

## **Glutathione – A summary:**

This article will demonstrate to you why Glutathione is so important to your health and well-being.

**Glutathione** (pronounced 'gloota-thigh-own') is the body's essential health ABC's – Antioxidant, Blood Booster and Cell Detoxifier.

It is a tripeptide composed of glutamic, cysteine and glycine. Glutathione is found in all cells in the body, including the bile, the epithelial lining fluid of the lungs, and – at much smaller concentrations – in the blood.

Glutathione is the smallest intracellular non-protein thiol (molecule containing an S-H or sulfhydryl group) molecule in the cells. This characteristic emphasizes its potent antioxidant action and supports a multifaceted thiol exchange system, which regulates cell activity.

This small protein, produced naturally in the body, maintains these three crucial protective functions.

In fact, your life depends on glutathione. Without it, your cells would disintegrate from unrestrained oxidation, your body would have little resistance to metabolic acids, and your liver would shrivel up from the eventual accumulation of acidic toxins.

Glutathione is not yet a household word. Even some medical and holistic doctors who have heard the term may still have only a vague idea of what it is. However, everyone will soon be talking about this critical non-nutritive substance.

There was a time when only scientists had heard of cholesterol and vitamins, but today, everyone knows about them. Now the magnificence of glutathione is becoming known.

In the last five years, over 25,000 medical articles about this substance have been published, and the scientific understanding of glutathione is gradually becoming common knowledge.

Each and every cell in the body is responsible for its own supply of glutathione and must have the necessary raw materials in order to produce it.

Glutathione is always in great demand and is rapidly consumed when we experience any sort of emotional or physical stress, fatigue and even moderate exercise.

**Some well-known causes of glutathione depletion are:**

- 1) Acidic lifestyle and diet
- 2) Air and Water pollution
- 3) Prescription and recreational drugs
- 4) Ultraviolet and Radiation from cells phones, computers, electrical power lines, hair dryers, etc.
- 5) Emotional and physical stress
- 6) Injury, trauma or burns
- 7) Heavy metals
- 8) Cigarette smoke
- 9) Household chemicals
- 10) Acetaminophen poisoning
- 11) Exhaust from motor vehicles
- 12) Septic shock

All of these above factors lead to a buildup of acidic toxins that cause the loss of glutathione as a non-nutritive buffer leading to cellular aging, disease and finally death.

**Why is Glutathione Essential to Health?**

Glutathione's three major roles in the body are summarized by the letters A-B-C.

- Antioxidant
- Blood Booster
- Cell Detoxifier

**These are the three critical processes driven by glutathione.**

## **The Master Antioxidant**

Over the past thirty years, researchers have explored the role of antioxidants in good health as well as the treatment and prevention of diseases involving oxidation or fermentation by metabolic acids.

Well known and widely used antioxidants such as vitamin A, vitamin E and selenium neutralize acid. They occur naturally in nature, but not in the body. They must be introduced as part of a balanced diet.

Given the critical role of antioxidants in good health, it is not surprising that the body itself manufactures its own natural antioxidants.

The most important of these is glutathione. Because all other antioxidants depend upon the presence of glutathione to function properly, scientists call it 'the master antioxidant.'

Glutathione binds to toxins, forming a water-soluble complex which is ultimately excreted in the urine or bile as waste.

## **Food for the Blood**

Elevated glutathione levels enable the body to produce more white blood cells. White blood cells are the body's garbage collectors and are the most important cells for maintaining sterility of the body fluids.

Glutathione plays a central role in the proper function of the white blood cells. Dr. Bustavo Bounous, a leading glutathione expert, says, 'The limiting factor in the proper activity of our lymphocytes (the white blood cells) is the availability of glutathione.' In other words, healthy growth and activity of the white blood cells depends upon glutathione's availability. Put simply, glutathione is 'food' for the white blood cells.

## **Cellular Detoxifier**

Whether we know it or not, we are continually inhaling and ingesting natural and synthetic acidic toxins. They are unavoidable in these modern times both in our polluted cities and our poorly engineered food supplies. When the body has the

health and the nourishment it needs, it works tirelessly to eliminate acidic toxins and to protect itself. But, increasing levels of environmental pollution are depleting the body's store of glutathione more and more rapidly.

Our main organ of detoxification of acidic waste products is the lymphatic system and the liver. This is the body's most concentrated source of glutathione.

Studies show that low glutathione levels lead to poor lymphatic and liver function, causing more and more acidic toxins to circulate through the body and resulting in damage to individual cells and organs.

Medical doctors today routinely use glutathione-promoting drugs to detoxify victims of certain types of drug overdose.

