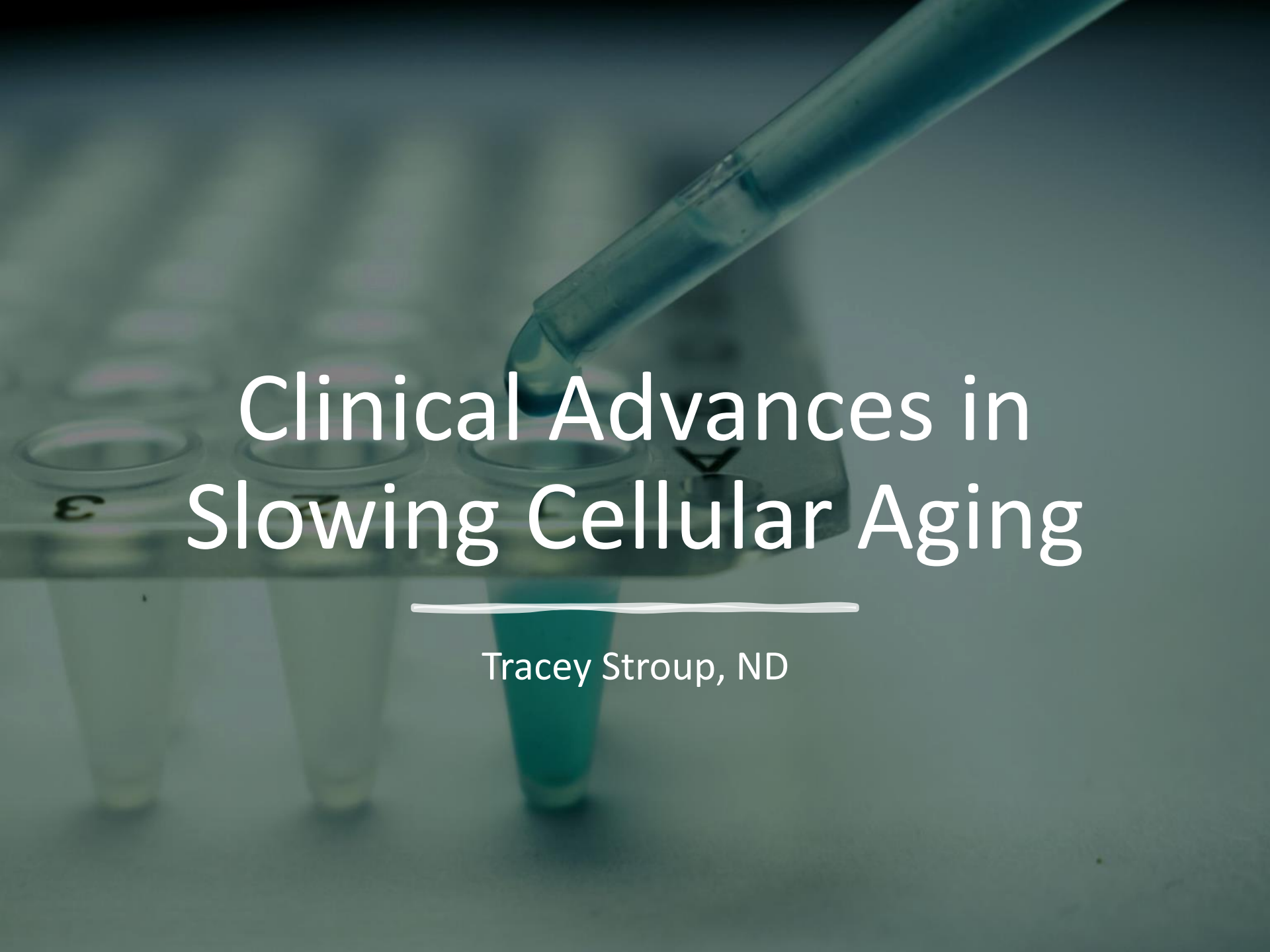


Clinical Advances in Slowing Cellular Aging

Tracey Stroup, ND

About me

- Chief Health & Growth Officer – GetHealthy.store
- B.S. Degree in Exercise and Sports Science; Minor in Nutrition Science
- Naturopathic Doctor
- Certified Natural Health Professional
- Level 2 Digestive Specialist with Food Enzyme Institute
- 25 years experience in the health and wellness field
- Mom, wife and Jesus lover!

Prevention is the best medicine

The Three Aging Levers

Regeneration capacity (stem cells, microtubule repair, mitochondrial biogenesis)

System communication (hormones, nervous system, microtubules, Gut)

Inflammation control (balanced immune system)

What Speeds Up Aging

- Chronic inflammation
- Poor metabolic health
- Mitochondrial damage
- Hormone decline
- Gut dysbiosis
- Poor detoxification
- Emotional/spiritual neglect

What Slows Aging

Nutrition: Whole, anti-inflammatory, nutrient-dense

Hydration: Clean, Electrolyte-balanced water

Movement: Strength, mobility, aerobic

Sleep: Deep, restorative

Stress mastery: Resilience, faith, community

Detox: Low toxicity or regular enhancement of detox pathways

Proper supplementation along with lifestyle

Targeted Therapies: Peptide, Complementary Modalities

Date Driven Decisions: Proper testing and Analysis

Regeneration Capacity

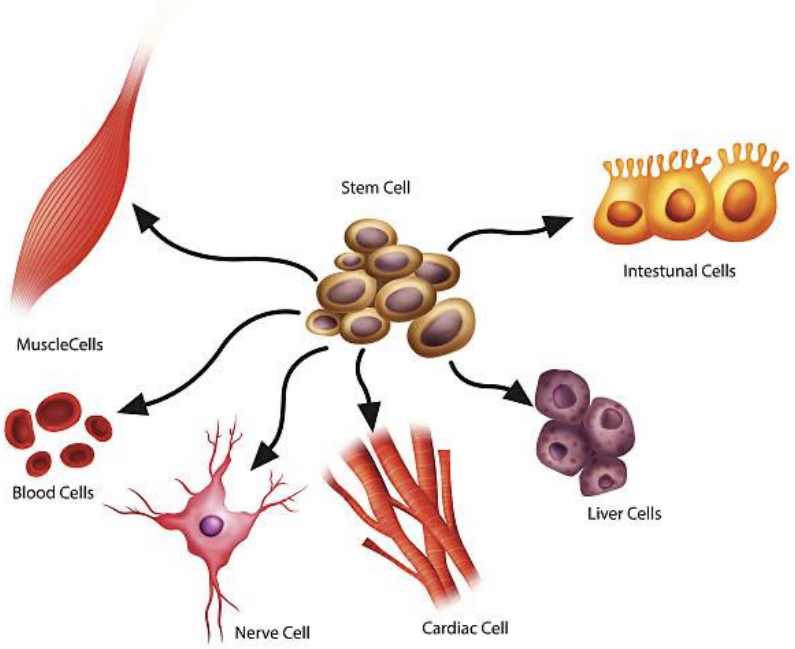
STEM CELL

MICROTUBULE REPAIR

MITOCHONDRIAL BIOGENESIS

Regeneration Capacity – STEM CELLS

- Stem cells are **undifferentiated "parent" cells** that can self-renew and become specialized cells. They are essentially the body's repair and regeneration system.
- Two defining abilities:
  - **Self-Renewal** – They can replicate themselves indefinitely under the right conditions.
  - **Potency** – They can differentiate into various cell types (muscle, nerve, blood, etc.).



Regeneration Capacity – TYPES OF STEM CELLS

Embryonic Stem Cells (ESCs): Derived from early-stage embryos.

- **Potency:** Pluripotent.
- **Use:** Research, regenerative medicine.
- **Considerations:** Ethical and legal debates, tumor risk.

Adult (Somatic) Stem Cells: Found in adult tissues like bone marrow, adipose tissue, skin, and brain.

- **Potency:** Multipotent or unipotent.
- **Key Examples:**
  - **Hematopoietic Stem Cells (HSCs)** – make blood and immune cells.
  - **Mesenchymal Stem Cells (MSCs)** – can become bone, cartilage, fat, and have strong anti-inflammatory signaling.

Perinatal Stem Cells: Found in umbilical cord blood, placenta, amniotic fluid.

- **Potency:** Multipotent, sometimes broader.
- **Use:** Banked for regenerative therapy; lower immunogenic risk.

Induced Pluripotent Stem Cells (iPSCs): Adult cells reprogrammed to act like embryonic stem cells.

- **Potency:** Pluripotent.
- **Use:** Research, patient-specific regenerative medicine.
- **Note:** Avoids embryo use but has tumor risk if not controlled.

Regeneration Capacity – STEM CELLS

Classification of stem cells is based on origin and potency

Administration of stem cells includes: intravenous infusion (like a blood transfusion), direct injection into the affected area, or through a surgical procedure to implant them into bone marrow.

Regeneration Capacity – STEM CELLS

Can we increase our stem cell potential through nutrition and supplementation?

