TRU NIAGEN®

SUPPORTING YOUR FITNESS WITH CELLULAR NUTRITION

Supporting Your Fitness with Cellular Nutrition

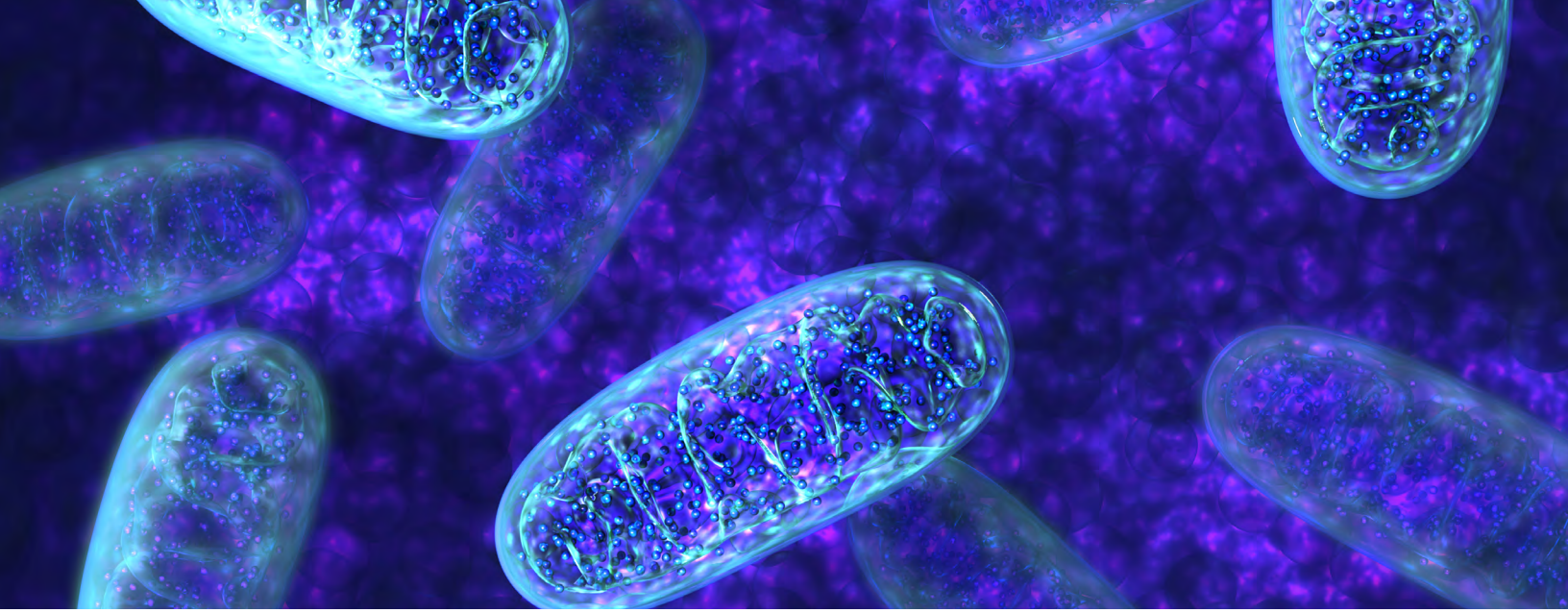
BY CHROMADEX

Muscles rely on a constant supply of energy to function. **ATP**, or adenosine triphosphate, is the one and only energy source your muscles use to contract.

ATP is **cellular energy** and it can be generated in different ways based on the demands of a given physical activity.

For activities like sprinting or weight-lifting that require quick bursts of energy, your muscles use a fast but inefficient form of ATP production called **anaerobic** respiration.

For endurance exercises that require more sustained energy, muscles produce ATP through a slower but more efficient process called **aerobic** respiration. This is why extended exercises like running, dancing, swimming, biking are called *aerobic* workouts.



Mitochondria in Your Muscles

Every cell in your skeletal muscles contains thousands of mitochondria, tiny organelles widely known as the "powerhouses of the cell." The mitochondria convert the energy stored in food into ATP.

The number of mitochondria we create correlates to the amount of energy we need. This means, in large part, our exercise activity dictates the number of mitochondria we create and sustain. Whenever there is a significant change in our lifestyle or habits, our muscle cells adjust the number of mitochondria.

David A. Hood, from York University, observes that there is a connection between exercise routines and mitochondrial biogenesis. Mitochondrial biogenesis is a series of complex chemical reactions within the body that signal the need for more ATP and therefore more mitochondria. Our mitochondria essentially clone themselves through a self-replication process in order to meet the new energy demand.

However, the opposite is also true. A sedentary lifestyle can signal the body that we don't need as much ATP and inhibit the mitochondria from replicating. As a result, your mitochondria produce less cellular energy.

