NAC Detox Regulators

Ingredients
Doctor’s Best NAC Detox Regulators supports the body’s natural biochemical pathways for neutralizing and excreting toxins. The three nutrients in this product—NAC (N-AcetylCysteine) and the essential minerals selenium (Se), and molybdenum (Mo)—sustain glutathione, the body’s most important antitoxin, along with many enzymes that use glutathione to neutralize toxins and clear them from the body.

These nutrients are all naturally integral to the body’s biochemistry. They are therefore ortho molecules, or right molecules for the body, following the idea of “the right molecules in the right amounts” for optimal health as conceived by two-time Nobel Prize winner Professor Linus Pauling.1

NAC is the nutrient best proven to sustain the body’s glutathione stores.2,3 Glutathione is concentrated in all human cells. Detoxification (“detox”) enzymes in the liver, kidneys, lungs, and other organs use glutathione to bond with (“conjugate”) toxins and thereby make them able to mix into water for excretion (usually via the urine).

The Se and Mo in this formulation each have unique properties that power detox enzymes. The detox system has considerable overlap with the antioxidant defense (“antiox”) and redox regulatory (“redox”) systems. Selenium is required by a variety of enzymes that are detox, antiox and redox regulators.4 Molybdenum is indispensable for enzymes that detoxify sulfur compounds.5 This product’s combination of NAC plus Se plus Mo supports a diverse collection of detox enzymes that dispose of natural and man-made toxins (refer to the Table, Factors That Deplete Glutathione).

Benefits
NAC Supports Numerous Detox Functions
NAC’s detox value is grounded in its rapid conversion to cysteine that protects the blood and body fluids; the cells’ need for cysteine to make glutathione; and direct antitoxin effects by NAC itself.2,3,6

Supplies Cysteine To Make Glutathione. Taken by mouth, NAC elevates cysteine in the blood. Cysteine is the predominant antitoxin and antioxidant of the blood and other body fluids.7 Taking NAC is actually a better way to get cysteine than cysteine itself (l-cysteine), which is too unstable to be used in dietary supplements.2 NAC’s acetyl group keeps it stable for its absorption into the blood, then subsequently its acetyl group is removed (mostly by liver enzymes) and the molecule becomes cysteine.3

Cysteine may be a conditionally essential nutrient.2 The diet of some human populations may be relatively deficient in cysteine, and (beginning around the fourth decade of life) glutathione levels decline with age.2 A pioneering cysteine researcher (W. Droge) strongly advocated taking NAC to support healthy aging, suggesting “Everybody is likely to experience a cysteine deficiency sooner or later.”

Sustains The Body’s Glutathione Status. Glutathione is the most highly concentrated antitoxin and antioxidant within human cells, and adequate glutathione is a must for good health.2,3 Glutathione is used to neutralize toxins, whether these originate outside the body or are naturally produced by the body.

Healthy cells continually “top up” their glutathione stores by importing cysteine from the blood (not glutathione), then making new glutathione from scratch.2 The supply of cysteine is normally the limiting factor for the cells to make glutathione. Supplementing with NAC therefore helps sustain both cysteine levels in the blood, and glutathione levels inside the cells.

Potent Direct Antitoxin and Antioxidant. NAC, and the cysteine it delivers into the blood, have sulfur groups with electrons that can directly neutralize “free radical” and other electron-hungry toxins (collectively called oxidants).2,3 Many prominent environmental toxins as well as cigarette smoke and other “lifestyle” toxins are oxidants (refer to the Table). Further, NAC and cysteine also help neutralize potentially toxic “free radicals” and other oxidants that the body itself naturally and continually produces. These

**Supplement Facts**

**Serving Size**: 1 veggie capsule

<table>
<thead>
<tr>
<th>Serving per container</th>
<th>60 servings</th>
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<tbody>
<tr>
<td><strong>Amount per serving</strong></td>
<td><strong>% Daily Value</strong></td>
</tr>
<tr>
<td>Selenium (from SelenoExcell® high selenium yeast)</td>
<td>50 mcg</td>
</tr>
<tr>
<td>Molybdenum (from molybdenum glycinate)</td>
<td>50 mcg</td>
</tr>
<tr>
<td>N-Acetylcysteine (NAC)</td>
<td>600 mg</td>
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† Daily Value not established.

**Other Ingredients**: Modified cellulose (vegetarian capsule), citric acid, natural vanilla flavor.

**Suggested Adult Use**: Take 1 capsule daily, preferably with a meal. For additional detoxification support take up to 4 capsules daily, or as recommended by a nutritionally-informed physician.