Nutrients to Enhance Stem Cell Activation

Nutrient	Function in Stem Cells	Food Sources	NF Solution
Omega-3 fatty acids (EPA/DHA)	Reduce marrow inflammation; shift mesenchymal stem cells (MSCs) away from becoming fat cells	Wild salmon, sardines, anchovies, algae oil	Omega D3
Polyphenols (Resveratrol, Quercetin)	Activate SIRT1/AMPK, enhance HSC self-renewal, reduce senescence	Blueberries, red grapes, onions, apples, green tea	InFlam EstroCleanse
Curcumin	Downregulates NF-κB, protecting stem cells from inflammatory damage	Turmeric (with black pepper for absorption)	Turmeric Plus
Green Tea Catechins (EGCG)	Promote stem cell viability, antioxidant defense	Green tea, matcha	Pro Oranges EstroCleanse
Sulforaphane	Activates Nrf2 pathway, increases antioxidant enzymes in marrow	Broccoli sprouts, cruciferous vegetables	
Vitamin D3 + K2	Vitamin D regulates HSC niches; K2 supports bone integrity and marrow microarchitecture	Pastured eggs, fatty fish, natto, supplementation	Super K2 Plus
Vitamin C	Essential for HSC self-renewal and collagen matrix of bone marrow	Citrus, kiwi, bell peppers, camu camu	Buffered C Plus
B-Complex (especially B12, Folate, B6)	DNA methylation, red blood cell production, and HSC proliferation	Leafy greens, grass-fed liver, eggs	Super B Complete Woman's Complete Men's Complete
Zinc	Supports immune cell production from HSCs	Oysters, beef, pumpkin seeds	Super Zinc
Magnesium	Regulates stem cell differentiation and bone marrow metabolism	Nuts, seeds, leafy greens, magnesium glycinate supplement	Mag Glycinate Mag Complete

REGEN CAPACITY – Microtubule Repair

How Microtubules Relate to Stem Cells

- Microtubules are part of the **intracellular "track" system** that stem cells use to move organelles and vesicles *within themselves*, but stem cells also need to **physically travel through the bloodstream and across vessel walls** to reach injury sites.
- **Good blood flow + low oxidative stress + healthy membranes** = microtubules can reorganize properly for migration.
- These compounds mostly **optimize the "road" and "environment"** so microtubule dynamics can work effectively.

REGEN CAPACITY – Microtubule Repair

How Microtubules Relate to Stem Cells

- Stem cells rely on **dynamic microtubule polymerization/depolymerization** to **migrate** through blood vessels, cross the endothelium, and reach damaged tissues.
- Microtubules are made from **α- and β-tubulin proteins** which require specific amino acids and cofactors to be produced and function properly.

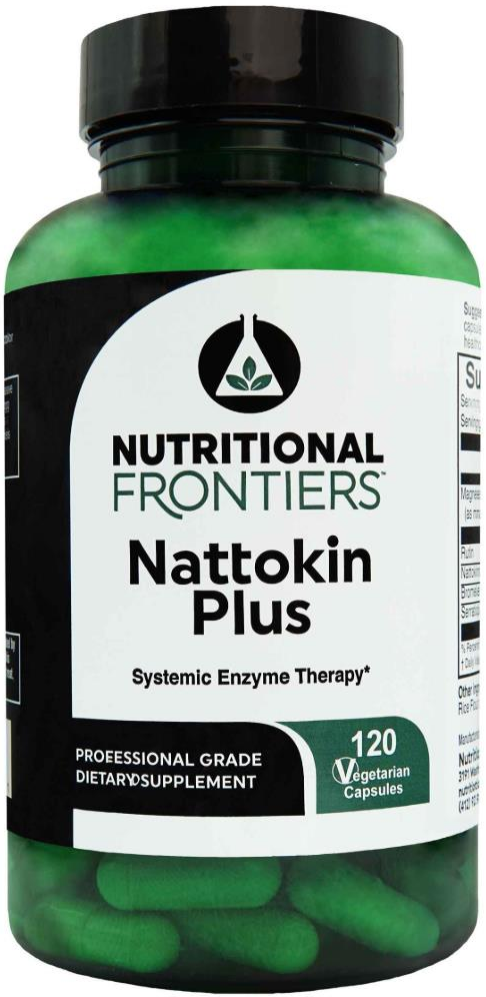
Nutrients to Repair the Microtubules

Nattokinase

- **Primary role:** Enzyme that breaks down fibrin and reduces microclots.
- **Microtubule relevance:** By improving microcirculation and reducing fibrin blockages, stem cells can travel more freely to target tissues. Better perfusion = better oxygen and nutrient delivery to both stem cells and their destination.
- **Extra benefit:** Enhances blood viscosity, making endothelial “homing” easier.

Nutritional Frontiers Formula

Magnesium (as magnesium citrate) 140 mg
Rutin 200 mg
Nattokinase (3,000 FU) 30 mg
Bromelain (80 GDU) 28.3 mg
Serratiopeptidase (18,000 SU) 7.5 mg



Nutrients to Repair the Microtubules

Nitric Oxide (via Beetroot, L-Citrulline, etc.)

- **Primary role:** Vasodilation via cGMP pathway.
- **Microtubule relevance:** Stem cell migration through vessel walls (extravasation) is easier when endothelial cells are relaxed and perfusion is high. Nitric oxide also influences cytoskeletal reorganization *inside* stem cells via Rho GTPase pathways.
- **Extra benefit:** NO enhances endothelial microtubule stability, supporting the adhesion/migration interface.

Nutrients to Repair the Microtubules

L-Arginine

- **Primary role:** NO precursor; also supports collagen synthesis for bone marrow matrix health.
- **Microtubule relevance:** Feeds the nitric oxide pathway for vascular dilation, improving stem cell delivery routes. Also supports actin–microtubule interactions during cell migration.

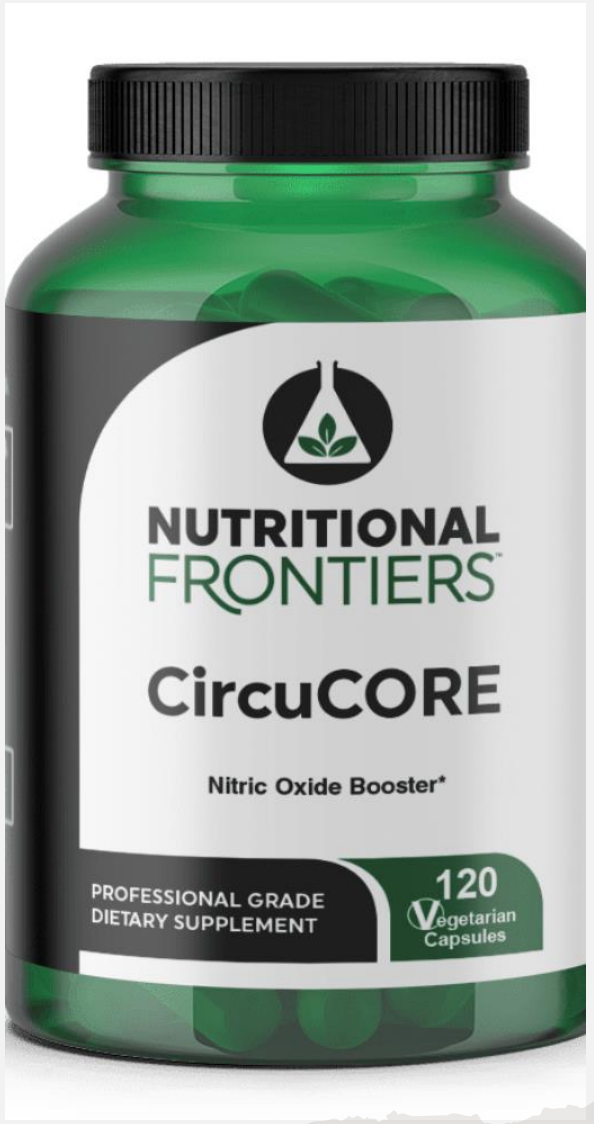
Nutrients to Repair the Microtubules

Grape Seed Extract (OPCs)

- **Primary role:** Strong antioxidant and collagen stabilizer.
- **Microtubule relevance:** Protects microtubule proteins and associated membrane structures from oxidative damage. OPCs also inhibit MMP overactivity, preserving the extracellular matrix that microtubules anchor to during migration.
- **Extra benefit:** Enhances microvascular elasticity, supporting perfusion to marrow and target tissues.

Nutritional Frontiers Formula

Vitamin C (as Ascorbic Acid) 100 mg
Vitamin B12 (Methylcobalamin) 100 mcg
Folate 100 mcg
(as Quatrefolic® (equivalent to 200 mcg of [6S]-5-Methyltetrahydrofolic acid, glucosamine salt))
Beet Root Powder 200 mg
Activin® Grape Seed Extract 120 mg
(vitis vinifera) 100:1
Hawthorne 100 mg
L-Citrulline 100 mg
L-Arginine 100 mg



Nutrients to Repair the Microtubules

N-Acetyl Cysteine (NAC)

- **Primary role:** Precursor to glutathione, major intracellular antioxidant.
- **Microtubule relevance:** Prevents oxidative stress–induced tubulin oxidation and dysfunction. In damaged cells, NAC can restore normal polymerization cycles, which are essential for stem cell division and migration.
- **Extra benefit:** Protects the “stem cell niche” in bone marrow from ROS damage.

