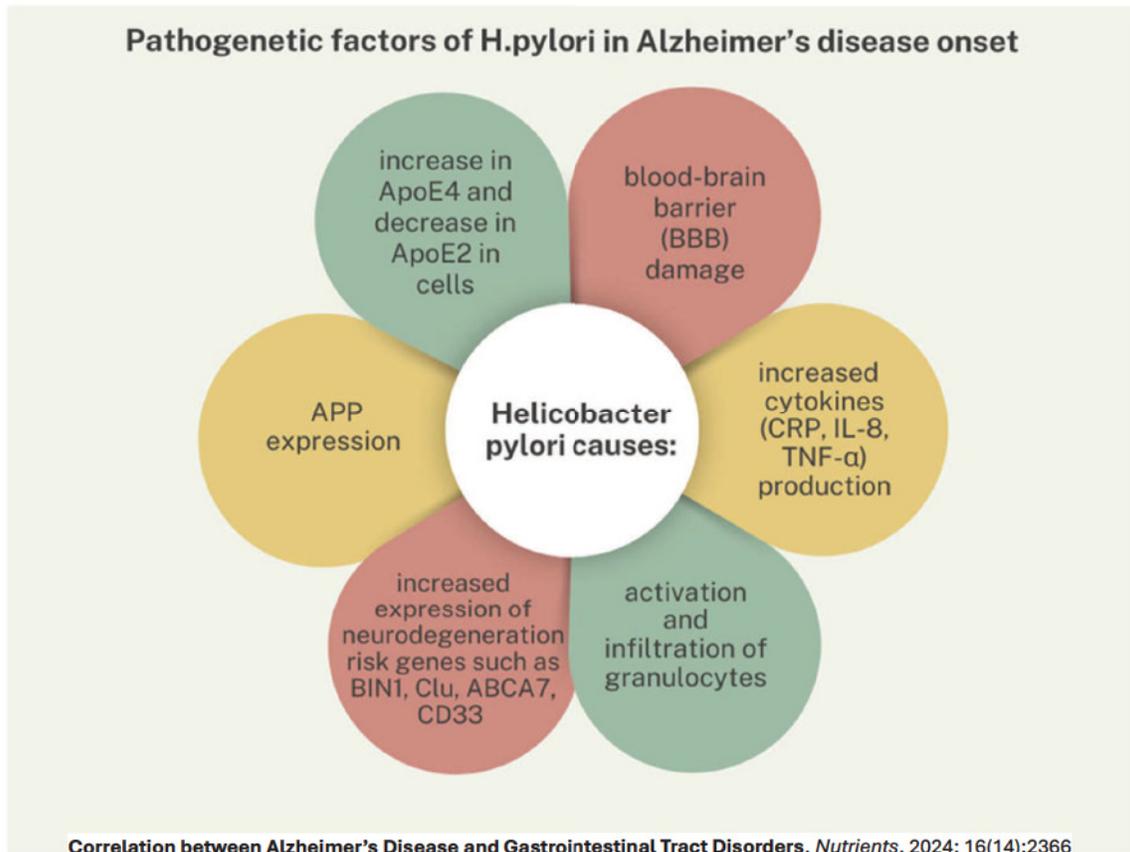
Findings:

- Link between chronic cytomegalovirus (HCMV) infections in gut, and AD in certain individuals
- Role of microglia in AD development

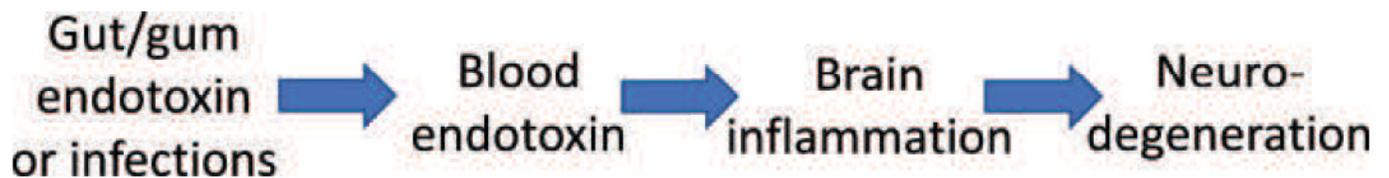
Conclusion:

Virus activates immune response in the brain that contributes to AD pathology, including production of amyloid and TAU proteins

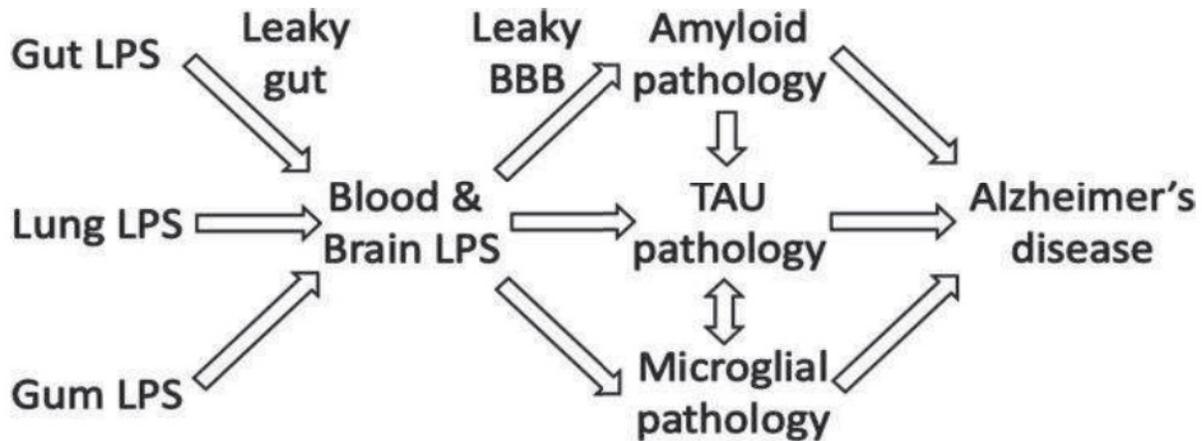
BP Readhead, DF Mastroeni, *et al.* **Alzheimer's disease-associated CD83(+) microglia are linked with increased immunoglobulin G4 and human cytomegalovirus in the gut, vagal nerve, and brain.** *Alzheimer's & Dementia*, 19 December 2024



Central pathway of how endotoxin leads to neurodegeneration



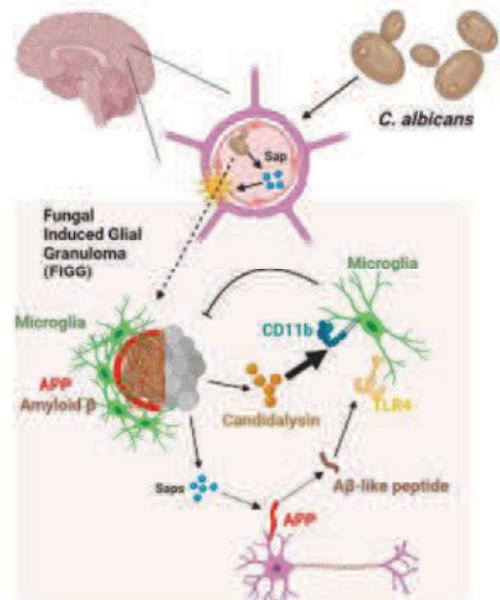
Endotoxin hypothesis of Alzheimer's disease



The endotoxin hypothesis of Alzheimer's disease. *Mol Neurodegener.* 2024 Apr 1;19(1):30

Candida infection/Alzheimer's

- *Candida albicans* – a yeast – type of single-celled fungus
- Part of the body's natural microflora
- Overgrowths can lead to infections
- Detected in the brains of individuals with Alzheimer's disease – can produce amyloid proteins



Toll-like receptor 4 and CD11b expressed on microglia coordinate eradication of *Candida albicans* cerebral mycosis. *Cell Reports*, 31 Oct 3023; 42 (10):113240

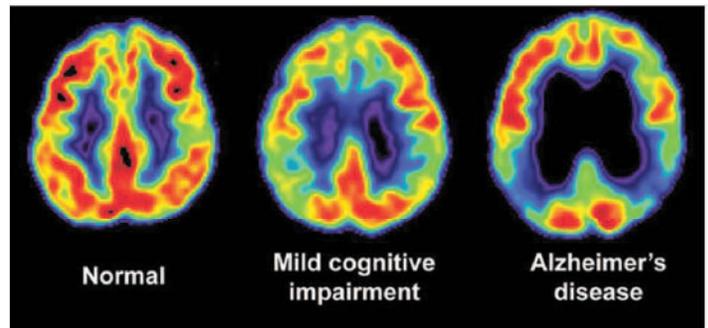
Alzheimer's disease and obesity

- Previous research found link between obesity and Alzheimer's disease
- Obesity directly impacts CNS. Other mechanisms:
 - Increased inflammation
 - Oxidative stress
 - Hormonal regulation
 - Glucose metabolism/insulin resistance
- Both obesity and Alzheimer's have loss of grey matter brain cells