### **Glutathione in Natural Medicine**

Practitioners of complementary and alternative medicine (CAM) have long advocated the use of milk thistle for liver problems. It turns out that this herb works by modestly elevating glutathione levels. The mineral selenium also produces subtle elevations in glutathione by becoming integrated into the glutathione peroxidase.

### **Glutathione in Traditional Medicine**

Emergency medical doctors, toxicologists and lung and liver specialists are well acquainted with glutathione's therapeutic uses.

### **Drugs That Raise Glutathione Levels**

Pharmaceutical drugs like Procyteine, OTC, OTX, Glutathione monoesters and Glutathione diesters have been used to raise glutathione levels. However, they all produce side effects and are unsuitable for long term use.

This pharmaceutical non-nutritive chemical is used to break up mucus in lung diseases such as cystic fibrosis, chronic bronchitis and asthma. It remains the standard treatment for acetaminophen overdose.

## **Glutathione in Health and Disease**

There are over 96,000 medical studies on the National Institute of Health website, [www.pubmed.gov](http://www.pubmed.gov), that document glutathione's beneficial role in health and well-being.

It is believed that glutathione has an important role to play in the prevention and treatment of disease. It may in the future be considered as important to health as an alkaline diet, exercise and alkaline lifestyle. Clinical tests show that raised glutathione levels may address some of the eight major health issues of our time:

### **1) Cardiovascular**

- Prevents heart disease – Shimizu H, Kiyohara Y, Kitazono T, Kubo M, Ibayashi S, Fufishima M, Lida M.

Relationship Between Plasma Glutathione Levels and Cardiovascular Disease in a Defined Population: The Hisyama Study. Stroke. 2004 Sep; 35(9):2072-7.

- Prevents stroke – Paterson PG, Juurlink BH.  
Nutritional Regulation of Glutathione in Stroke.  
Neurtox Res. 1999 Dec; 1(2): 99-112.

- Prevents atherosclerosis – Coppola L, Grassia A, Giunta R. Glutathione Improves Hemostatic and Hemorrhological Parameters in Atherosclerotic Subject. Drugs Exp. Clin Res 1992  
18:493-98

- Reverses artherosclerosis

- Prevents reperfusion injury

### **2) Cancer**

Cancer causing polychlorinated biphenyls (PCBs) have been found to alter levels of glutathione compounds in experiments, which may alter the body's resistance to certain types of cancer.

Glutathione deficiencies have been linked to many forms of cancer.

- Prevents cancerous tissue
- Suppresses tumor growth
- Eliminates carcinogen – acids
- Retards oxidative stress
- Prevents wasting disease
- Eases side effects of chemotherapy and radiotherapy

### **3) Pulmonary**

Glutathione is the most efficient free radical (acid) scavenger in the airways, and dozens of studies have confirmed that free radical (acid) damage is a primary player in Chronic Obstructive Pulmonary Disease. Rahman I, MacNee W. Oxidative Stress and Regulation of Glutathione in Lung Inflammation. Eur Respir J. 2000 Sep; 16(3):534-54.

- Breaks up mucus – Rahman I, MacNee W. Oxidative Stress and Regulation of Glutathione in Lung Inflammation. Eur Respir J. 2000 Sep; 16(3):534-54

- Cystic fibrosis: Glutathione neutralized harmful oxidants introduced into the lungs or those released by cells. Exotoxins from bacteria can overload the endobronchial terrain and feed the fires of acidic inflammation. This staggering burden increases the oxidative sensitivity of the CF lung, resulting in further injury of lung parenchyma. Data supports evidence of a decrease in the antioxidant tripeptide glutathione (Roum JH, Buhl R, McElvaney NG, et al. Systemic Deficiency of Glutathione in Systick Fibrosis. J Appl Physiol 1993; 75:19-24).

- Asthma

- Chronic bronchitis

- Emphysema – Lamson, David, MD, Grignall, Matthew, ND. The use of Nebulized Glutathione in the Treatment of Emphysema: A Case Report. Altern Med Review. 5(5);429-431, 2000 Oct.

- Pulmonary fibrosis: Ishii T, Fujishiro M, Nakajima J, Teramoto S, Ouchi Y, Matsuse T. Depletion of Glutathion S-Transferase P1 Induces Apoptosis in Human Lung Fibroblasts. *Exp Lung Res.* 29(7);523-36, 2003 Oct-Nov.

#### **4) Aging**

Glutathione is critically important to our brain as it is one of the most important brain antioxidants. Glutathione helps preserve brain tissue by preventing damage from free radicals (acids).

In addition to quenching dangerous acids, glutathione also acts to recycle vitamin E which also has the ability to reduce acidity in the brain.