The Role of NAD^+ in Cellular Energy Production

Your mitochondria cannot produce ATP or generate cellular energy without one important coenzyme, NAD^+—nicotinamide adenine dinucleotide. Coenzymes, like NAD^+, help catalyze a chemical reaction for their bigger brothers, enzymes.

Specifically, NAD^+ transports packages of positively-charged electrons to several enzymes that sit patiently in the mitochondrial membrane. The positively-charged electrons power the enzymes, like electricity powers a factory. Thereafter, the enzymes work together like an assembly line, building out the final package: ATP.

The Role of NAD^+ in Cellular Repair

NAD^+ is also involved in cellular repair, crucial for muscle recovery.

Poly (ADP-ribose) polymerase (PARP) enzymes, another class of NAD^+ utilizing enzymes, are actively involved in repairing damaged cells.

But PARP-mediated cellular repair consequently drains your NAD^+ reserves, especially during the presence of excess oxidative stress.

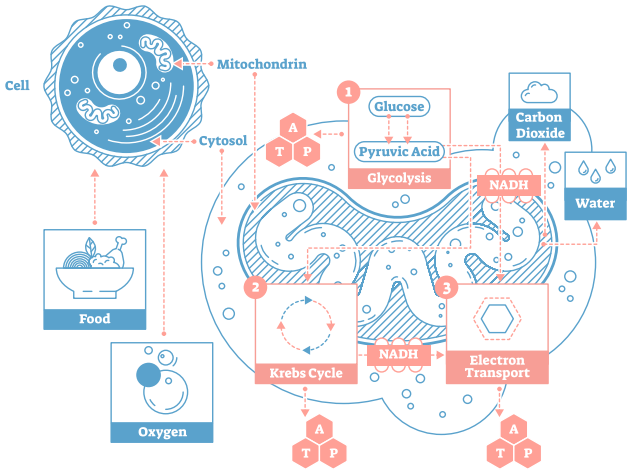
Intense exercise has been shown to increase oxidative stress in humans, especially in skeletal muscle.

Restoring Your ATP

In post-exercise, your body is working to restore expended ATP. This could be quite taxing on the body.

Susanna Törnroth-Horsefield and Richard Neutze from the University of Gothenburg observed that the human body expends about the same weight of ATP as our body weighs when resting.

Therefore, maintaining a sufficient NAD^+ supply becomes critical even after your workout.



Elevating Your NAD^+

Methods such as fasting and moderate exercise can increase the production of NAD^+ naturally, but their results vary and these might not be viable options for everyone.

Fortunately, there are several supplements on the market to help you replenish your NAD^+ levels to help counter the effects of physiological stress that exercise can bring.

The most obvious way to supplement your NAD^+ is with more NAD^+. However, NAD^+ as a straight supplement is very difficult to maintain in capsule form. The supplement degrades quickly when exposed to light and heat, and deteriorates when exposed to water. In fact, an FDA briefing document says NAD^+ is unlikely to remain stable in capsule form under ordinary storage conditions.

NAD^+ is also a very large molecule that is unable to enter the cell directly. Rather, your body must first break it down to smaller pieces before passing through the cell membrane, deeming it less effective as an NAD^+ booster.