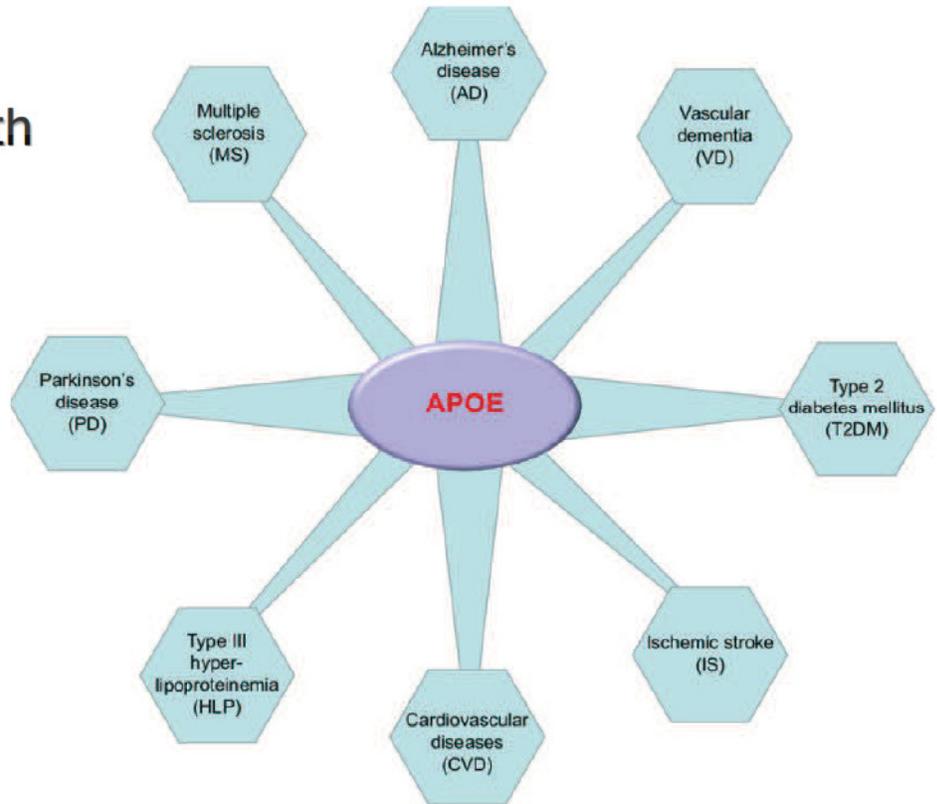
F Morys, O Potvin, Y Zeighami, et al. **Obesity-Associated Neurodegeneration Pattern Mimics Alzheimer's Disease in an Observational Cohort Study.**
J of Alzheimer's Disease, 13 Jan 2023;91(3):1059-1071

Alzheimer's protocols

- Check for ApoE e4 gene
- Increase BDNF
- Keto or Mediterranean diets
- Plant-forward diets
- Intermittent fasting
- Choose foods with GI under 35
- GPS/DNA/IRS
- Pre and probiotics/heal the gut
- Cook at proper temperatures and times
- Lifestyle changes



APOe is associated with disease progression in various conditions



Role of apolipoprotein E in neurodegenerative diseases. *Neuropsychiatric disease and treatment*, July 2015;11:1723-37

Maternal history of Alzheimer's – important genetic risk

- “...striking asymmetry suggesting that genetic information from the mother might have a stronger impact on the risk of Alzheimer's disease”.
- Maternal inheritance pattern observed in mitochondrial disorders

Did
you
know

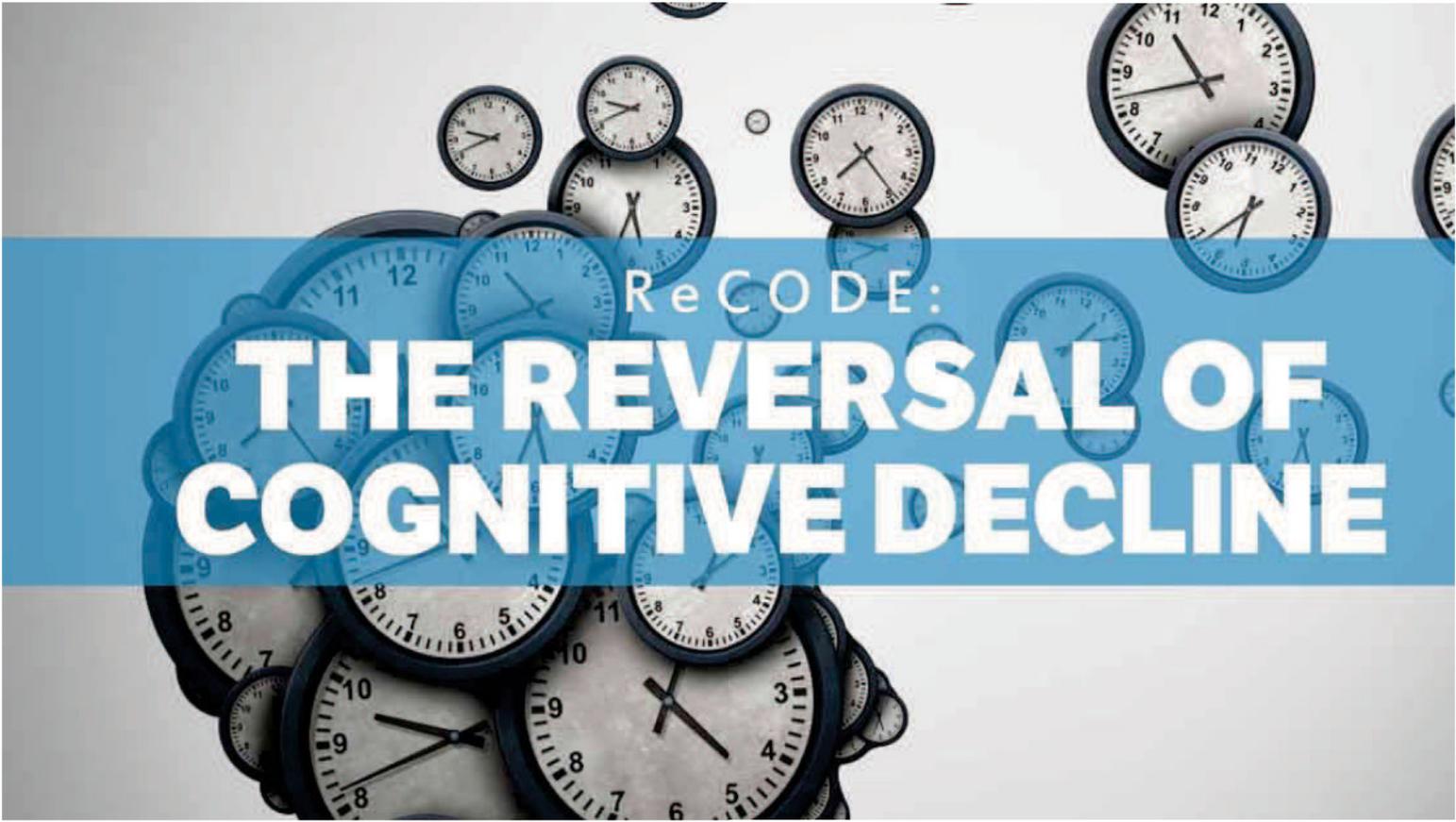


Having a father with
Alzheimer's disease may be
tied to a greater spread of tau
protein in the brain

V Ourry, A Fajardo-Valdez, et al. **Amyloid and Tau Pathology in Cognitively Unimpaired Individuals With a Parental History of Alzheimer Disease.**
Neurology, 13 May 2025;104(9)