Nutritional Frontiers Formula

Nutrients to Repair the Microtubules

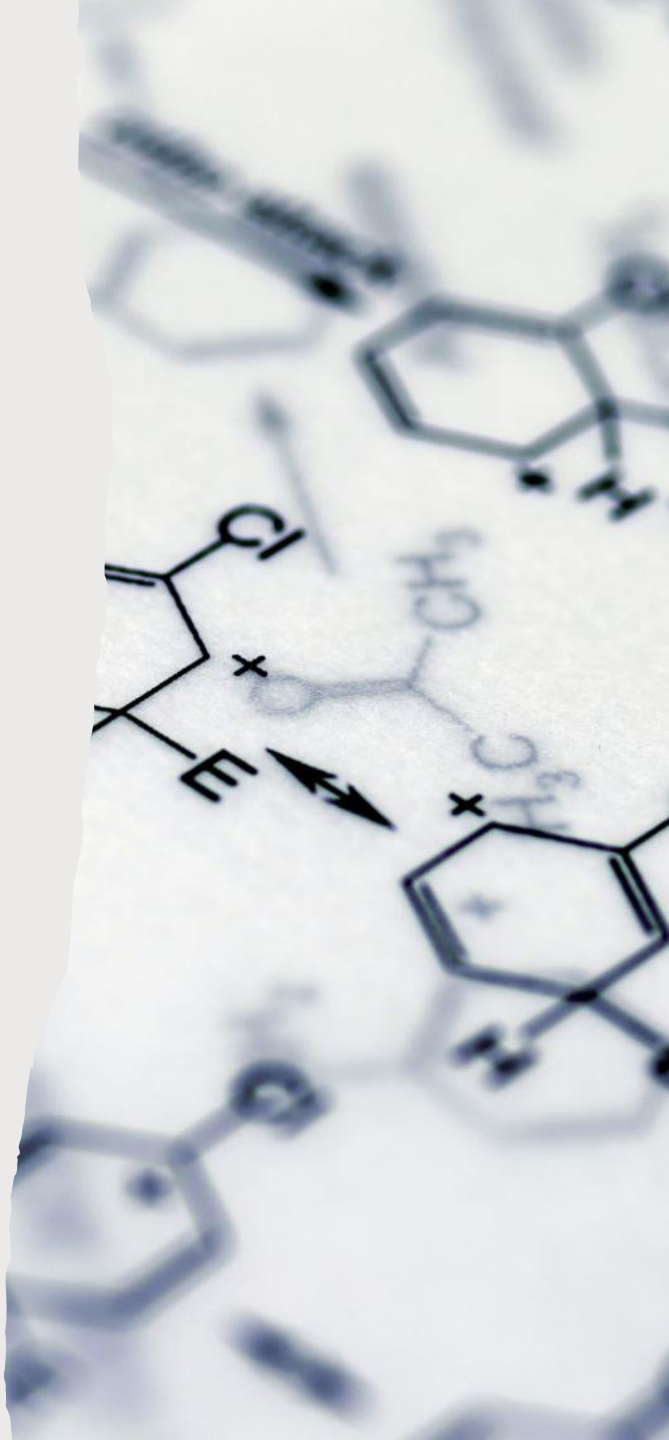
When combined, these compounds:

- **Improve blood flow** (NO, L-arginine, nattokinase)
- **Protect intracellular tracks from oxidative damage** (NAC, grape seed extract)
- **Preserve endothelial health** so stem cells can cross the vessel wall effectively (NO, OPCs)
- **Maintain extracellular matrix integrity** where microtubules attach during migration (OPCs, L-arginine)

Mitochondrial Biogenesis

Mitochondrial biogenesis is the process by which cells **create new mitochondria** the “power plants” that make ATP.

- It’s regulated by **cellular energy sensors** like **AMPK** and **SIRT1**, and master transcriptional coactivators like **PGC-1α** (Peroxisome proliferator-activated receptor gamma coactivator 1-alpha).
- It involves **replication of mitochondrial DNA (mtDNA)**, synthesis of mitochondrial proteins, and assembly of functional organelles.
- **Why it matters:** More (and healthier) mitochondria mean **better cellular energy**, less oxidative stress per mitochondrion, and more capacity for regeneration.



Mitochondrial Biogenesis

Aging = Mitochondrial Decline

- With age, mitochondria accumulate DNA damage, produce more reactive oxygen species (ROS), and become less efficient.
- Dysfunctional mitochondria trigger **cellular senescence**, chronic inflammation, and loss of tissue repair capacity.

Mitochondrial Biogenesis

Biogenesis Slows Aging

- Boosting mitochondrial biogenesis **restores energy supply**, improves redox balance, and can **reverse some aspects of cellular aging**.
- In animal models, activating biogenesis pathways increases lifespan (e.g., via caloric restriction, exercise, NAD+ precursors).

Mitochondrial Biogenesis

Organ Systems Most Affected

- Brain (neurons have massive energy demand)
- Heart (cardiomyocytes are mitochondria-rich)
- Muscles (skeletal & smooth)
- Immune system (especially in memory T cells and stem cells)

Mitochondrial Biogenesis

Damaged mitochondria in stem cells:

- Lower their ability to engraft and survive.
- Increase ROS → DNA damage.
- Accelerate **stem cell exhaustion** (loss of regenerative pool).

Mitochondrial signals (via metabolites like NAD+, acetyl-CoA) also **control epigenetic programs** that decide whether a stem cell remains a stem cell or commits to a specific lineage.

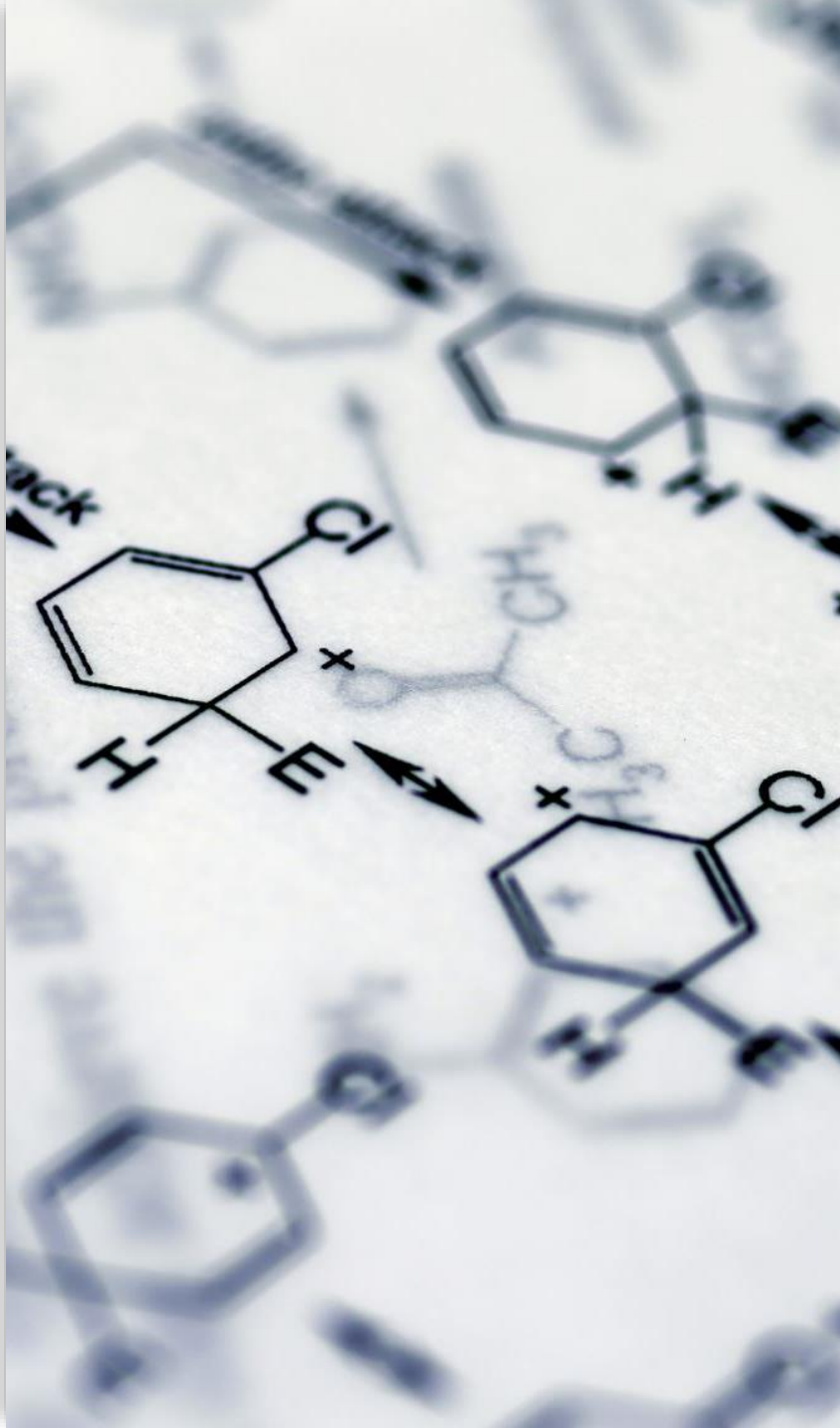
Bottom line: Supporting mitochondrial biogenesis in stem cells helps maintain a **larger, more functional stem cell pool** and improves **homing, survival, and repair** after mobilization or injection.

