



High-Dose NAD+

Choices for Your Health and Longevity

NAD+

or nicotinamide adenine dinucleotide, is fundamental to life. A coenzyme, it's essential to every cell in the body, and numerous metabolic processes.

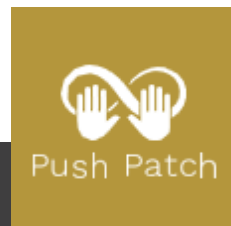
NAD+

helps to recharge our cells. It regulates energy metabolism, cellular repair, and immune system function. Conversely, **NAD+** depletion is associated with metabolic disease, neurodegeneration, and aging.

Unfortunately, levels of **NAD+** plummet with the passing years. By middle age, studies show **NAD+** levels drop to half of what they were in our youth. Declining **NAD+** can lead to fatigue, brain fog, aches, and soreness.

The good news is you can effectively boost your **NAD+** levels – and you have choices for how to do it. Two of the best and most effective high-dose **NAD+** treatment options include:

- **NAD+ Intravenous (IV) therapy**
- **Iontophoresis NAD+ transdermal patches**



Brought to you by Push Patch
Unlock the Future of NAD+ Supplementation

The Essential Role of **NAD⁺**

NAD⁺ is an essential coenzyme and cofactor, active both within and outside the cells, and vital to numerous metabolic processes.

- **NAD⁺** acts as a coenzyme in helping to control the redox balance, which is essential to the health and functioning of cells. A balanced redox state supports energy production, protects against oxidative damage, regulates cell signaling, preserves genomic integrity, and modulates cellular metabolism.
- **NAD⁺** is a cofactor for sirtuin enzymes, which play crucial roles in regulating metabolism, DNA repair, and longevity.



Why do **NAD⁺** levels decline with age?

With aging comes a decline in the body's synthesis of **NAD⁺**. **NAD⁺** may also be consumed more quickly. Because **NAD⁺** is involved with cellular metabolism and DNA repair, as cells age or undergo stress or damage, demand for **NAD⁺** may rise to support these repair mechanisms.

Benefits of Boosting **NAD⁺**



Boosted Metabolism & Energy

NAD⁺ is vital for cellular metabolism, converting nutrients to energy. Higher levels boost metabolic rate, combating fatigue and maintaining vigor. Its role is essential for robust metabolic function.



Improved Performance & Recovery

NAD⁺ fuels cellular energy, vital for performance and recovery. It enhances mitochondrial function, boosting aerobic and anaerobic capacity, reducing stress, and aiding cellular repair for quicker recovery to peak performance.



Improved Longevity

Evidence links **NAD⁺** levels to longevity. It's vital for sirtuins, proteins tied to healthspan and lifespan. Together, they promote DNA repair and stress resistance, potentially extending lifespan.



Better DNA Repair

DNA integrity is vital for cell function and survival. **NAD⁺** fuels DNA repair enzymes, crucial for fixing damage. This supports genomic stability, preventing mutations and age-related diseases like cancer.



Reduced Inflammation

Chronic inflammation underlies numerous diseases. **NAD⁺** regulates inflammation via sirtuins and anti-inflammatory molecules, promoting a balanced response, combatting chronic inflammation and supporting overall health.



Better Mental Clarity

NAD⁺ fuels the brain, enhancing brain health by boosting energy production and neuroprotection. It fortifies cells against stress, protects neurons from damage, and promotes clarity, focus, and mental agility.



How is **NAD⁺** Synthesized?

NAD⁺ is synthesized and delivered to cells primarily from **NAD⁺** precursor molecules:

- **Nicotinamide mononucleotide (NMN)**
- **Nicotinamide riboside (NR)**
- **Nicotinic acid (NA)**
- **De novo from tryptophan**

Nicotinamide mononucleotide (NMN): The salvage pathway is one of the major routes of supplying **NAD⁺** to cells. In it, the **NAD⁺** precursor NMN is taken up through the cell membrane. Once inside, a series of enzymatic reactions converts NMN into **NAD⁺**. The **NAD⁺** generated from NMN can then be used as a coenzyme in other cellular processes, including glycolysis, the Krebs/citric acid cycle, oxidative phosphorylation, and DNA repair.