STUDIES INDICATE
LIFESTYLE INTERVENTIONS CAN
REVERSE SYMPTOMS



ReCODE:
**THE REVERSAL OF
COGNITIVE DECLINE**

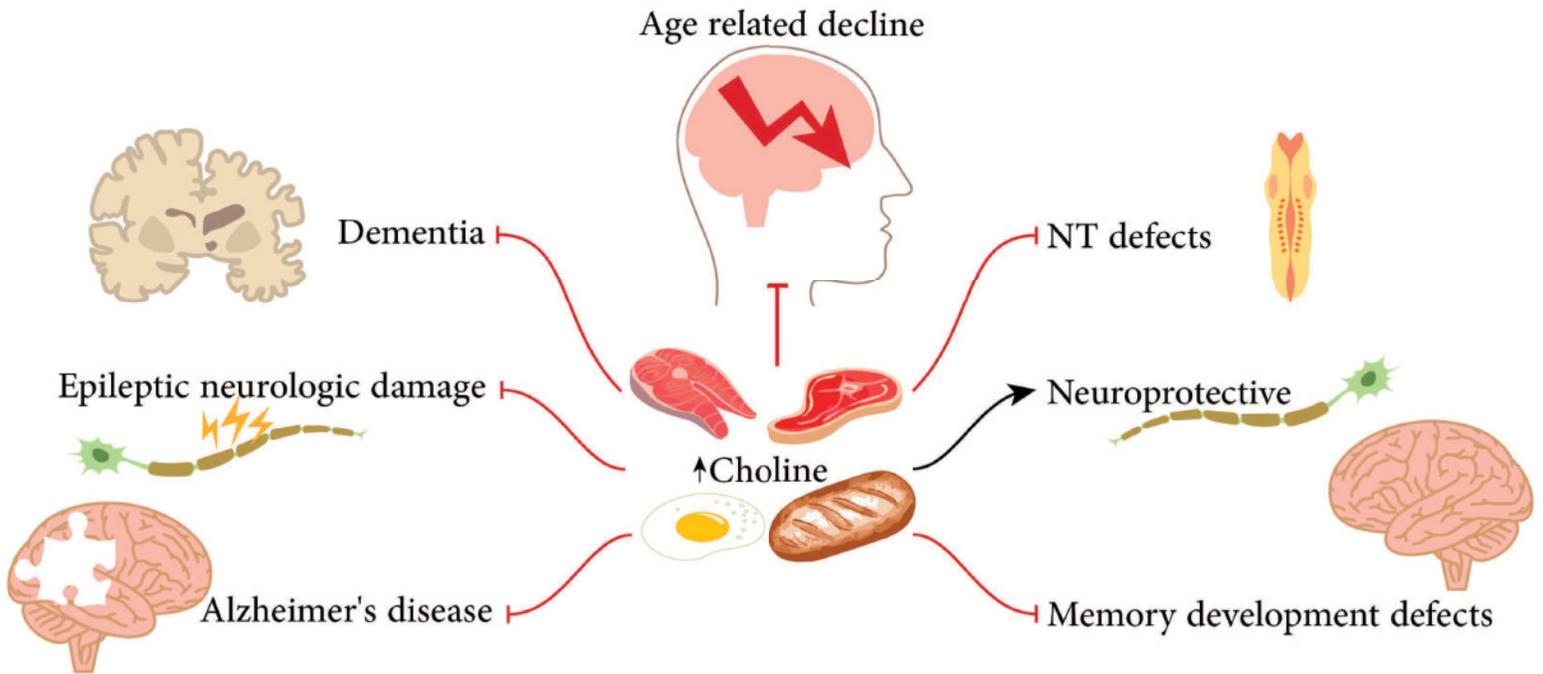
ANTI-ALZHEIMER'S DIET: KETOFLEX 12/3

- Include supplements:
 - Methylated B vitamins
 - Vitamin C – 1 g
 - Vitamin D – 5000 IU
 - Vitamin E – mixed tocopherols – 600 IU
 - Vitamin K2 (MK-4 and MK-7) – 100 mcg
 - Resveratrol – 100 mg
 - Acetyl-L-carnitine – 500 mg
 - Co-enzyme Q10 – 200 mg
 - Omega-3 FA – 2-4 g
 - Curcumin – 1 g
 - Pro-resolving Mediators – 1000 mcg
 - Mg – 400-600 mg

Adapted from *The End of Alzheimer's*, Dr. Dale Bredesen



Overview of choline's effects on nervous system



The Importance of Gut Microbiota on Choline Metabolism in Neurodegenerative Diseases. *Biomolecules*. 2024; 14(11):1345

Alzheimer's disease

- 494,632 adults
- 40-71 years
- Median follow-up of 11.9 years
- Zinc supplementation associated with reduced risk of all-cause dementia and AD (29%)

Shang X, Liu J, Zhang X, et al. Association of antioxidants use with the risk of dementia among community-dwelling adults in the United Kingdom biobank. *Front Nutr*. 2024 Jan 4;10:1270179

Alzheimer's disease

- Improve cognitive function in elderly people with impaired memory:
 - Bifidobacterium breve
 - L. acidophilus
 - L. casei

Probiotics Show Promise in Alzheimer's Disease, *International Probiotics Assoc.* 26 November 2022

Conclusion:

Oral benfotiamine – efficacious in improving cognitive outcomes among persons with MCI and mild AD

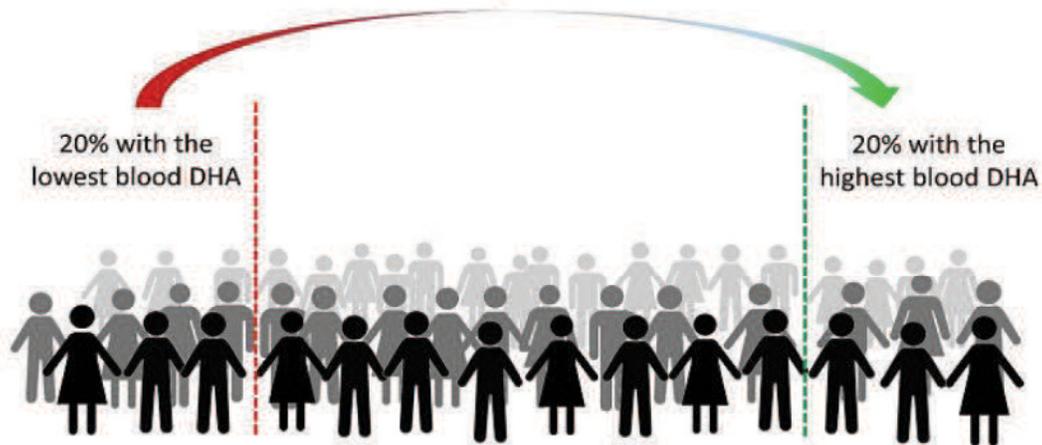
Gibson GE, Luchsinger JA, Cirio R, et al. **Benfotiamine and Cognitive Decline in Alzheimer's Disease: Results of a Randomized Placebo-Controlled Phase IIa Clinical Trial.** *J Alzheimers Dis.* 2020;78(3):989-1010

Keto diet/Alzheimer's disease

- Keto diet significantly delays early stages of Alzheimer's-related memory loss – Mild-Cognitive Impairment (MCI)
- Boosts Beta-Hydroxy-butyrate (BHB)
- BHB increases 7-fold
- BHB improves function of synapses

Ketogenic diet and BHB rescue the fall of long-term potentiation in an Alzheimer's mouse model and stimulates synaptic plasticity pathway enzymes. *Communications Biology*, 16 February 2024;7(1):1-11

Lower risk of having Alzheimer's (reduction by 49%)
& estimated 4.7 additional years of life free of Alzheimer's



Participants from Framingham Offspring Study,
aged ≥ 65 years old and free of dementia

Red Blood Cell DHA Is Inversely Associated with Risk of Incident Alzheimer's Disease and All-Cause Dementia: Framingham Offspring Study. *Nutrients*. 2022; 14(12):2408

Aerobic exercise lowers AD markers

Findings:

- 8-week aerobic exercise program
- Focused on hippocampal formation
- Significant reductions in tau tangles (63%), amyloid plaques (76%), and iron accumulation (58% in brains of subjects)
- Enhanced brain cell health, including increased numbers of protective oligodendrocytes
- Reduced brain inflammation (between 55% and 68%), and cell death
- Improved communication between brain cells

RC Gutierre, PR Rocha, et al. Tau, amyloid, iron, oligodendrocytes ferroptosis, and inflammaging in the hippocampal formation of aged rats submitted to an aerobic exercise program. *Brain Research*, 1 March 2025;1850:149419

Lifestyle changes

- Exercise
- Sleep
- Reduce stress
- Brain training
- Resolve inflammation
- Inhibit new inflammation
- Remove all inflammatory sources
- Heal the gut – 7R Program

Adapted from *The End of Alzheimer's*, Dr. Dale Bredesen



New blood test for Alzheimer's

Category		
A	Beta-Amyloid 42/40 Ratio	Assess levels of pathologic change consistent with Alzheimer's disease
T	Phosphorylated Tau 181 (pTau181)	
N	Neurofilament Light Chain (NFL)	Assess disease severity by measuring neurodegeneration

- Amyloid-Tau-Neurodegeneration (ATN) profile
- Sensitivity – 96% and specificity – 86.7%
- **A for amyloid plaques:** Accumulations of beta-amyloid 42 proteins begin to form plaques in the brain years before initial symptom onset
- **T for tau tangles:** Beta-amyloid 42 accumulation causes misfolding of tau proteins, which tangle into knots and disrupt normal brain cell function
- **N for neurodegeneration:** Brain cell functional impairment causes cells to die, which exacerbates the characteristic cognitive impairment symptoms observed in Alzheimer's patients

<https://www.labcorp.com/providers/neurology/atn/primary-care>

Biomarker changes during 20 years preceding AD

- Levels of $A\beta_{42}$ in CSF and ratio of $A\beta_{42}/A\beta_{40}$ who developed AD at 18 and 14 number of years respectively, before diagnosis diverged from those of peers who remained cognitively normal
- P-tau 181 increased 11 years before disease onset
- Neurofilament light chain levels increased 9 years before diagnosis

JP Jia, Y Ning, ML Chen, et al. Biomarker Changes during 20 Years Preceding Alzheimer's Disease. *N Engl J Med*. 22 February 2024; 390:712-722