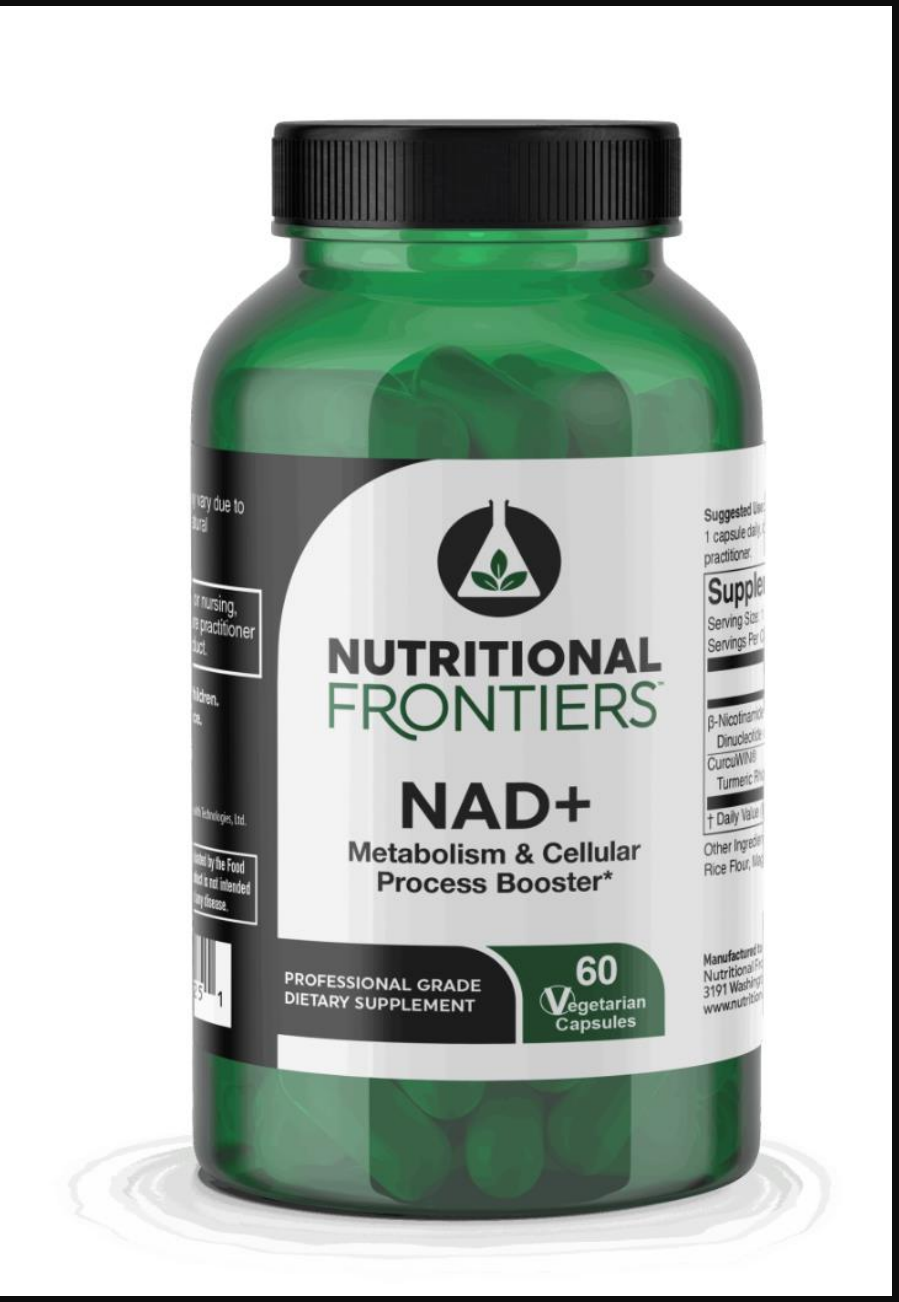
Nutreints for Mitochondrial Biogenesis

- NAD+
- DMG
- CoQ10
- Electrolytes & BCAAs
- Creatine
- Resverotol, EGCG, Curcumin etc

NAD+

- A **coenzyme** found in all living cells.
- Exists mainly in two forms:
  - **NAD^+** – oxidized form
  - **NADH** – reduced form
- Core functions:
  - **Electron transport** in mitochondria (ATP production via oxidative phosphorylation)
  - **Substrate for enzymes** like sirtuins and PARPs (regulating DNA repair, mitochondrial biogenesis, and stress resistance)



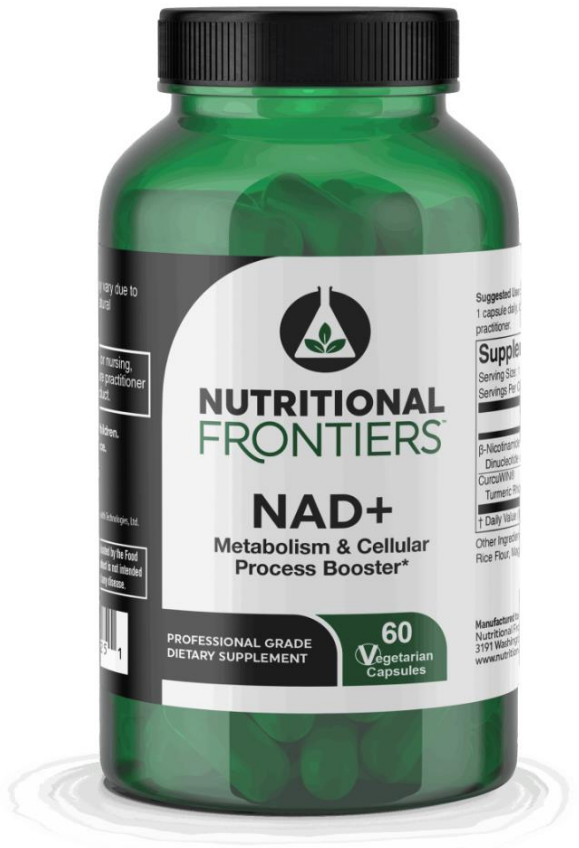


NAD+

- Higher NAD^+ → more active sirtuins → more **new mitochondria** and better maintenance of existing ones
- Declines **30–50% by middle age**.

NAD+

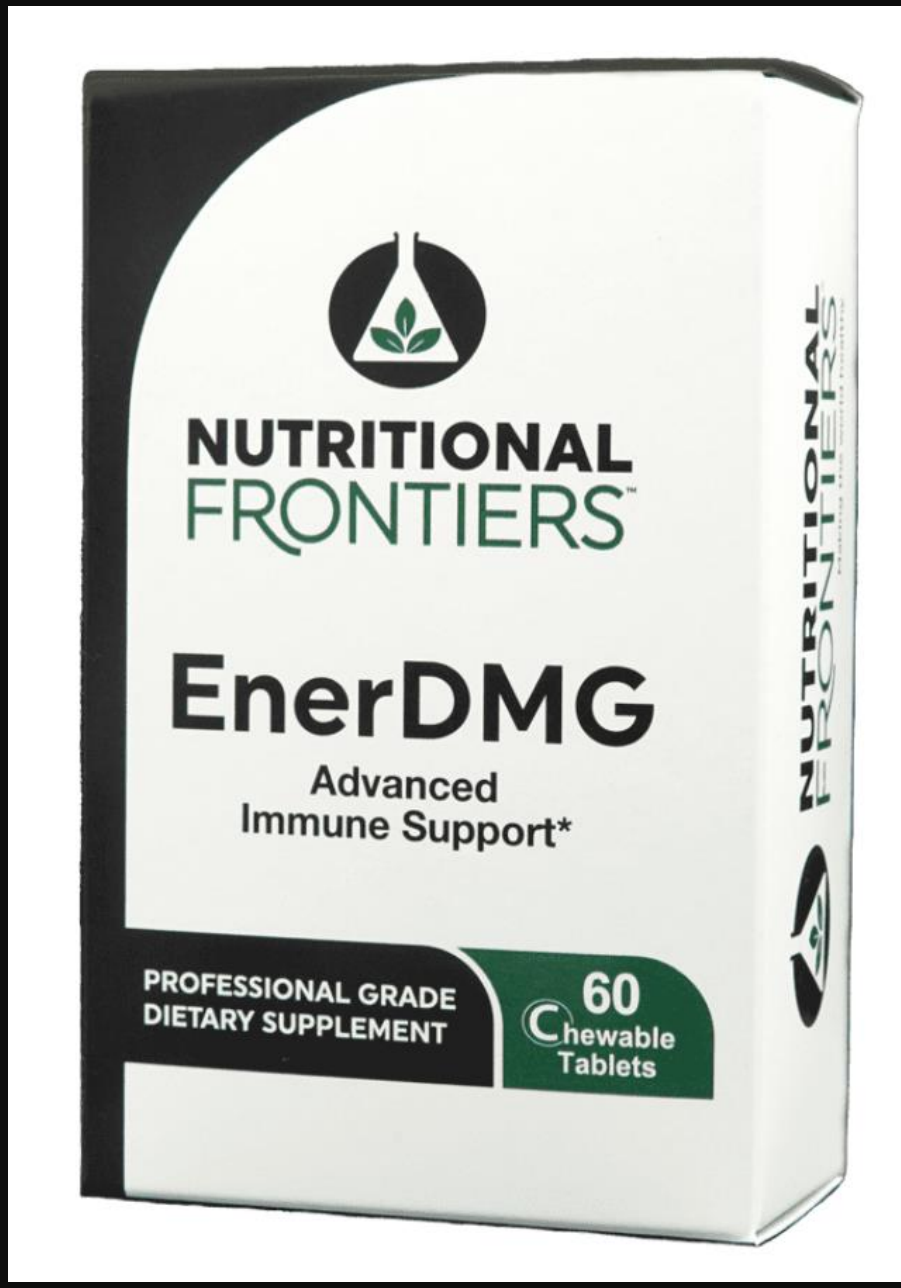
- Stem cells, especially when activated to repair, need **a surge in mitochondrial biogenesis**.
- NAD^+: Protects stem cells from oxidative stress and DNA damage.
  - Helps maintain a healthy “resting” state until they are needed.
  - Improves **stem cell differentiation potential**.