**Non-GMO / Gluten Free / Soy Free / Vegetarian**

Store in a cool dry place.

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include oxygen free radicals (oxyradicals), nitrogen free radicals, and free radicals of sulfur.2,3,5-14

NAC Has A Wide Scope Of Clinical Benefit

More than 30 controlled clinical trials with NAC have established a broad range of clinical benefits for this versatile nutrient.

Protects Against Oxidative Stress. The condition of oxidative stress occurs when “free radical” oxidative activity is abnormally high or antioxidant capacity is abnormally low. If prolonged, oxidative stress can lead to tissue and organ damage.2 Taking NAC helps counter oxidative stress, both by lowering oxidative activity and by raising antioxidant capacity.

One very intense oxidative stressor is cigarette smoke. In a double-blind trial with smokers, NAC (1200 mg daily for 6 months) significantly lowered DNA damage in lung cells.10 A more subtle cause of oxidative stress is heavy exercise in untrained individuals, which markedly elevates oxygen metabolism and causes a surge in oxidative stress that can damage the muscles.2 NAC countered such oxidative stress in a double-blind trial, also increasing muscle endurance.11

Emotional stress can translate into oxidative stress, as with medical students studying for finals.16 These students showed not only GSH depletion but also sperm abnormalities. In a controlled trial, men with poor sperm quality who received NAC (600 mg per day) had significantly lower oxidative stress markers in the blood after 3 months, and their semen volume, motility and viscosity also were significantly improved.17

Benefits The Brain And Other Organs. NAC has shown strong benefits for mood, function and behavior in multiple controlled clinical trials.7,12-15 NAC supported healthy mood stability, insight, self-care, motivation, clarity of thought, and social interaction.12-14 Used in combination with B vitamins, NAC also helped stabilize memory in elderly individuals.15 Animal experiments suggest NAC may support certain brain transmitter systems by actions different from its usual detox and antioxidant actions.7

In numerous other clinical trials, NAC benefited the liver,5,18 lungs,19 colon,20 pancreas,21 immune system,21,22 circulation,21 and skin.23 NAC also supported healthy growth in children,24,25 improved skeletal muscle mass and function in elderly individuals,2,24 and provided nutritional support for wellbeing all across the lifespan.6,7,9,16,24

NAC effectively repletes glutathione in individuals who have sustained depletion. In a clinical study on severely depleted children, NAC restored glutathione synthesis as measured in the red blood cells.9 In adults, NAC also effectively repleted glutathione in immune cells.3 NAC is widely accepted as a safe and effective means to replenish glutathione.2,3,9

NAC Is The Premier Nutrient For Redox Support. “Redox” stands for “reduction-oxidation.” Reduction indicates relative electron abundance, which is good for health, and oxidation indicates relative electron scarcity, which is bad for health. The healthy body has sufficient reducing power to keep oxidative challenges under control. The body under oxidative stress typically has less reducing power, with fewer electrons available to cope with oxidative challenge. Maintaining redox balance on the side of electron abundance is crucial to health.

Redox regulating enzymes maintain the necessary balance by drawing electrons from cysteine or glutathione, then positioning them on redox-sensitive enzymes and other proteins (such as receptors, transporters, and gene regulators). Redox-sensitive proteins typically have sulfur groups that must be kept loaded with electrons in order for the molecule to work.28 NAC, the cysteine it provides, and the glutathione made from cysteine all have sulfur groups available to donate electrons to those proteins that need them.29

In the blood, it is reduced cysteine that mainly determines the redox balance, but inside the cells glutathione predominates.23 By supplying cysteine, both to sustain blood cysteine and for the cells to make glutathione, NAC is the body’s premier redox support nutrient.

Selenium Activates Glutathione-Enzyme, Other Redox Proteins

The selenium atom’s unique electronic properties are specifically required by at least 25 “selenoproteins,” including the four glutathione peroxidase enzymes that use GSH to protect against oxidative radicals.2,26 Several other Se proteins are redox enzymes that help regulate a complex web of redox-sensitive proteins involved in gene activation, protein synthesis and cell to cell communication.2,26

Another Se protein family includes several enzymes that regulate iodine metabolism and healthy thyroid hormone production.4 Other Se proteins regulate muscle development and sensitivity to calcium. Still others support and regulate healthy immunity.27 Altogether, the Se proteins have complex functional interrelationships with cysteine, glutathione, and other substances with active sulfur groups, as well as with the Mo enzymes, to protect and regulate a broad swath of life processes.