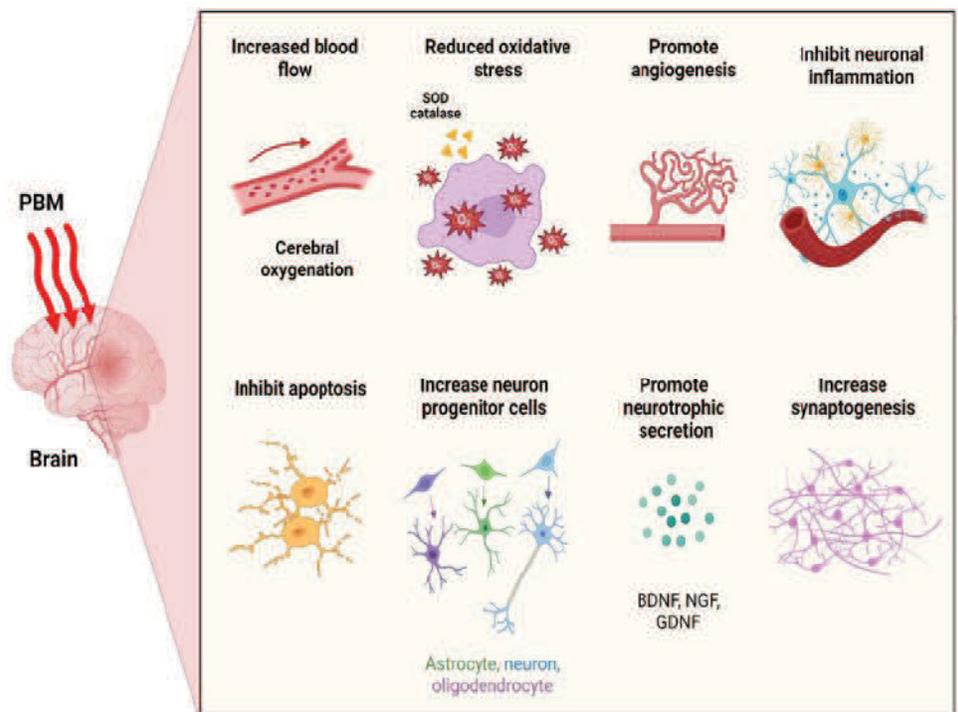
LASER for Alzheimer's

How LLLT works

- Improve cerebral circulation and brain oxygenation
- Increase ATP
- Regulate mitochondrial homeostasis
- Reduce neurodegeneration and inflammation
- Stimulate neurogenesis and neuroplasticity
- Reduce levels of amyloid beta in brain

Ramanishankar A, S AS, et al. **Unleashing light's healing power: an overview of photobiomodulation for Alzheimer's treatment.** *Future Sci OA.* 2024 May 24;10(1):FSO922

Functional processes specific to brain tissue following photobiomodulation therapy



Photobiomodulation Therapy on Brain: Pioneering an Innovative Approach to Revolutionize Cognitive Dynamics. *Cells.* 2024 Jun 3;13(11):966

Alzheimer's disease

- LLLT can directly disassemble amyloid-beta in vitro and in vivo
- Activates mitochondrial cytochrome-c to produce ATP in the neurons
- A promising strategy combined LLLT with nanopacked Q10 proposed to apply for treating AD

Tian Z, Wang P, Huang K, et al. Photobiomodulation for Alzheimer's disease: photoelectric coupling effect on attenuating A β neurotoxicity. *Lasers Med Sci.* 2023 Jan 12;38(1):39

Photobiomodulation (PBM) in Alzheimer's disease

Results:

Studies showed PBM able to reduce inflammatory response, oxidative stress and apoptotic effects generated by amyloid beta and restore mitochondrial function/cognitive behavior

Conclusion:

Results indicate PBM maybe be useful tool for treating AD

Cardoso FDS, Lopes Martins RÁB, Gomes da Silva S. Therapeutic Potential of Photobiomodulation In Alzheimer's Disease: A Systematic Review. *J Lasers Med Sci.* 2020 Fall;11(Suppl 1):S16-S22

PBM/exercise/Alzheimer's disease

Findings:

The experimental group which received active LLLT in addition to moderate-intensity aerobic exercise showed more significant results compared to control group which received placebo LLLT and moderate-intensity aerobic exercise

Nagy EN, Ali AY, Behiry ME, et al. **Impact of Combined Photo-Biomodulation and Aerobic Exercise on Cognitive Function and Quality-of-Life in Elderly Alzheimer Patients with Anemia: A Randomized Clinical Trial.** *Int J Gen Med.* 2021;14:141-152

Photobiomodulation therapy and Alzheimer's

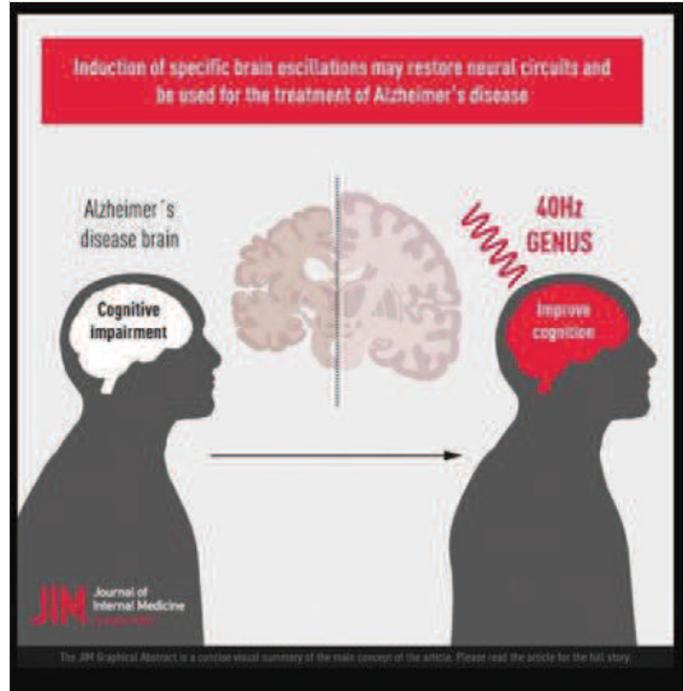
Findings:

Gf (gut flora)-targeted PBM regulates diversity of intestinal flora, which may improve damage caused by AD. Gf-targeted PBM has potential to be noninvasive microflora regulation method for AD patients

Qianqian C, Jinpeng W, Xiaoxi D, et al. **Gut flora-targeted photobiomodulation therapy improves senile dementia in an A β -induced Alzheimer's disease animal model,** *J of Photochemistry and Photobiology B: Biology,* 2021;216:112152

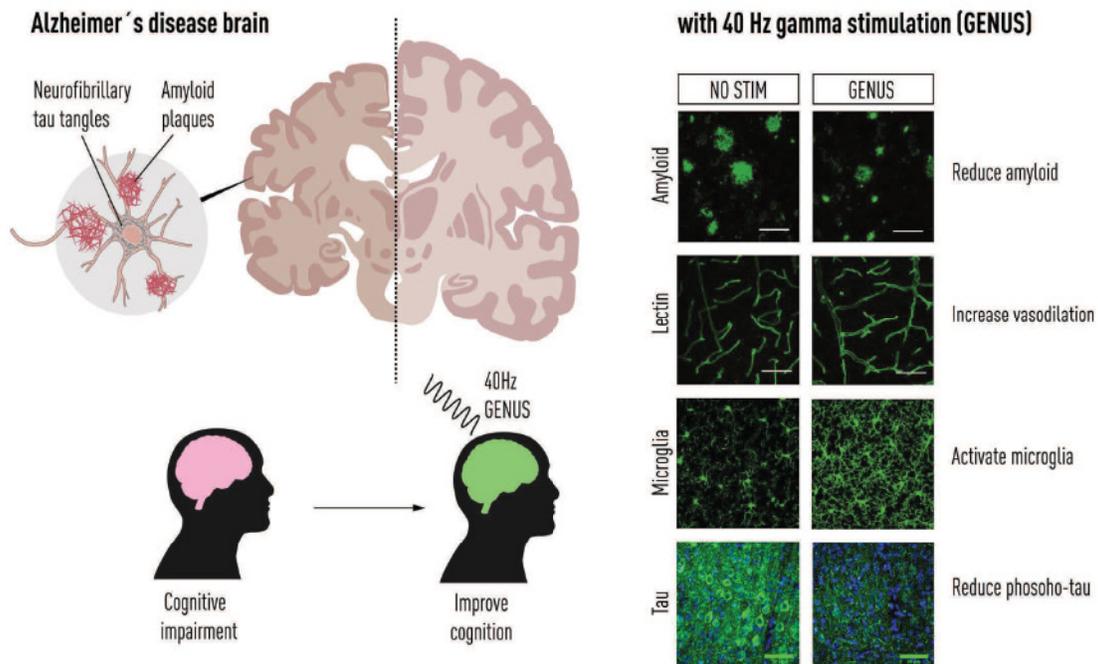
40 Hz transcranial alternating current stimulation

Exogenously-induced 40 Hz gamma oscillations – reduced amyloid- β and p-TAU deposition presumably via microglia activation



Dhaynaut M, Sprugnoli G, Cappon D, et al. **Impact of 40 Hz Transcranial Alternating Current Stimulation on Cerebral Tau Burden in Patients with Alzheimer's Disease: A Case Series.** *J Alzheimers Dis.* 2022;85(4):1667-1676

Effects of 40-Hz light and sound GENUS on the AD brain



Induction of specific brain oscillations may restore neural circuits and be used for the treatment of Alzheimer's disease. *J of Int Med*, 22 June 2021;290(5):993-1009

Light therapy

- 15 high-quality randomized controlled trials from 2005-2022
- 598 participants

Conclusion:

- Light therapy significantly improved sleep efficiency
- Improved intraday variability

In Alzheimer's: light therapy also alleviated depression and reduced patient agitation

L Zang, X Liu, et al. **The effect of light therapy on sleep disorders and psychobehavioral symptoms in patients with Alzheimer's disease: A meta-analysis.** *PLOS ONE*, 6 December 2023;18(12):e0293977

Alzheimer's Protocol



Fig. A

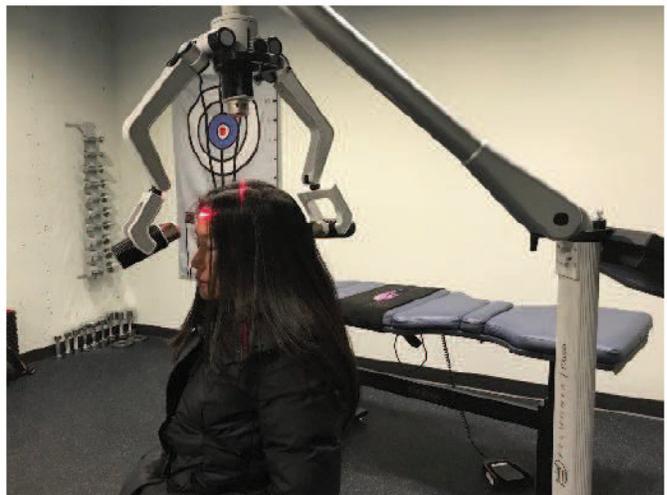


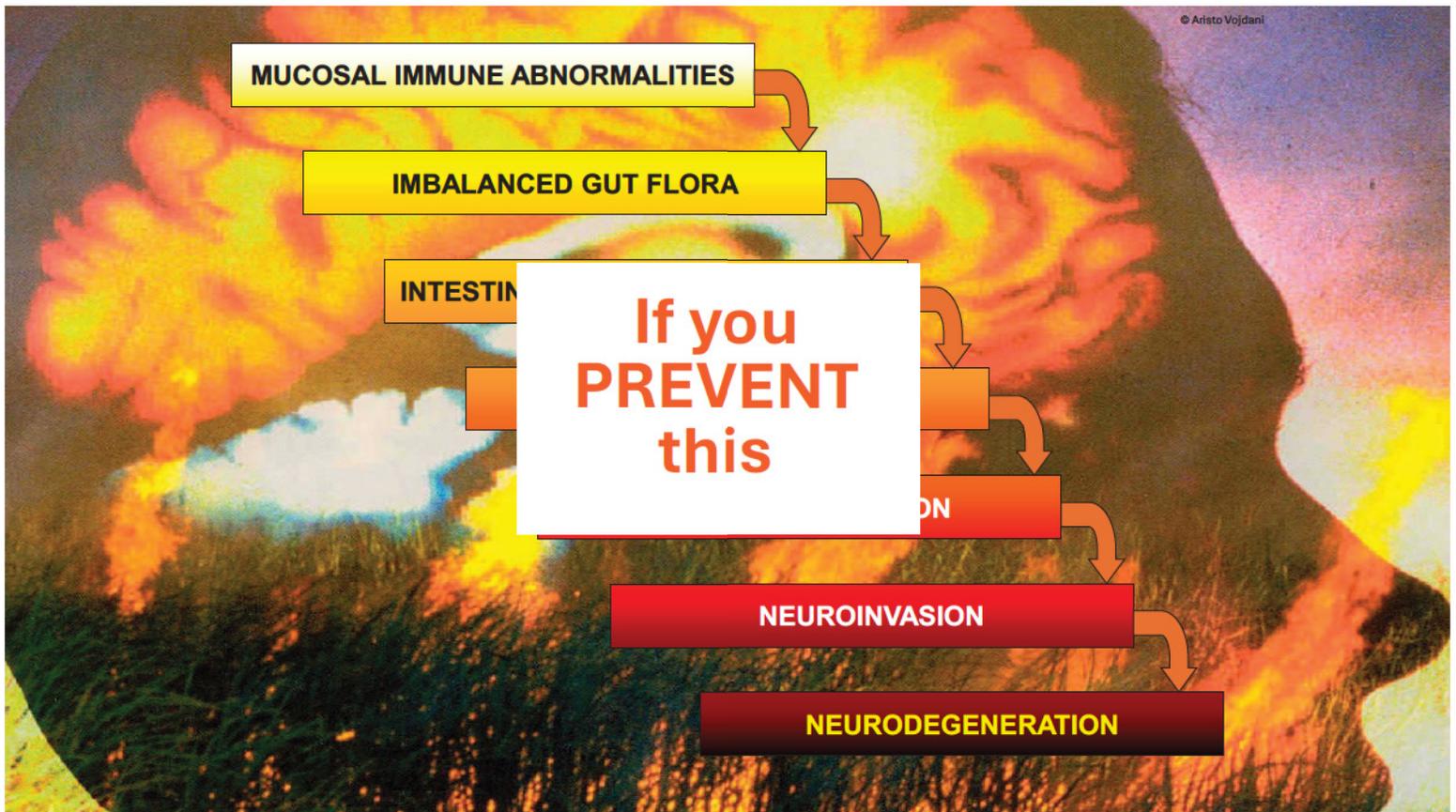
Fig. B

Alzheimer's protocol

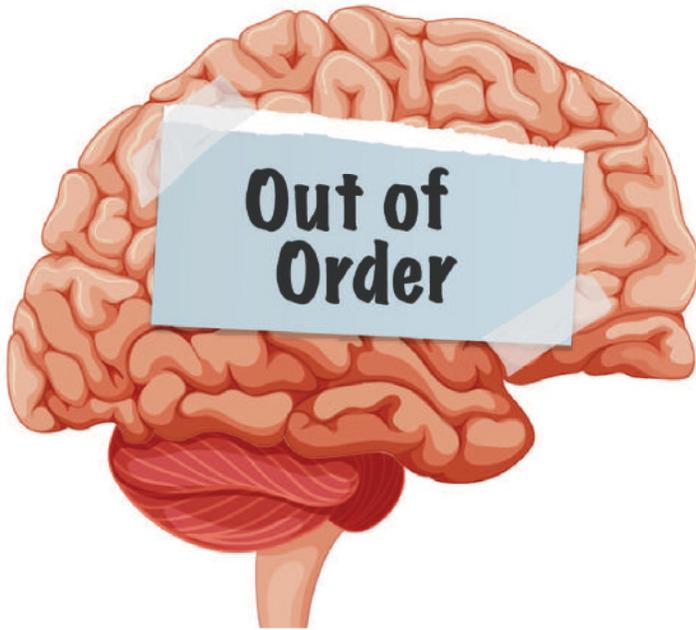
- Master gut: 4, 4, 9, 26
- Alzheimer's: 1, 40, 10, 40
- Lung: 9, 21, 53, 78
- Gums: 4, 9, 66, 88
- Vagus nerve: 10, 10, 10, 10

Execute in order:

- 1) Gut-brain (vagus nerve)
- 2) Lung-brain (bilateral)
- 3) Gum-brain (whole area)