DMG

DMG (Dimethylglycine)

- Supports methylation reactions for **mtDNA replication** and repair.
- Improves oxygen utilization, especially in high-demand states.
- May reduce lactic acid buildup, enhancing exercise capacity (biogenesis stimulus).



CoQ10

- Fat-soluble quinone naturally made in the body (biosynthesis declines after ~age 30).
- Exists in two forms:
- **Ubiquinone** – oxidized form, accepts electrons.
- **Ubiquinol** – reduced form, donates electrons (more bioavailable in older adults or those with absorption issues).

CoQ10

- Central role in the **electron transport chain (ETC)** — shuttles electrons between complexes I/II and III in mitochondria.
- Generates ATP via oxidative phosphorylation.
- Potent lipid-soluble antioxidant — protects mitochondrial and cell membranes from lipid peroxidation.
- Regenerates vitamin E and vitamin C in membranes.

Power Fuel

Mitochondria depend on ion gradients to make ATP

Magnesium Cofactor for ATP synthase and all ATP-utilizing enzymes.

- Required for GTP binding to tubulin (links microtubules to mitochondrial transport).

Potassium Maintains mitochondrial membrane potential for ATP production.

- Supports proper mitochondrial volume regulation.

Sodium –Essential for sodium–calcium exchange, indirectly influencing mitochondrial calcium signaling.

Calcium Regulates mitochondrial dehydrogenase enzymes that drive the Krebs cycle.

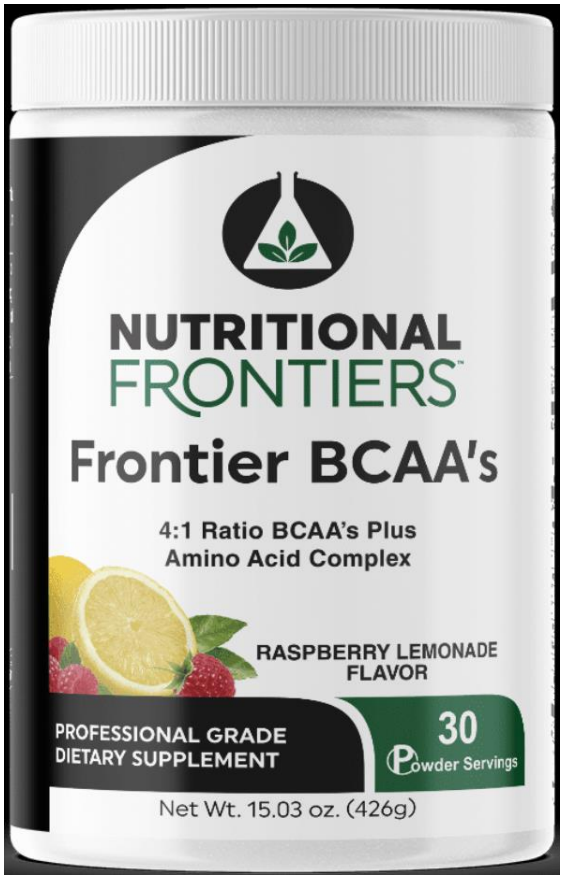
- Controlled bursts of Ca^{2+} entering mitochondria can stimulate ATP production.

Phosphorus Direct component of ATP (adenosine triphosphate).

- Also supports phospholipid synthesis for mitochondrial membranes.

BCAAs

- **L-Carnitine (esp. Acetyl-L-Carnitine)** Transports fatty acids into mitochondria for β-oxidation (fuel for ATP). Also has neuroprotective effects and may upregulate PGC-1α.
- **Taurine** Stabilizes mitochondrial membranes. Acts as an antioxidant inside mitochondria, protecting respiratory chain proteins.
- **Branched-Chain Amino Acids (Leucine, Isoleucine, Valine)** Stimulate mTOR for protein synthesis but also serve as mitochondrial fuel in catabolic states.
- **Glycine** Required for heme synthesis (cytochrome proteins in the electron transport chain).Also anti-inflammatory, protecting mitochondrial proteins from oxidative stress.
- **Glutamine** Serves as an anaplerotic substrate for the Krebs cycle.So it replenishes molecules removed in the cycle. Supports gut lining and immune cells, which indirectly preserve mitochondrial function.



Creatine

Stores high-energy phosphate groups (phosphocreatine) to quickly regenerate ATP.

Reduces mitochondrial strain during high-energy demand, giving mitochondria space to adapt and grow.

Phosphocreatine shuttle helps signal the need for **more mitochondria** in muscle and neurons.

PQQ

- A **redox cofactor** found in soil bacteria, plants, and small amounts in food (kiwi, green tea, parsley, fermented soy).
- Originally studied for its vitamin-like activity in bacteria — humans can't make it, but it seems to act as an essential nutrient for mitochondrial function.
- **Mechanisms**
  - **Direct activator of mitochondrial biogenesis** via **PGC-1α** and **CREB** pathways.
  - Increases the number of mitochondria in cells (shown in muscle, nerve, and immune cells).

Pro Purples

Folate 200 mcg
(as L-5-Methyltetrahydrofolate Calcium (Biofolate®))
Sodium 20 mg
Proprietary Fruit Blend 4 g
Cranberry Fruit Powder, Blueberry Fruit Powder, Raspberry Fruit Powder, Black Currant Fruit Powder, European Elder Fruit Powder, Black Cherry Fruit Powder, Plum Fruit Powder, Dried Plum Fruit Powder, Vitis labrusca Fruit Powder, Bilberry Fruit Powder, Fig Fruit Powder.
Proprietary Vegetable Blend 1 g
Beet Root Powder, Carrot Root Powder, Asparagus Shoot Powder, Solanum melongena Fruit Powder, Cabbage Leaf Powder.
Proprietary Circulation Matrix Blend 660 mg
Cabbage Palm Fruit Powder, Camu Camu Fruit Powder, Mangosteen Fruit Extract, Lycium Fruit Powder, Pomegranate Fruit Extract, Activin® Grape Seed Extract.
Proprietary Brain Blend 91.01 mg
N-N-Dimethyl Glycine, L-Carnosine, Trans-Resveratrol (from Japanese Knotweed Root Extract), Alpha Glycerylphosphorylcholine, NutriPQQ™ Pyrroloquinoline Quinone Disodium Salt, Huperzine-A (from Toothed Clubmoss Leaf and Stem Extract).

Making Regeneration a Lifestyle

Multi + Omega D3 with breakfast or lunch – Full B vitamins, cofactors, minerals and probiotics

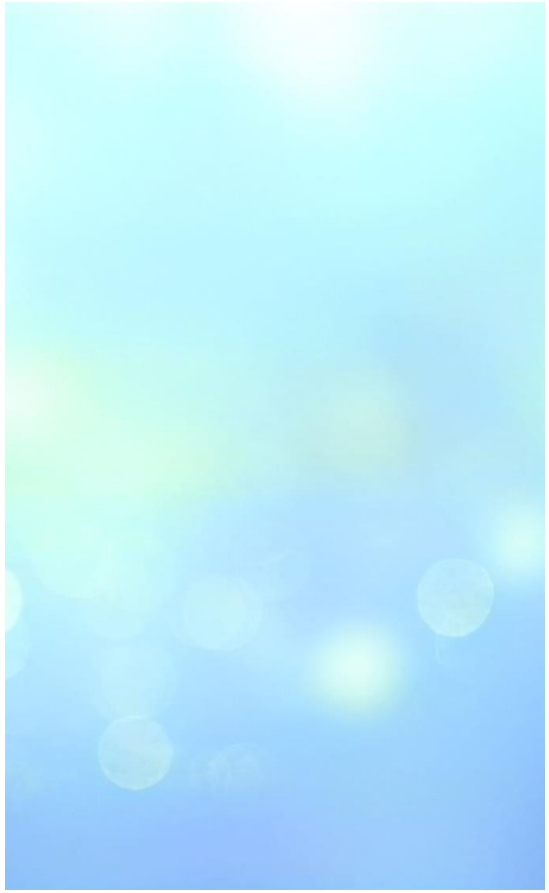
Choose a color – Orange or Purples mid day

Pre or Post workout – PowerFuel , BCAAs and Creatine

Complementary supplements: NAD+, DMG, EnerCo10, Turmeric Plus

Aches or pains: Inflam

Bedtime – Mag Complete or Mag Glycinate or both



SYSTEM COMMUNICATION

Hormones

Nervous system

Gut

Hormones

- Hormones are **master regulators** of cellular repair, mitochondrial function, stem cell activity, and inflammation — all of which drive aging.
- As hormone production naturally declines with age (endocrine senescence), the body loses **metabolic flexibility**, **tissue regeneration speed**, and **neurological resilience**. The art of anti-aging medicine is knowing **which hormones to optimize, how, and when**, without pushing physiology into imbalance.