Nicotinamide riboside (NR): NR is another **NAD⁺** precursor. NR is phosphorylated to NMN by the NR kinases, NRK1 and NRK2, and is then ready for conversion into **NAD⁺**.

Nicotinic acid (NA): The Preiss-Handler pathway is another important **NAD⁺** synthesis route. In this pathway, nicotinic acid phosphoribosyltransferase (NAPRT) converts NA to nicotinic acid mononucleotide (NAMN). NAMN then forms nicotinic acid adenine dinucleotide (NAAD⁺). The last step is another reaction which converts NAAD⁺ to **NAD⁺**.

De novo synthesis from tryptophan: Tryptophan is an amino acid found in many foods. Tryptophan can be converted into N-formylkynurenine, which then goes through several additional conversions to eventually become quinolinic acid (QA). QA is synthesized to become NAMN, which can then be transformed into **NAD⁺**.

Key Terms

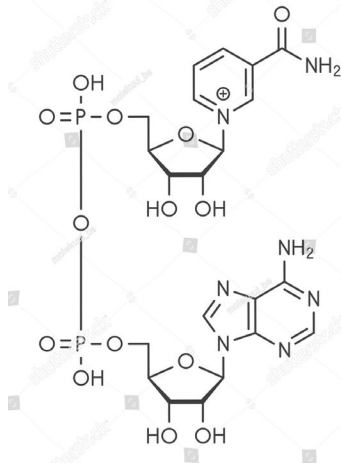
Precursor molecules = Molecules that can be converted into **NAD⁺**

Salvage pathway = A biochemical process in which cells recycle **NAD⁺** precursor molecules into **NAD⁺**

Preiss-Handler pathway = Another key metabolic pathway for synthesizing **NAD⁺**

NAD+ Inside and Outside of Cells: Different But Interconnected Roles

NAD+ increases the energy production of cells and upregulates cellular repair. Research has shown that that **NAD+** has a range of benefits in the body – increasing insulin sensitivity, reversing mitochondrial dysfunction, and even enhancing longevity.



Pools of **NAD+** can be found both inside cells (**intracellular**) and outside cells (**extracellular**). The vital role of **NAD+** cells is well-documented in scientific literature. The precise role of extracellular **NAD+** is still being uncovered. But studies have shown there's a dynamic interplay between pools of **NAD+** found inside and outside cells, and they serve different but interconnected roles.

Intracellular NAD+

Inside cells, **NAD+** is crucial for energy production (ATP synthesis) and DNA repair. Intracellular **NAD+** is also coenzyme for other enzymes. Among the most important are sirtuins, a type of protein that regulate cellular aging and resistance to stress, and poly (ADP-ribose) polymerases (PARPs), a family of proteins involved in DNA repair and genomic stability.

Intracellular **NAD+** is essential for redox reactions, acting as an electron “shuttle bus” and facilitating metabolic processes such as glycolysis, the Krebs/ citric acid cycle, and oxidative phosphorylation to produce cellular energy.

Levels of intracellular **NAD+** are regulated to maintain

cellular homeostasis. But factors such as **NAD+** availability, degradation and consumption can cause levels to fluctuate.

Extracellular NAD+

Outside cells, **NAD+** is a signaling molecule that's important for communications between cells. Research shows it's involved with the activation and function of immune cells, inflammatory responses and tissue repair.

Outside cells, **NAD+** activates purinergic receptors in the P2Y and P2X receptor families. These receptors are involved in neurotransmission, immune response, and vascular regulation. Activation of these receptors by extracellular **NAD+** may also regulate intracellular calcium signaling. Calcium signaling is involved with a host of cellular functions: neurotransmission, muscle contraction, gene expression, inhibition of inflammation, and immune regulation.

Extracellular **NAD+** can also be converted to adenosine, which is important for neurotransmission, cardiovascular function, inflammation, and immune response. Adenosine can also be taken up by the cells and metabolized to ATP for cellular energy.