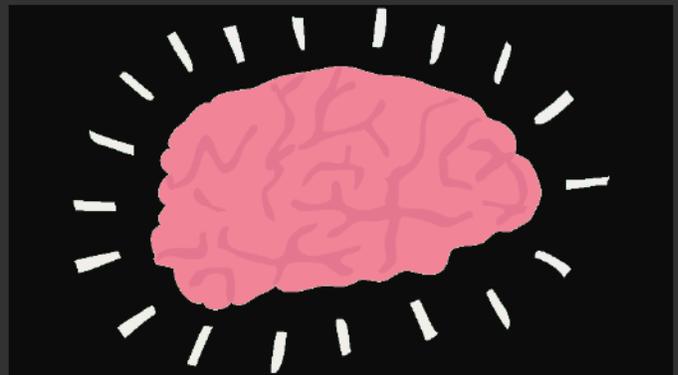


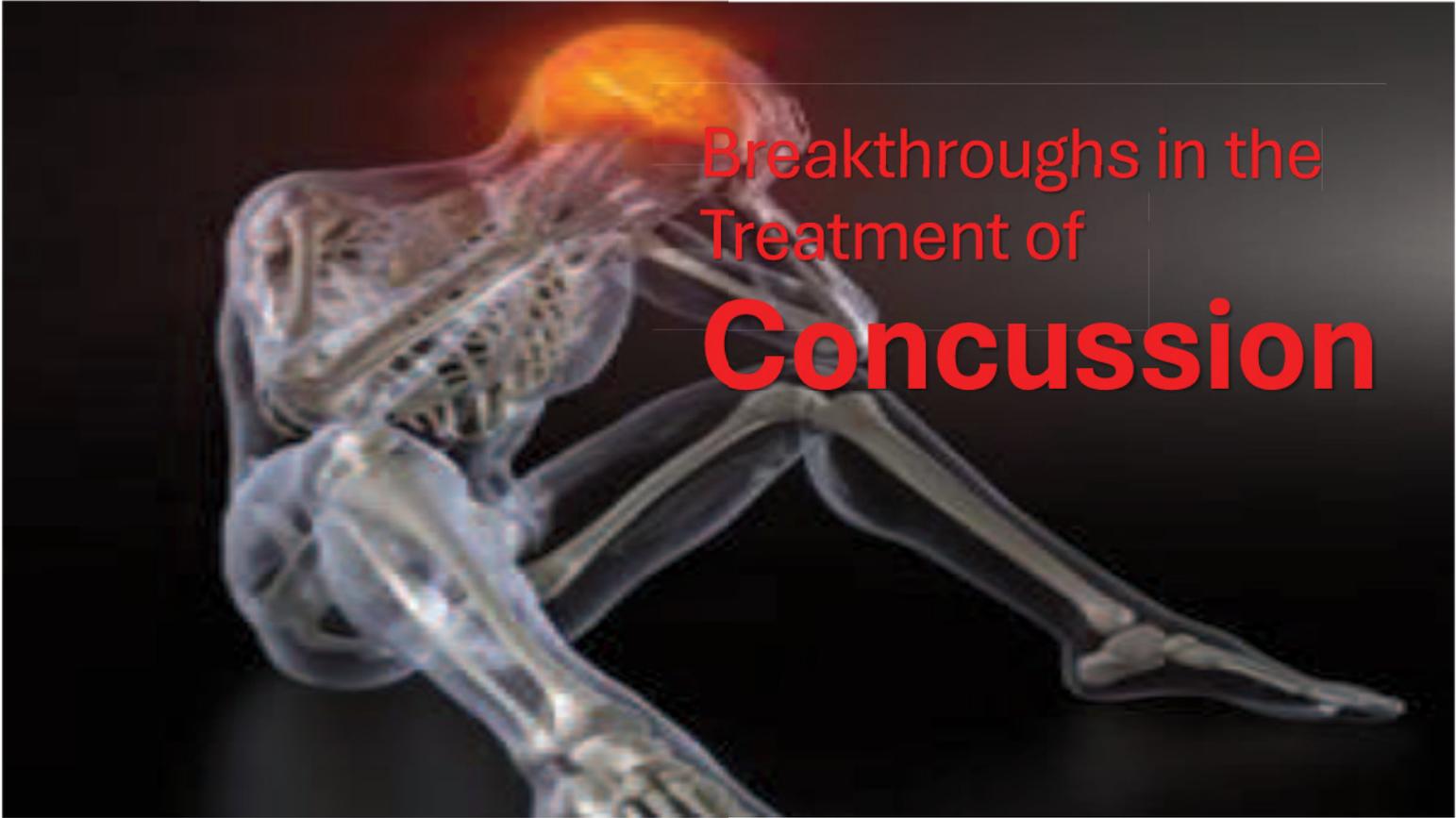
**You can
PREVENT
this**



Brain health & longevity

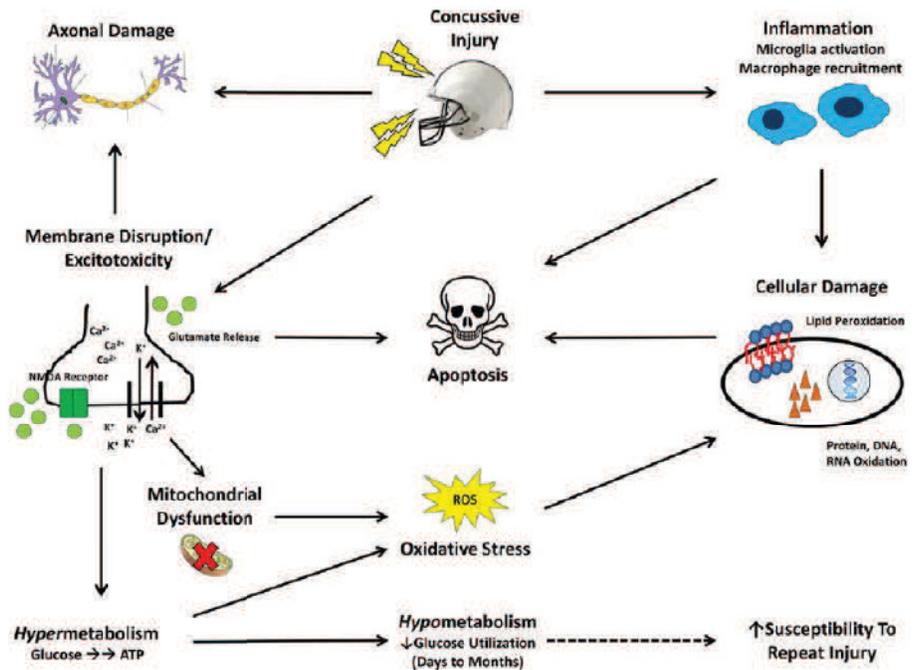
Concussions can potentially reduce longevity – some studies suggesting a shortened life expectancy after TBI





Breakthroughs in the Treatment of Concussion

Molecular cascade of events after a mild traumatic brain injury



Erin Cernkovich Barrett et al. *Adv Nutr* 2014;5:268-77

Multi-modal neurorehabilitation for **post-concussion** symptoms

Ross EA, Hines RB, et al. **Multi-Modal Neurorehabilitation for Persisting Post-Concussion Symptoms.**
Neurotrauma Rep. 2023 May 12;4(1):297-306

Conclusion:

Patients suffering from PPCS 2 years after injury may have significant benefits with some moderate effect sizes from an intensive, multi-modal neurorehabilitation program

Exercises:

- Neuromuscular re-education
- Gaze stabilization
- Orthopedic
- Cognitive

Blood markers for concussion

<https://www.fda.gov/news-events/press-announcements/fda-authorizes-marketing-first-blood-test-aid-evaluation-concussion-adults>

Association of Blood Biomarkers of Inflammation With Acute Concussion in Collegiate Athletes and Military Service Academy Cadets. *Neurology*, 23 January 2024;102(2):e207991

- Tau proteins: an increase shows 7% decrease in thalamus size
- NF-L (neurofilament light): protein enzyme released from acute brain damage
- UCH-L1: enzyme highly and exclusively expressed in neurons
- GFAP: astrocyte injury in either white or gray matter. Abbot's Alinity – FDA-approved
- IL-6, IL-1Ra: elevated in concussions
- Blood-brain barrier test
- Gut barrier panel

Dr. Rob's Concussion Protocol

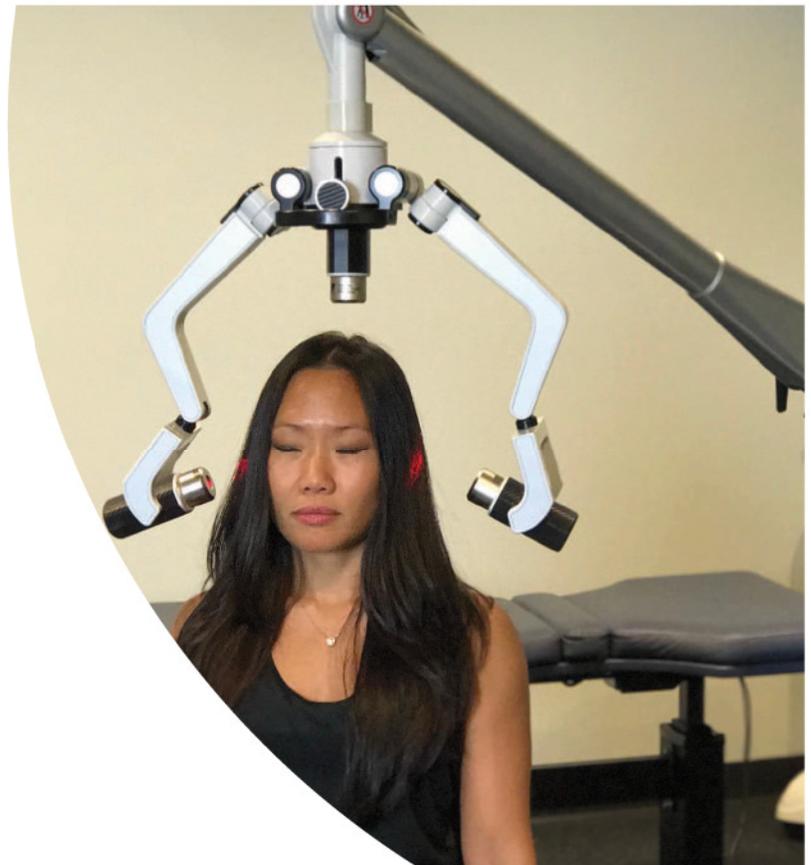
Multisystem approach:

- Musculoskeletal system
- Balance
- Visual disturbances
- Laser
- Nutrition support



Is Transcranial Laser Therapy effective in acute phase recovery post TBI?

Low level laser therapy (LLLT) effective in reduction of pain, swelling and inflammation Chung. *Ann Biomed*, 2012, improves cerebral circulation Tian. *Lasers Surg Med* 2016 and may “significantly improve neural function, decreased lesion volume, augment cell proliferation and even protect the brain against neuronal damage.” Xuan W, et al. *Transcranial LLLT improves neurological performance in TBI in mice*, PlosOne



Is Transcranial Laser Therapy efficacious in acute phase recovery post TBI?