Hormones

- **Men:** Gradual decline in testosterone (~1% per year after age 30), reduced DHEA, growth hormone, and melatonin.
- **Women:** More abrupt changes with menopause — loss of estrogen, progesterone, DHEA, testosterone, and growth hormone.
- Both sexes experience **increased insulin resistance**, **altered cortisol rhythms**, and **lower thyroid output** over time.

Anti- Aging Hormones

Sex Hormones

- **Testosterone** (Men & Women)
  - Supports muscle mass, bone density, mood, libido, mitochondrial function.
  - Low levels → sarcopenia, insulin resistance, cognitive decline.
  - In longevity: maintaining mid-to-upper physiological range improves strength, repair, and quality of life.
- **Estrogen** (esp. Estradiol, E2)
  - Neuroprotective, antioxidant, maintains skin elasticity, supports vascular health.
  - Loss accelerates bone loss, cognitive decline, cardiovascular disease risk.
  - Timing is critical: early post-menopause replacement shows most benefit ("window of opportunity" theory).
- **Progesterone**
  - Balances estrogen, supports sleep, mood, GABA receptor function, and neuroprotection.
  - Declines contribute to anxiety, insomnia, and increased cancer risk from unopposed estrogen.

Anti-Aging Hormones

Adrenal & Steroid Precursors

DHEA

- Precursor to testosterone and estrogen; has independent immune-modulating and anti-inflammatory effects.
- Declines linked to frailty, poor stress tolerance, reduced healing.

Pregnenolone

- “Mother hormone” for steroidogenesis; supports cognition and myelination.
- May decline with chronic stress and aging.

Anti-Aging Hormones

Metabolic Hormones

Insulin

- High insulin accelerates aging via inflammation, oxidative stress, and mTOR overactivation.
- Insulin sensitivity is a hallmark of healthy longevity (linked to centenarians).

Thyroid Hormones (T3, T4)

- Regulate basal metabolic rate, mitochondrial biogenesis, and repair signaling.
- Suboptimal levels lead to fatigue, weight gain, cognitive slowing.

Anti-Aging Hormones

Growth & Repair Hormones

Growth Hormone (GH) / IGF-1

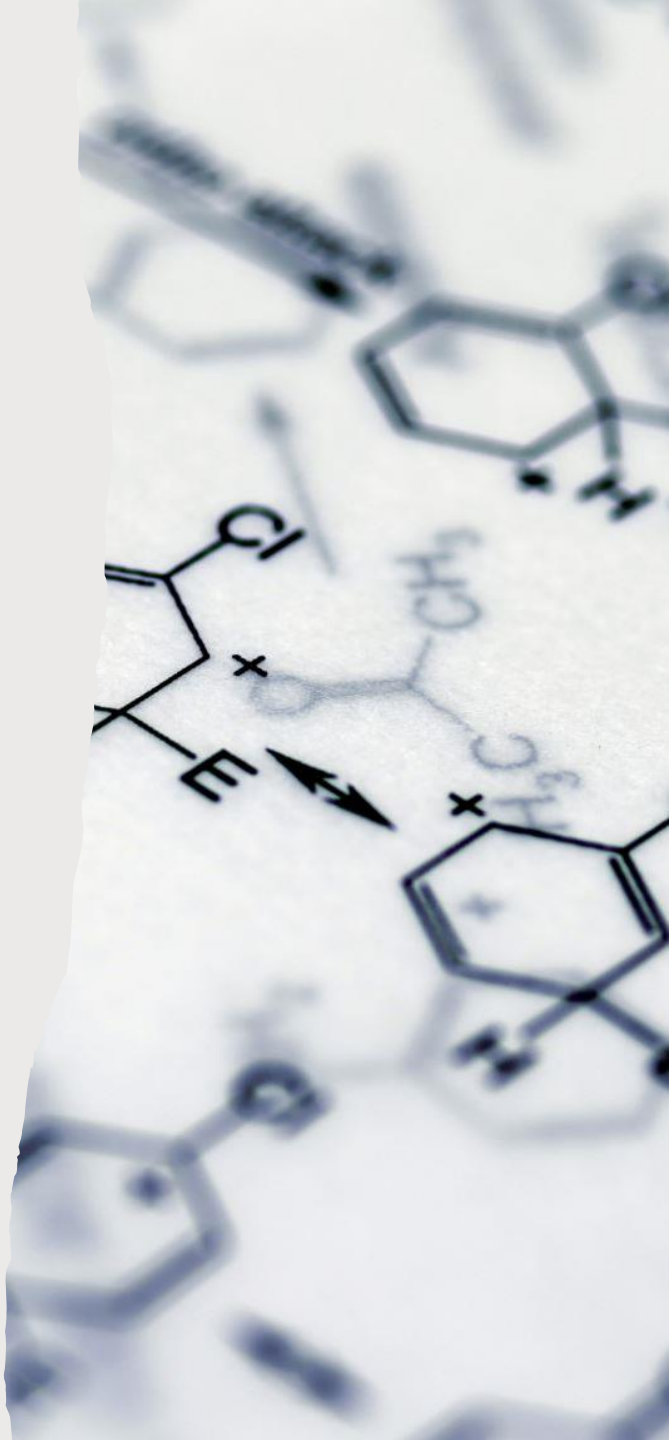
- Promote protein synthesis, tissue repair, stem cell activation.
- Decline with age → slower recovery, decreased muscle and bone density.
- Pulsatile GH release is important — constant high IGF-1 may increase cancer risk.

Melatonin

- Beyond sleep — it's a mitochondrial antioxidant, regulates circadian rhythm, supports DNA repair.
- Declines with age → sleep disruption, higher oxidative stress.

Hormones, Stem Cells & Mitochondria

- **Testosterone & Estrogen**: Enhance mitochondrial efficiency and ATP production in muscle and brain cells.
- **GH & IGF-1**: Stimulate stem cell proliferation and tissue regeneration.
- **Thyroid hormones**: Directly increase mitochondrial biogenesis (via PGC-1α).
- **Melatonin & DHEA**: Protect stem cells from oxidative damage and senescence.
- Without these hormonal signals, stem cells stay quiescent or function poorly, slowing repair and accelerating tissue aging.



NF Hormonal Solutions

Estrocleanse – Supports healthy estrogen metabolism and detoxification pathways.

DHEA Cream – Promotes energy, mood, and hormone balance through DHEA replenishment.

Progesterone Cream – Helps restore progesterone levels for hormonal harmony and symptom relief.

PSA – Supports prostate health, urinary function, and normal inflammation response in men.

Virility – Enhances male sexual performance, stamina, and vitality.

Fertility – Nourishes reproductive health and supports natural conception processes.

UTR – Promotes urinary tract health and microbial balance.

Menoflash – Helps ease hot flashes, night sweats, and other menopausal discomforts.

Testo180 – Boosts testosterone levels to support muscle, mood, and energy.

Pregnanolone – Calms the mind, supports cognitive function, and balances stress responses.

Melatonin – Regulates healthy sleep cycles and supports nighttime cellular repair.

Adrenal Glandular & AdrenaMax – Strengthens stress resilience and supports adrenal hormone production.

ThyroComplete – Enhances thyroid function to optimize metabolism, energy, and weight balance.

Nervous System and Aging

The **nervous system–stress–anti-aging connection** is one of the most important but often overlooked pillars of longevity.
If you think of anti-aging as the preservation of **cellular function, repair capacity, and systemic balance**, the nervous system is the *master conductor* — and chronic stress is the static that throws the entire symphony off rhythm.

Nervous System and Aging

The nervous system controls:

- **Autonomic regulation** (heart rate, blood pressure, digestion, detox, repair)
- **Neuroendocrine function** (via the hypothalamus–pituitary–adrenal/gonadal/thyroid axes)
- **Cognitive performance** (memory, processing speed, learning)
- **Neuromuscular control** (coordination, reaction time, balance)

Nervous System & Aging

With aging:

- Neurons shrink, myelin thins, and neurotransmitter production declines.
- Mitochondrial function in neurons diminishes, slowing signaling speed.
- Reduced plasticity = less ability to adapt to stress, injury, or environmental changes.