Key Terms

Intracellular NAD+ = NAD+ found inside cells, essential for cellular metabolism

Extracellular NAD+ = NAD+ outside cells, involved with signaling between cells

Redox reactions = Molecules that shuttle electrons from one reaction to another

Glycolysis = Break down of glucose in preparation for energy extraction

Krebs cycle = AKA the citric acid cycle, the Krebs cycle is a series of reactions in the mitochondria to release energy stored from nutrients

Oxidative phosphorylation = Metabolic pathway in which cells use enzymes to oxidize nutrients, releasing their energy. Through oxidative phosphorylation, cells produce their basic energy source, ATP (adenosine triphosphate)

Mechanism and Impact: How **NAD⁺** Supports Health and Longevity

The therapeutic benefits of boosting **NAD⁺** through methods such as iontophoresis patches or IV therapy involve several mechanisms:

Cellular Energy Metabolism

Mechanism: Extracellular **NAD⁺** is metabolized to adenosine, which enters cells and is transformed into ATP, the primary cellular energy molecule.

Impact: Enhanced cellular energy metabolism, improved energy efficiency in cells, support for a multitude of metabolic activities and overall health.

Immune System Modulation

Mechanism: **NAD⁺** interacts with the purinergic receptors P2X and P2Y, which are involved in intracellular signaling.

Impact: Modulates immune cell activation and inflammatory responses. Dysregulation of immune responses is associated with autoimmune disease. Preclinical research suggests **NAD⁺** may protect from autoimmune diseases, such as multiple sclerosis.

Neuroprotection and Cognitive Health

Mechanism: **NAD⁺** affects neuronal cells' metabolic functions and repair mechanisms.

Impact: May protect against neuronal damage, improve cognitive function, and protect from neurodegenerative conditions like Alzheimer's disease.

Skin Health and Anti-Aging

Mechanism: **NAD⁺** is involved in DNA repair and cellular maintenance, crucial for skin cell rejuvenation.

Impact: May aid in reducing signs of aging, enhancing skin repair, and maintaining skin health.

Longevity and Metabolic Health

Mechanism: By enhancing cellular metabolism and energy, **NAD⁺** may slow aging processes.

Impact: Potential in slowing age-related metabolic decline and healthier aging.



3 Ways to Boost Levels of **NAD+**

Supplementation with NAD+ Intermediates: Oral supplements containing NMN and other intermediates may boost **NAD+** pools.

Intravenous NAD+: Provides a direct infusion into the bloodstream, bypassing gastrointestinal absorption and liver metabolism.

Iontophoresis Patches: Iontophoresis technology uses painless electrical current to propel **NAD+** through the skin. Offering non-invasive, convenient, high bioavailability and direct-to-bloodstream delivery. Paired with the peptide glutathione, the patches are a powerful combo.

Why Push Patch?

PushPatch provides a high dose of **NAD+** and the peptide glutathione. It's designed for various therapeutic purposes, including boosting metabolism, improving mental clarity and enhancing longevity.

Iontophoresis patches offer a direct route into the bloodstream, bypassing digestive system breakdown. By using the slow release and direct-to-bloodstream advantage of iontophoresis patches, clinicians can maximize the time under dose, **NAD+** pharmacokinetics and bioavailability.

The Added Power of **Glutathione**

Glutathione, an antioxidant, neutralizes free radicals that damage cells. As with **NAD+**, age and certain health conditions cause glutathione levels to drop. Symptoms of low glutathione include fatigue, brain fog, sleep problems, and infections.

NAD+ is essential for regenerating glutathione. Research has found glutathione may help prevent neurological disorders, liver disease, certain heart conditions, autoimmune disorders, and respiratory diseases.



How Does Iontophoresis Work?

With iontophoresis, minimal electrical charges transmit medication through the skin – absolutely pain-free. Think of it as a magnet-like operation, but with two electrodes instead of magnets.