- Low Level Laser therapy improves neurological performance in TBI (PLoS One, 2013)
- Treatment can stimulate growth of new nerve tissue (Xuan W, et al. *Transcranial LLLT enhances learning, memory, and neuroprogenitor cells after TBI in mice*, J Biomed Opt, 2014 Oct(10);19)
- Also been shown to modulate oxidative stress and nitric oxide production (Manchini. PLoS One, 2014. Chen. PLoS One, 2011)
- LLLT down-regulates pro-inflammatory microglial cytokine expression (Song, 2012)

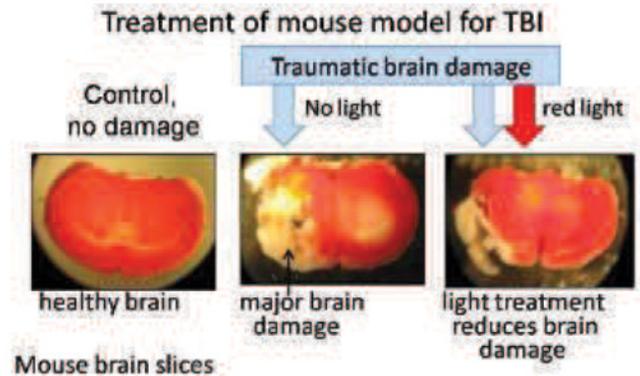
Is Transcranial Laser Therapy efficacious in acute phase recovery post TBI? (cont'd)

- 635 nm LLLT modulates NF- κ B signaling pathways (Lim, 2013)
- Laser shown to mitigate cell apoptosis (Moreira, 2011)
- Transcranial Laser Therapies researched in stroke injury (Naeser, 2011 and Lampl 2007) and in clinical trials (Stemer, 2010)
- LLLT improves cognitive deficits and inhibits microglial activation after controlled cortical impact in mice (*J Neurotrauma*, 2012 Jan 20)

Proof lasers heal the brain

Study from Israel, Dr. Oron found:

- Laser on mice with traumatic brain injuries had far fewer neurological deficits 5 days later than control groups
- And size of injury 30 days later was significantly smaller



A. Oron, et al. Low level laser therapy applied transcranially to mice following traumatic brain injury, *J of Neurotrauma*, 2007, 24:651-56

“LLLT suppressed pro inflammatory cytokine expression of IL-1b and IL-6...LLLT elevated production of Immediate Early Responsive Gene X-1 in injured brain. The protective effect of LLLT may be ascribed to enhanced ATP production and selective modulation of pro inflammatory mediators.”



Low-level Laser effectively prevents second brain injury induced by immediate early response gene X-1 deficiency. Zhang, *J Cereb Blood Flow Metab.* 2014

LLLT for BDNF

Conclusion: Benefit of LLLT to the brain is mediated by stimulation of BDNF production, which may in turn encourage synaptogenesis. LLLT may have applications for neurodegenerative conditions

Xuan W, Agrawal T, huang L, et al. *J Biophotonics*. 2015 Jun;8(6):502-11

Study suggests upregulation of BDNF with LLLT can ameliorate AB-induced neurons loss and dendrite atrophy. Thus, identifying a novel pathway by which LLLT protects against AB-induced neurotoxicity

J Mol Neurosci 2013 Aug 14;33(33):13505-17

LLLT post-TBI

LLLT improves:

- Neurological function
- Lessens size of brain lesion
- Reduces inflammation in the brain
- Stimulates formation of new neurons – increase BDNF, synaptogenesis

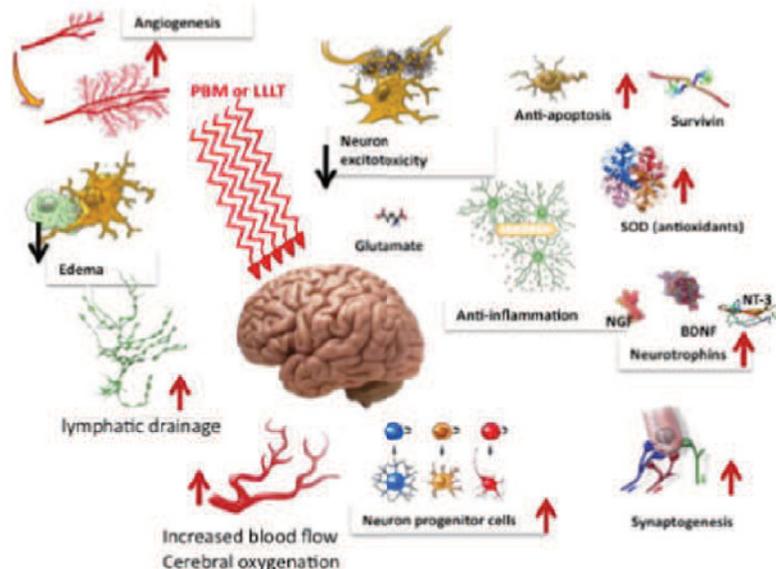
Thunshelle C, Hamblin MR. *Transcranial Low-Level Laser (Light) Therapy for Brain Injury*. *Photomed Laser Surg*. 2016;34(12):587-598

Photobiomodulation for TBI

- Findings: PBM
 - Reduce swelling
 - Increase antioxidants
 - Decrease inflammation
 - Protect against apoptosis
 - Modulate microglial activation
- Acute TBI found positive effects:
 - Neurological function
 - Learning and memory
 - Reduced inflammation
 - Reduced cell death in brain
 - Upregulate BDNF

Hamblin MR. *J Neurosci Res* 2018 Apr;96(4):731-743. doi: 10.1002/jnr.24190. Epub 2017 Nov 13

Shining light on the head: Photobiomodulation for brain disorders



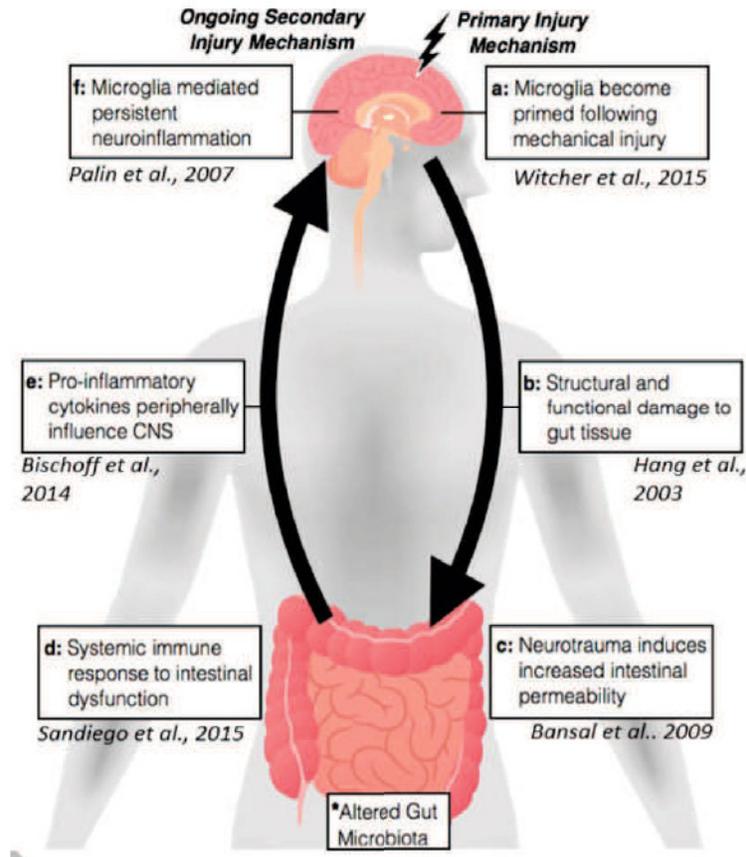
BBA Clin. 2016 Dec;6:113-124. Published online 2016 Oct 1 *Journal of Neuroscience Research*, first published 13 November 2017; 96(4):731-43

Dr. Rob's Laser Concussion Protocol: hand-held

- Low-level laser therapy area of impact – 8 mins.
- GVL: 1,10,13,40
- 30 sec. each area:
 - Cerebellum
 - Temporal lobe
 - Occipital lobe
 - Cerebrum (frontal/parietal lobe)
- Laser occipital region, post. neck/trap, upper TS – all 1 min.
- Master gut: 4, 4, 9,26 – 5 mins.
- Vagus nerve protocol: 10, 10, 10, 10

Dr. Rob's Laser Concussion Protocol

- ★ FX405 – 10 minutes. (Fig. A & B – 5 mins each)
 - First 3 weeks: 1,1,10,13,10,10,13,40
 - After 3 weeks: 1,5,1,10,15,20,1,40
 - Chronic (6 months): 1,10,40,60,1,10,40,60
- ★ Vagus nerve (GVL)-10,10,10,10
 - Nose region for CSF: 60 sec., hard palate open mouth: 30 sec.
- ★ 2 lasers – use gut-brain reconnection
 - 1 laser – use Master gut protocol – 5 mins.