Nervous System And Chronic Stress

Chronic stress — psychological or physiological — keeps the **HPA axis** (hypothalamus–pituitary–adrenal) in overdrive.
This leads to:

- **Cortisol dysregulation** → catabolism, bone loss, muscle wasting, insulin resistance.
- **Sympathetic dominance** ("fight or flight" stuck on) → reduced parasympathetic repair, poor digestion, impaired immunity.
- **Neuroinflammation** → accelerated brain aging, higher Alzheimer's risk.
- **Shortened telomeres** → faster cellular aging.
- **Stem cell exhaustion** → poor tissue regeneration.

Nervous System And Chronic Stress

Parasympathetic Activation = Longevity Signal

- The parasympathetic nervous system (PNS) is the **rest–digest–repair** branch.
  When active:
- Heart rate variability (HRV) improves — a strong longevity biomarker.
- Growth and repair hormones (GH, DHEA, melatonin) increase.
- Immune surveillance improves while inflammation decreases.
- Stem cells leave quiescence more readily to repair tissue.
- **High HRV + Low chronic cortisol** = “youthful” nervous system pattern.

NF Solutions

B Vitamins – Support neurotransmitter production and adrenal function to improve stress resilience and slow neurological aging.

Calm Day – Promotes relaxation and balanced cortisol levels for optimal nervous system recovery.

AdrenaMax – Enhances adrenal hormone output and energy for better stress adaptation and longevity.

Adrenal Glandular – Provides targeted adrenal tissue support to restore healthy cortisol rhythms.

Melatonin – Regulates circadian rhythm, improves sleep quality, and protects the brain from oxidative aging.

Sleep Time – Combines calming nutrients to promote restorative sleep and nervous system repair.

Magnesium – Calms nerve excitability, reduces stress response, and supports cellular anti-aging processes.

CBD – Modulates the endocannabinoid system to lower stress, balance cortisol, and protect against neuroinflammation.

The Gut Longevity Axis

The gut influences aging through:

- **Nutrient bioavailability** → fuels mitochondrial biogenesis and stem cell activity.
- **Immune regulation** → prevents chronic low-grade inflammation ("inflammaging").
- **Microbiome signaling** → gut bacteria produce metabolites that directly influence mitochondrial and stem cell function.
- **Barrier integrity** → prevents endotoxemia that damages mitochondria and depletes stem cells.

The Gut Longevity Axis

Dysbiosis & Aging

- **Dysbiosis** = imbalance in gut microbial populations (too many harmful species, too few beneficial).
  Aging and stress tend to reduce **microbial diversity**, while increasing **pro-inflammatory species**.
- **Effects on anti-aging pathways:**
- Increased **LPS (lipopolysaccharides)** → systemic inflammation → mitochondrial oxidative damage.
- Reduced **SCFA (short-chain fatty acids)** like butyrate → less mitochondrial fuel for colonocytes and fewer anti-inflammatory signals.
- Altered bile acid metabolism → impaired fat-soluble vitamin absorption (A, D, E, K) → reduced mitochondrial protection and stem cell health.

The Gut Longevity Axis

Assimilation & Absorption

- Even if diet is nutrient-rich, the gut must **break down (assimilate)** and **transport (absorb)** nutrients effectively.
- **Enzyme deficiencies** → poor breakdown of proteins, carbs, fats → less amino acids for mitochondrial proteins and stem cell membranes.
- **Low stomach acid (hypochlorhydria)** → reduced absorption of B12, iron, magnesium, zinc → all critical for mitochondrial enzyme systems.
- **Bile insufficiency** → reduced absorption of omega-3s and fat-soluble vitamins that protect mitochondrial membranes.

The Gut Longevity Axis

Gut Barrier Integrity

- The **intestinal lining** is a selective filter:
- **Healthy:** Allows micronutrients in, keeps pathogens and toxins out.
- **Leaky gut:** Tight junctions loosen, allowing large antigens and LPS into circulation → chronic immune activation → “inflammaging”.
- **Impact on mitochondria & stem cells:**
- Chronic inflammation **shortens telomeres**, increases ROS production, and pushes stem cells toward senescence.
- Damaged gut barrier = constant immune activation = less energy available for repair and regeneration.

NF Solutions For Gut Longevity Axis

Probiotics: Frontier Biotics, SuperBiotics, SBC

Enzymes: CybZyme, Betazyme, Systemic enzymes

Gut Integrity: GI Complete, IgG

Binder: Remove Complete

NF Solutions For Gut Longevity Axis

Probiotics – Replenish beneficial gut bacteria that produce short-chain fatty acids (like butyrate) to activate AMPK/SIRT1, lower inflammation, protect stem cell niches, and stimulate mitochondrial biogenesis.

Digestive Enzymes – Break down macronutrients into bioavailable forms, ensuring delivery of amino acids, fatty acids, and micronutrients required for mitochondrial proteins, coenzymes, and stem cell membrane synthesis.

Systemic Enzymes – Reduce circulating fibrin and inflammatory complexes, improving microcirculation and oxygen delivery to mitochondria and stem cells while lowering oxidative stress that accelerates aging.

NF Solutions For Gut Longevity Axis

GI Complete – Provides gut-repair nutrients (e.g., L-glutamine, aloe, zinc carnosine) that restore barrier integrity, reduce endotoxin leakage, and preserve low-inflammation conditions ideal for stem cell survival and mitochondrial efficiency.

IgG – Binds and neutralizes gut-derived antigens and pathogens, lowering immune activation and chronic ROS production, thereby protecting mitochondrial DNA and prolonging stem cell function.

Remove Complete Binder – Sequesters and eliminates toxins and heavy metals that impair mitochondrial enzymes and damage stem cell DNA, reducing cellular senescence triggers.

The Gut Longevity Axis

Gut health is a central driver of anti-aging because the gastrointestinal system governs nutrient absorption, immune regulation, inflammation control, and metabolic signaling — all of which directly impact mitochondrial efficiency and stem cell vitality.

A balanced microbiome produces metabolites like **short-chain fatty acids** that activate AMPK and SIRT1, stimulating mitochondrial biogenesis and protecting stem cells from oxidative damage.
An intact gut barrier prevents **endotoxemia** and chronic inflammation ("inflammaging"), preserving telomere length and cellular repair capacity.

Efficient digestion and absorption ensure a steady supply of amino acids, minerals, and cofactors for mitochondrial enzymes and stem cell membranes, while dysbiosis or leaky gut accelerate tissue degeneration, energy decline, and immune aging.

In short: A healthy gut fuels the biochemical pathways that slow cellular aging, optimize mitochondrial performance, and maintain a youthful, regenerative stem cell pool.

Inflammation Control

A balanced Immune System

Inflammation and Aging

Inflammation sits at the **center of the aging process** — it can either protect and repair or accelerate degeneration, depending on its balance.
In the anti-aging world, we often talk about **inflammaging** — the persistent, low-grade, systemic inflammation that rises with age and underlies nearly every chronic disease.

Inflammation and Aging

Acute inflammation → short-term, targeted, and essential for repair.

Chronic inflammation → constant, low-level immune activation that:

- Increases oxidative stress.
- Damages mitochondrial membranes and mtDNA.
- Drives stem cell exhaustion and senescence.
- Shortens telomeres, accelerating biological age.

This smoldering inflammation is often fueled by **gut permeability, metabolic dysfunction, unresolved infections, deficiencies and environmental toxins**.

Inflammation and Mitochondrial Biogenesis

Mitochondria are both **sources and targets** of inflammatory signals:

Damaged mitochondria leak ROS and mitochondrial DNA into the cytosol, activating inflammatory pathways (e.g., NF-κB, NLRP3 inflammasome).

Chronic inflammation **suppresses PGC-1α**, the master switch for mitochondrial biogenesis.

Anti-inflammatory signals (from omega-3s, polyphenols, fasting, exercise) restore PGC-1α and SIRT1 activity, enabling **new, healthy mitochondria** to be built.

Key point: Low inflammation = mitochondria spend energy on repair and ATP production; high inflammation = mitochondria are stuck in defense mode.

Inflammation and Stem Cell Health

Stem cells live in **protective niches** that must remain low in oxidative and inflammatory stress for the cells to stay quiescent and viable.

Chronic inflammation disrupts these niches, forcing stem cells into overactivity → premature exhaustion and reduced regenerative pool.

Inflammatory cytokines can impair stem cell differentiation and even reprogram them toward a more senescent, non-repair state.

Conversely, reducing inflammation:

Preserves stem cell numbers.

Improves their ability to engraft and repair.

Extends the functional regenerative capacity across the lifespan.