Applying the patch initiates a charge, which gently propels the medication through your skin and directly into your bloodstream. Iontophoresis patches evade the gastrointestinal system, where stomach acid breaks down medications and starts the process of eliminating them. By going directly into the bloodstream, **NAD+** reaches the cells where it will be used.

Advantages of Iontophoresis Patch

High bioavailability – Direct delivery into the bloodstream, bypassing the digestive system, which can reduce efficacy.

Painless and discreet – Comfortable patch can be easily worn under clothes. Requires no needles. Ideal for those uncomfortable with injections.

Consistent dosing – Provides a steady and controlled release of **NAD+** over 12 hours, leading to more predictable outcomes. Each patch is pre-loaded with an optimal dose of **NAD+**.

Convenient – Simple and easy to use, no need for injections, pills, or frequent clinic or doctor's visits.

Low risk of side effects – Minimizes the gastrointestinal upset that often accompanies oral supplementation, and has a low risk of adverse effects, supported by clinical data.

Cost-effective – Comparative cost analysis with other treatment methods.

Patient compliance – High adherence rates due to convenience and effectiveness.

Scientific validation – Backed by numerous peer-reviewed studies on **NAD+**'s role in cellular metabolism and across various conditions.

Tech-Forward – Iontophoresis integrates technology into health.

How to Measure NAD+ Levels?

Monitoring **NAD+** levels can be done by methods that measure its concentration and redox state within cells.

One method is a cycling assay that can measure **NAD+** or NADH levels using a plate reader equipped with fluorescence measurement capabilities. This method relies on commercially available materials and biological samples. Specifically, it involves the enzymatic conversion of **NAD+** to a form that can be detected fluorescently. This method is advantageous due to its simplicity and the ability to handle multiple samples simultaneously.

Another advanced method utilizes stable isotope-method requires mass spectrometry and compares endogenous **NAD+** with exogenous isotope-labeled **NAD+** for quantification. It's a more precise method, especially suitable for detailed studies where exact quantification is crucial.

Treatment with **NAD+** increases adenosine levels. However, the measurement of **NAD+** doesn't directly measure free adenosine levels. **NAD+** assays are specific to the **NAD+** molecule and its redox state. To measure adenosine, different targeted assays are needed.





NAD+ Use Cases

Pain management

Accelerates the healing process, reduces inflammation and swelling, and potentially reduces nerve pain.

Inflammatory conditions

Reduces chronic inflammation in skin conditions, diabetes, and neurodegenerative disorders, and activates cellular repair mechanisms.

Skin applications

Promotes faster cellular repair and rejuvenation of skin tissues, reduces signs of aging, and improves hydration and elasticity. A *New England Journal of Medicine* study found NAD+ supplements reduced the risk of non-melanoma skin cancer in those at high risk due to a previous skin cancer.

Post-surgical recovery

Accelerates incision healing time, promotes quicker tissue repair, improves scar appearance, reduces post-surgical inflammation, minimizes discomfort and swelling, and reduces recovery time.

Reproductive health

Improves cellular health and delays cellular aging in the reproductive tissues. Helps prevent metabolic disorders and potentially aids in reproductive health and vitality.

Hormonal regulation

Helps regulate processes related to the production

of hormones such as estrogen, progesterone, and testosterone, helping to maintain hormonal equilibrium and improve blood circulation important for both male and female reproductive systems.

Stress reduction

At the cellular level, **NAD+** activates the sirtuins, which promote cellular repair, reduce oxidative stress and inflammation.

Muscular health

Enhances mitochondrial function and energy production, promotes muscle growth and repair, and supports overall muscle function and performance.

Neurodegenerative disorders

Protects neurons from damage and degeneration, potentially slowing the progression of neurodegenerative disorders such as Alzheimer's and other forms of dementia.

Enhanced cognitive function

NAD+ levels decline in the brain with age. Studies suggest restoring **NAD+** levels may improve neurotransmission, which is important in maintaining neural communications, and may improve brain health and cognitive function.

Cardiovascular diseases

Promotes cardiac cell repair and regeneration, potentially improving heart function and aiding in the management of cardiovascular diseases. Reduces inflammation and enhances blood flow.