Molybdenum Enzymes Detoxify Sulfur Toxins

Molybdenum’s electronic properties are required by sulfite oxidase (SO) and at least 3 other enzymes that detoxify various sulfites and bisulfites.5 These potentially toxic sulfur compounds are generated from breathing sulfur dioxide, a common environmental air pollutant, but also from the body’s normal metabolism of the sulfur in proteins and other biomolecules.26 Sulfites also are sprayed onto vegetables at salad bars to prevent spoilage, used as preservatives in wines, vinegars, and other foods, and also employed to preserve medical products. Inadequate functioning of SO results in difficulties from sulfite buildup in the blood and tissues.5

Sulfite buildup can initiate toxic reactions that especially target energy production by the mitochondria.26 The body’s four molybdenum enzymes work to detoxify a variety of potentially toxic substances produced from sulfur. Among the substances they help detoxify are “free radical” combinations of sulfur with oxygen or nitrogen that potentially could deplete glutathione.5,28 Molybdenum is a crucial dietary component of the glutathione redox system.

These Detox Regulators Are Also Antiox and Redox Regulators

NAC, Se and Mo support, enhance and promote not just detoxification but also the interconnected metabolic webs of antioxidant defense and redox regulation.

Antioxidant Defense Centers On Mitochondria. Cysteine and lesser amounts of other antioxidants in the blood provide help defend against newly absorbed toxins.23 Those toxins that penetrate into cells can be neutralized by glutathione, which occurs in high concentrations in the cell interior.2 But the mitochondria need glutathione to cope with the ongoing toxic challenge that they themselves create.29

As the cells’ micro-electric generators, the mitochondria generate our life energy by using oxygen to “burn” our foods. But oxygen is highly reactive and is continually generating oxyradicals within the mitochondria. These oxyradicals can generate “downstream” oxidants such as nitrogen radicals, sulfur radicals, and peroxides. The mitochondria cannot make their own glutathione, and instead use energy to import glutathione from the cell cytoplasm into their interior.29 They also use Se and Mo enzymes for additional protection.4,12 Supplemeting the diet with NAC, Se and Mo helps the mitochondria avoid self-destruction from their own free radical production.4,12

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**Redox Regulates Life.** In the healthy body, an overall reducing redox balance, i.e., relative abundance of electrons, helps keep the sulfur groups of proteins saturated with electrons and fully active. Such redox-sensitive proteins make up the vast majority of the cell’s proteins, and collectively ensure healthy production and utilization of DNA, RNA, phospholipids, proteins, hormones, and thousands of other essential biomolecules. Healthy redox balance also is essential to regulate energy generation, gene and chromosome activities, cell growth and proliferation, cell-to-cell coordination, electrical activity, wound healing and regeneration, detox and antiox defense, and practically all the other life processes.2,3,25,26

By simultaneously enhancing the body’s detox, antiox and redox systems, this product’s nutrient combination is a boon to anyone striving for optimal health or seeking additional nutritional insurance against the hazards of living and working in the modern world.

### Factors That Deplete the Body’s Glutathione Stores

- Acetaminophen, an OTC pharmaceutical8,30
- Acrylamide, used in the plastics industry and naturally occurring in foods31
- Aging32
- Alcohol33
- Cement dust34
- Cigarette smoke30
- Emotional stress, as in medical students studying for exams.16
- Heavy metals arsenic, cadmium, lead, mercury35,36
- Inhaled fibers37
- Malnutrition in children9
- Methacrylates, used in dental work and other applications38
- Methyl mercury, ubiquitous environment pollutant39
- Octachlorostyrene, industrial byproduct of chlorine processing40
- Oxygen deficit (hypoxia)41
- Paraquat42 and phosphamidon, common pesticides43
- Polychlorinated biphenyls (PCBs), ubiquitous pollutants44
- Styrene, used in plastics45
- Surgery, other illness46
- Thimerosal, mercury compound currently uses as medical preservative36
- Ultraviolet23
- X-rays, occupational exposure in radiology technicians47

### Safety

NAC, Se, and Mo are all well tolerated and safe to take long-term. These three functionally linked nutrients render Doctor’s Best NAC Detox Regulators well suited for an exceptionally wide range of dietary supplement applications.

For maintenance take 1 capsule daily, preferably with a meal. For additional detoxification support take up to 4 capsules daily, or as recommended by a nutritionally-informed physician.

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