NF Solutions for Inflammation

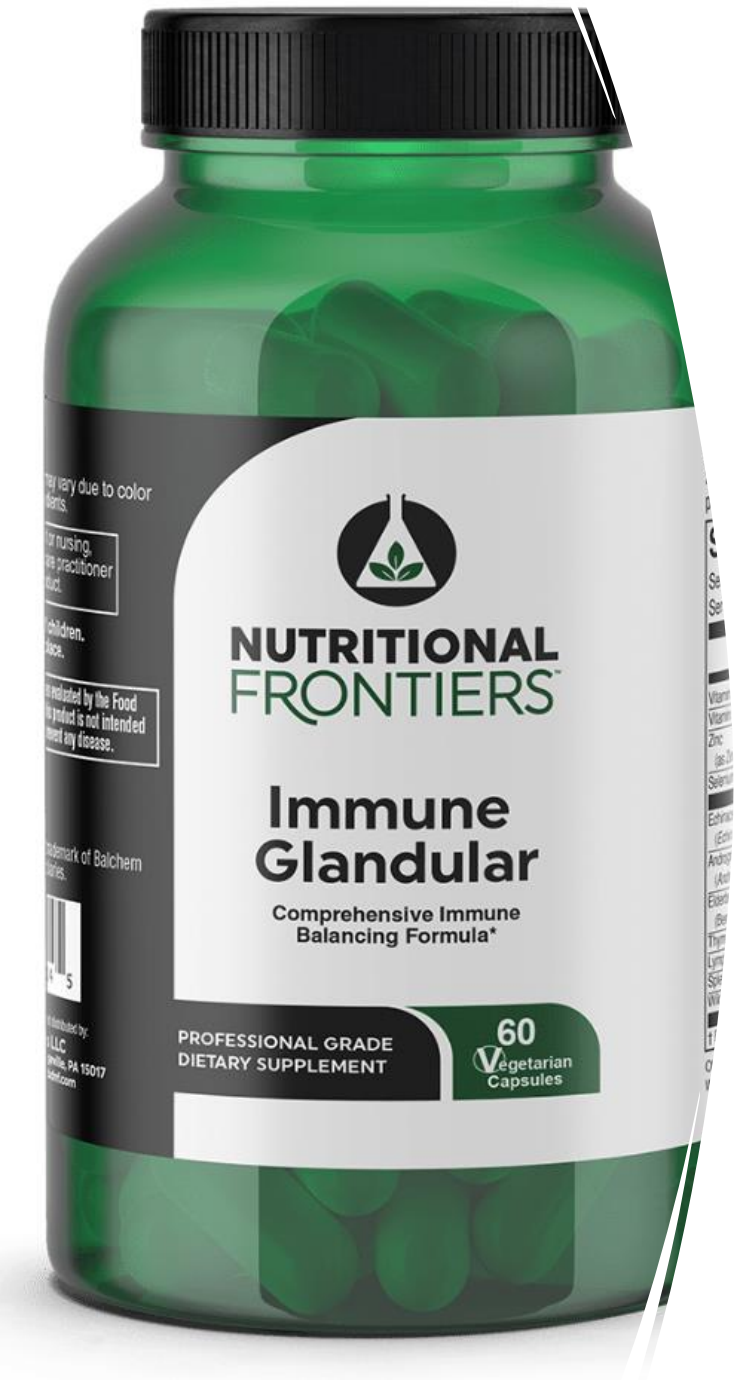
InFlam

- **What it is:** Ablend of anti-inflammatory botanicals (curcumin, boswellia, ginger, berberine, resveratrol, etc.).
- **Inflammation Role:** Downregulates NF-κB and COX-2 pathways, reducing chronic pro-inflammatory cytokines.
- **Longevity Impact:** Less inflammatory signaling allows **PGC-1α and SIRT1** to stay active → more mitochondrial biogenesis and less oxidative damage to stem cell niches.

NF Solutions for Inflammation

SPM (Specialized Pro-Resolving Mediators)

- **What it is:** Lipid mediators derived from omega-3 fatty acids (EPA/DHA) that *actively resolve* inflammation.
- **Inflammation Role:** Instead of just blocking inflammation, SPMs complete the healing cycle by signaling macrophages to clear debris and stop the immune response.
- **Longevity Impact:** Restores tissue homeostasis, protects mitochondria from chronic oxidative stress, and maintains a low-inflammatory environment for stem cells to thrive.



NF Solutions for Inflammation

Immune Glandular

- **What it is:** Concentrated extracts of immune-related tissues (e.g., thymus, spleen) to support immune modulation.
- **Inflammation Role:** Can help normalize immune responses, reducing overactivation while supporting adequate defense.
- **Immune Role:** The thymus, a specialized organ in the immune system, plays a crucial role in the development and maturation of T cells, which are essential for cell-mediated immunity. Initially large in babies, the thymus shrinks and becomes less active after puberty, eventually being replaced by fatty tissue.
- **Longevity Impact:** Balanced immunity means less “background” inflammation, which protects mitochondrial energy production and preserves stem cell regenerative capacity.

NF Solutions for Inflammation

Immune Boost/ImmunoMax

- **What it is:** Broad-spectrum immune support formulas including Galactoarabinan, with a purified D-fraction from Maitake Mushroom and Beta 1,3 Glucans, quercetin, D, C, Zinc, DMG and NAC
- **Inflammation Role:** Helps the immune system respond appropriately to threats, reducing the chronic activation that drives inflammaging.
- **Longevity Impact:** Keeps immune activity efficient, lowering ROS production and inflammatory cytokines that damage mitochondria and stem cells.

NF Solutions for Inflammation

Vitamin C

- Potent water-soluble antioxidant.
- **Inflammation Role:** Neutralizes ROS generated during inflammatory responses, reduces oxidative signaling to NF-κB.
- **Longevity Impact:** Protects mitochondrial and nuclear DNA, supports collagen synthesis for tissue repair, and helps maintain stem cell viability.

Zinc

- Essential mineral for over 300 enzymatic reactions, including antioxidant enzymes like superoxide dismutase (SOD).
- **Inflammation Role:** Modulates immune cell activity, reduces production of inflammatory cytokines, supports mucosal barrier function.
- **Longevity Impact:** Critical for DNA repair, telomere maintenance, and stem cell proliferation; low zinc accelerates immune aging.

Vitamin D

- **Pro-** Hormone-like vitamin regulating over 1,000 genes.
- **Inflammation Role:** Downregulates pro-inflammatory Th17 cells, increases anti-inflammatory T-reg cells, and supports antimicrobial defense without overactivation.
- **Longevity Impact:** Preserves mitochondrial health by lowering chronic inflammation, supports musculoskeletal integrity, and protects stem cell niches through immune modulation.

Test! Don’t Guess

Bloodwork

- Baseline panel (CBC with diff, CMP, Lipid, Total Serum Iron)
- Inflammation markers
- Hormones

Specialty Testing

- GI Map
- Dutch
- OAT Test
- Neurotransmitter Test
- Genetic Testing

Additional Longevity Interventions That Move the Needle

Intermittent Fasting (IF)- How it works:

- Activates **AMPK** and **SIRT1** → stimulates **PGC-1α** for mitochondrial biogenesis.
- Triggers **autophagy** to clear damaged proteins and organelles.
- Improves insulin sensitivity → reduces inflammatory signaling and protects stem cell niches.

Red Light Therapy - How it works:

- Wavelengths (630–850 nm) stimulate **cytochrome c oxidase** in the mitochondria → boosts ATP production.
- Improves cellular signaling for repair, collagen synthesis, and neuroprotection.
- Reduces inflammatory cytokines and oxidative stress.

Additional Longevity Interventions That Move the Needle

Infrared Sauna - How it works:

- Mild hyperthermia induces **heat shock proteins** (HSPs) that protect proteins and mitochondria.
- Increases circulation and lymphatic flow → supports detoxification and nutrient delivery to stem cells.
- Lowers systemic inflammation markers (CRP, IL-6).

Peptides - How they work:

- **BPC-157, TB-500** → enhance angiogenesis, tissue repair, and stem cell activation.
- **MOTS-c, SS-31** → improve mitochondrial function, reduce ROS, and enhance resilience to metabolic stress.
- **Epitalon** → telomere protection and circadian regulation.

Additional Longevity Interventions That Move the Needle

Hyperbaric Oxygen Therapy (HBOT) - How it works:

- Increases plasma oxygen → enhances tissue oxygenation for repair.
- Stimulates **HIF-1α** and growth factors that trigger **stem cell mobilization**.
- Reduces inflammation and promotes mitochondrial regeneration.

Exercise (Resistance + HIIT) - How it works:

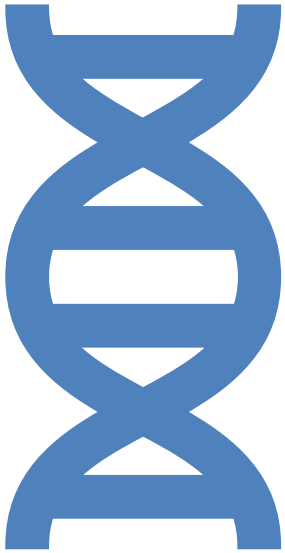
- Mechanical stress activates satellite cells (muscle stem cells).
- HIIT triggers AMPK and mitochondrial biogenesis.
- Improves systemic communication via hormone signaling and neural plasticity.

Summary

Longevity is built on the synergy between **regeneration capacity**, **efficient system communication**, and **inflammation control**.

When stem cells remain viable and active, when the body's signaling networks (nervous, hormonal, immune, and mitochondrial) communicate seamlessly, and when inflammation is kept in balance, the body can repair, adapt, and thrive well into advanced age.

By protecting and fueling these systems through nutrition, targeted supplementation, lifestyle, and regenerative therapies we can slow biological aging, extend health span, and maintain optimal function across all tissues.



Thank you!

"Longevity isn’t luck — it’s the sum of the choices you make every day."

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