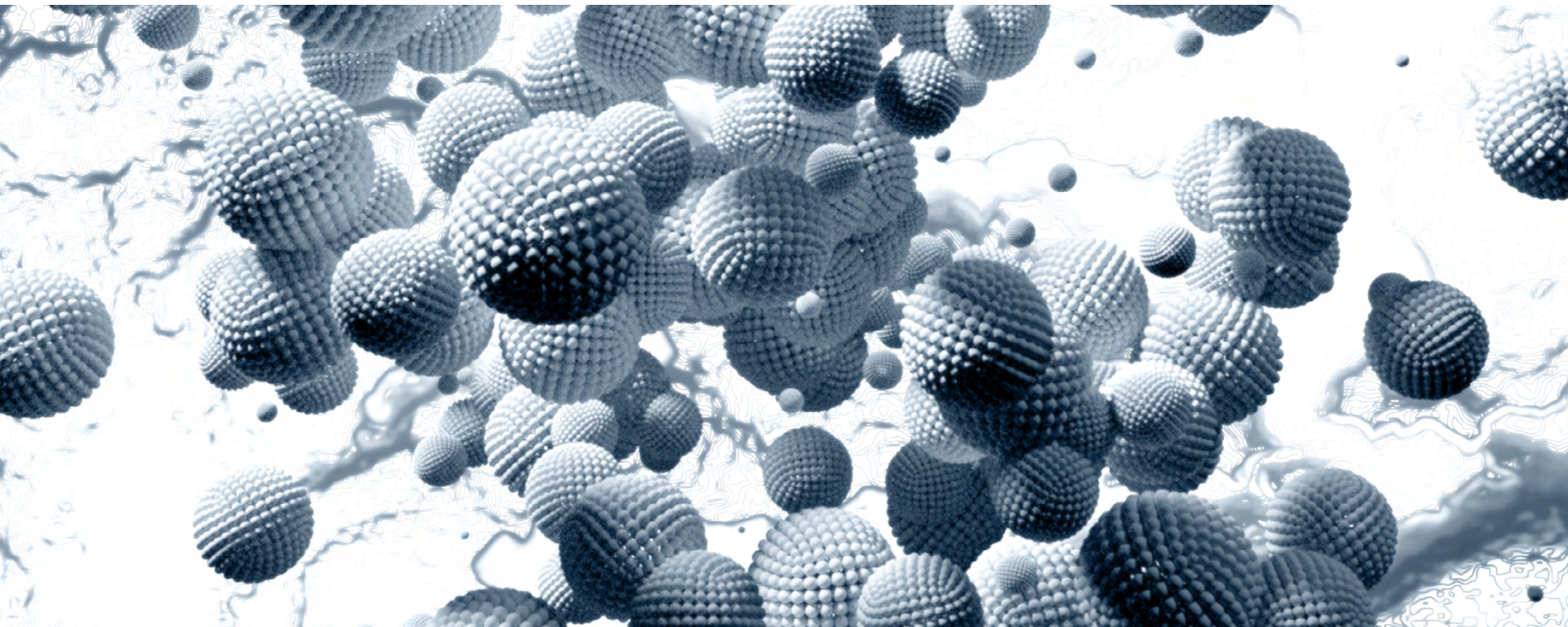
Nicotinamide Riboside as an NAD^+ Supplement

The best way to supplement your NAD^+ is through an NAD^+ precursor. NAD^+ precursors are smaller molecules used as building blocks to create NAD^+. Once they pass through the cell, they are built together by enzymes to form NAD^+.

Niagen® (nicotinamide riboside) is a clinically proven NAD^+ precursor that safely and effectively increases your NAD^+ levels supported by eight published human clinical studies.

For example, a clinical trial published in *Scientific Reports* in 2019 concludes nicotinamide riboside both safely and effectively increases NAD^+ levels in a dose-dependent manner in healthy overweight adults. The study used an 8-week randomized, double-blind, placebo-controlled trial to conduct its evaluation. After two weeks, the study results are as follows:

The dose of Niagen® (nicotinamide riboside) administered:	Percentage Increase in whole blood NAD^+ and other NAD^+ metabolites within 2 weeks:
100 mg	**+22%**
300 mg	**+51%**
1000 mg	**+142%**



Niagen® has achieved acceptance by the leading regulatory authoritative bodies in the world:

- Successfully reviewed twice under the US Food and Drug Administration's (FDA) New Dietary Ingredient Notification (NDIN) program
- Successfully notified to the FDA as Generally Recognized As Safe (GRAS)
- Received approval as a Natural Health Product by Health Canada
- Received approval as a Novel Food Ingredient by the European Commission
- Received approval as a permissible ingredient in Complementary Medicines by the Therapeutic Goods Administration of Australia

These approvals and acceptance by the world's leading authoritative regulatory bodies is a clear, unequivocal recognition of the quality of the science, the safety of the ingredient, and the reproducibility of the production process for Niagen®.

NSF Certified for Sport®

Tru Niagen®, the consumer product of Niagen®, bears the NSF Certified for Sport® mark.

The Certified for Sport® includes a certification that Tru Niagen® is made to current Good Manufacturing Practice (cGMP) standards, testing to confirm the level of Niagen® in the product is consistent with the amount claimed on the label and testing to confirm the absence of over 270 athletic banned substances and harmful contaminants.

The NSF International's Certified for Sport® program helps athletes, dieticians, coaches and consumers make safer decisions when choosing sports supplements.

The Certified for Sport® certification is the only independent third-party certification program recognized by the United States Anti-Doping Agency (USADA), Major League Baseball, the National Hockey League and the Canadian Football League.

Certified for Sport® is also recommended by the NFL, NBA, PGA, LPGA, CCES, CPSDA, iNADO, Ironman, NASCAR, Taylor Hooton Foundation and many other organizations seeking to ensure the safety of supplement consumption with athletes.

The Importance of Cellular Health

Optimal exercise performance requires high functionality from each and every cell.

Cells within skeletal muscles are essential for locomotion, gait, and balance. Cells in hearts and vessels are critical in delivering nutrients and oxygen to all other cells throughout the human body. Brain cells and neurons provide the cognition and coordination for targeted movements.

Thus, maintaining NAD^+ sufficiency, as well as supporting healthy mitochondria, is critical for optimal cellular health and exercise performance.

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