STIMULATING THE VAGUS NERVE TO PREVENT INTESTINAL DYSFUNCTION AFTER TRAUMATIC BRAIN INJURY (TBI)

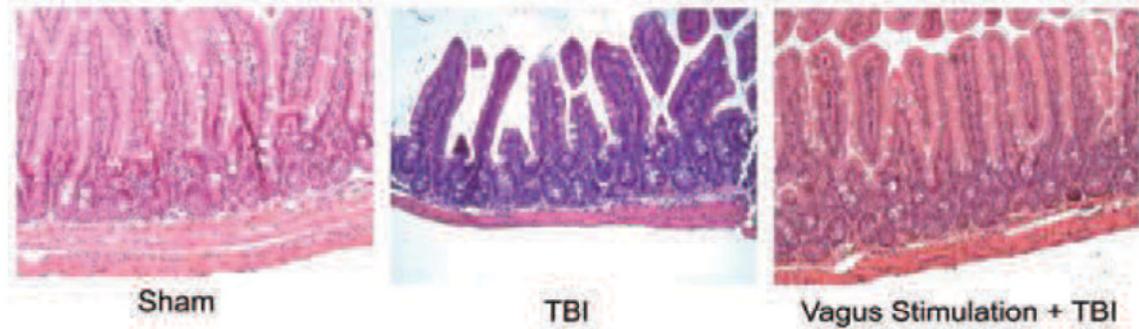
Conclusion:

- Vagal nerve stimulation prevented TBI-induced intestinal permeability, prevented intestinal injury, and significantly reduced intestinal NF-kappa B
- Vagal nerve stimulation also increased enteric glial activity

Journal of Trauma, Injury, Infection and Critical Care. 68(5), May 2010

- Post-injury VNS prevents gut epithelial breakdown when performed within 90 min. of injury
- Prevents effects on tight junction protein expression

Journal of Trauma, Injury, Infection and Critical Care. 70, May 2011



Representative H & E staining and microscopy (60×) from terminal ileum was harvested 6 hours after sham, TBI, or vagal stimulation + TBI. Sham animals had normal appearing villi with consistent villous height. TBI caused blunting of intestinal villi and necrosis. Vagal stimulation prevented intestinal injury with histology showing intestinal architecture unchanged from sham

J Trauma. 2010 May; 68(5): 1059–1064

Concussion Nutrition Protocol

Feed the concussion

- 1) **Ketogenic diet:** ketone bodies provide energy for the brain
- 2) **Creatine:** gives the brain an intense/immediate energy to heal cells
- 3) **Reduce inflammatory damage** to brain DHA, boswellia, quercetin, ginger, turmeric
- 4) **Antioxidants:** alpha-lipoic acid
- 5) **PRM:** resolution of inflammation
- 6) **Choline:** critical for brain development

"Enhancement of learning and memory by elevating brain magnesium". *Neuron*, Jan. 28, 2010:165-77

"Presynaptic NMDA receptors biology of the NMDA receptor". Boca Raton, FL. CRC Press, 2009

"The effects of nutrients on brain function". *Nat Rev Neuroscience*, 2008 Jul:568-78

Concussion Nutrition Protocol (cont'd)

Feed the concussion

- 7) **Vitamin D:** neuroprotective
- 8) **Zinc:** enzyme for CNS
- 9) **Sulforaphane:** inhibits MMP-9 and activates NRF2
- 10) **Magnesium:** great weapon against delayed brain injury
- 11) **Acetyl-L-carnitine:** energizes the brain
- 12) **Glutathione:** body's #1 intracellular antioxidant
- 13) **Coffee fruit extract:** increases BDNF
- 14) **Taurine:** protection against excitotoxicity

"Enhancement of learning and memory by elevating brain magnesium". *Neuron*, Jan. 28, 2010:165-77

"Presynaptic NMDA receptors biology of the NMDA receptor". Boca Raton, FL. CRC Press, 2009

"The effects of nutrients on brain function". *Nat Rev Neuroscience*, 2008 Jul:568-78

Suit up



Study up

Speak up

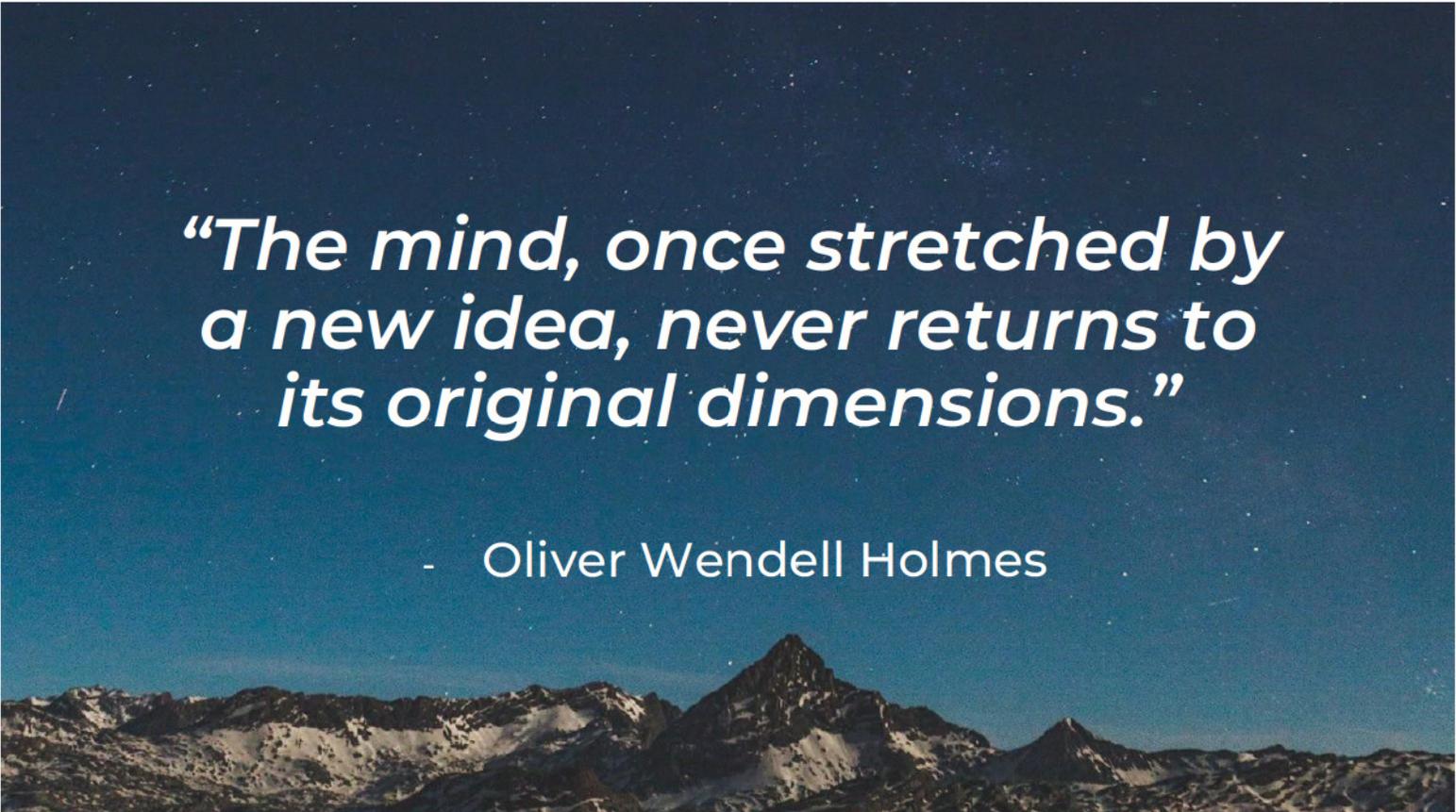


<http://www.biausa.org/brain-injury-children.htm>

Elite 8 protocols

- 1) 1, 2, 3 laser:
 - Point & shoot
 - Passive movement
 - Active movement
- 2) 5-step treatment for joint surgery/replacement
- 3) Master gut
- 4) Master brain
- 5) Vagus nerve
- 6) Phrenic nerve
- 7) Nerve/nerve mobilization
- 8) Stacking lasers:
 - Mitochondrial complex
 - M/S injuries

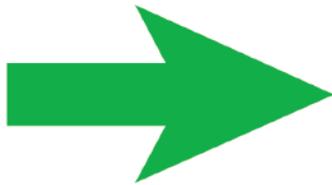
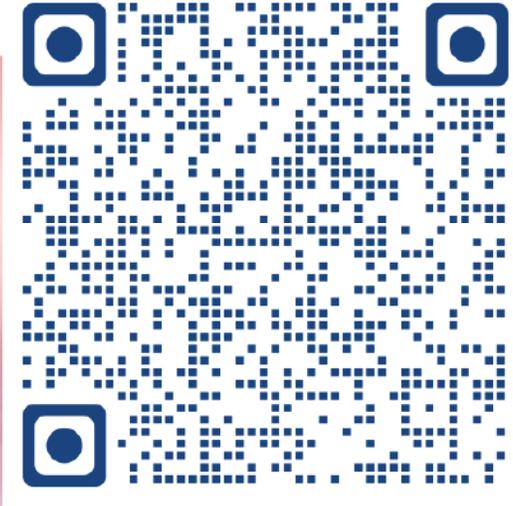
Bonus:
GLP-1 stimulation



*“The mind, once stretched by
a new idea, never returns to
its original dimensions.”*

- Oliver Wendell Holmes

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