(Perlmutter D., *BrainRecovery.com* July 2004, 5th ed:13)

- Autism: Medical literature documents that an outfection can lead to a lowering of glutathione which participates in detoxification, interacts with metallothioneins, and supports many crucial aspects of immunity. A link between glutathione and autism regression may derive from the fact that transient or chronic intestinal problems can impair an infant's or toddler's nutritional status, thereby minimizing the levels of amino-acids required for the production of glutathione (McCandless, J. *Children With Starving Brains.* 2003, 2nd ed; 252)

- Parkinson's Disease: Glutathione helps to preserve brain tissue by preventing damage from free radicals (acids) and destructive chemicals formed by the normal processes of metabolism, toxic elements in the environment, and as a normal response of the body to challenges by acidic agents or other stresses. With the understanding that glutathione is important for brain protection and that this protection may be lacking in the brains of Parkinson's clients due to glutathione deficiency, it can be seen as very beneficial.

(Di Monte DA, Cahn P, Sandy MS. Glutathione in Parkinson's Disease: A Link Between Oxidative Stress and Mitochondrial Damage? *An Neurol.* 32 Suppl; S111-115, 1992.)

- Alzheimer's Disease: Woltjer, R.L., Hgheim W., Maezawa I., Vaisar T, Montine K.S., Montine T.J., Role of Glutathione in Intracellular

Amyloid-Alpha Recursor Protein/Carboxy- Terminal Fragment Aggregation and Associated Cytotoxicity. J Neurochem. 2005 May; 93 (4): 1047-56.

- Huntington's Disease: Choo Y.S., Mao Z, Johnson GV, Lesort M. Increased Glutathione Levels In Cortical Striatal Mitochondria of the R6/2 Huntington's Disease Mouse Model. Neuroscience Letter. 2005 Sep 23; 386(1): 63-8.

- Multiple Sclerosis: Calabrese V, Scapaginini G, Ravagna A, Bella R, Butterfield DA, Calvani M, Pennisi G, Giuffrida Stella AM. Disruption of Thiol Homeostasis and Nitrostatic Stress in the Cerebrospinal Fluid of Patients with Active Multiple Sclerosis: Evidence for a Protective Role of Acetylcarnitine. 2003 Sep; 28(9): 1321-8. Mann CL, Davies MB, Aldersea J, Fryer AA, Jones PK, Ko Ko C, Young C, Strange RC, Hawkins CP. Glutathione S-Transferase Polymorphisms in MS: Their Relationship to Disability. Neurology. 2000 Feb 8;54(3):542-7.

- ALS (Lou Gehrig's Disease): Tohgi H, Abe T, Yamazaki K, Murata T, Ishizake E, Isobe C. Increase in Oxidized Products and Reduction in Oxidized Glutathione in Cerborospinal Fluid From Patients with Sporadic Form of Amyotrophic Lateral Sclerosis. Neurosci Lett. 1999 Feb 5; 260(3):204-6.

- Cataract formation

- Macular degeneration

- Cancers of aging

- Prostate problems

- Osteoarthritis: Hammarqvist F, Luo JL, cotgreave IA, Andersson K, Wernerman J. Skeletal Muscle Glutathione is Depleted In Critically Ill Patients. Crit Care Med. 25(1):78-84 1997 Jan.

## **5) Digestive**

- Inflammatory bowel dis-ease
- Hepatitis
- Malnutrition
- Pancreatititis
- Peptic ulcer

## **6) Toxicology**

- Detoxifies certain drug overdoses: Acetaminophen has been shown to reduce glutathione production, thus paving the way for enhanced brain destruction by metabolic acids. (Perlmutter D. July 2004, 5th ed:108)
- Detoxifies substances in cigarette smoke and auto exhaust – Rahman I, MacNee W.

Lung Glutathione and Oxidative Stress:

Implications In Cigarette Smoke-Induced Airway Disease. Am J Physiol. 277(6 Pt 1);1067-88, 1999 Dec.

- Detoxifies pollutants including heavy metals and pesticides – Elevated glutathione levels have been shown to protect tissue form lipid peroxidation created by exposure to certain metals. Consider infusions of glutathione to relieve the body burden of both neurotoxins and metal toxicity, including mercury. (Foster, JS. Kane PC, Speight N. The Detoxx Book. 2002;90)
- Prevents hearing loss from noise pollution
- Detoxifies many well-known carcinogens

## **7) Immunology**

- Anti-viral for AIDS, hepatitis, herpes, etc.: Low glutathione levels in HIV clients may contribute to their immune deficiency since glutathione plays an important role in the function of lymphocytes. Some lymphocytes require adequate levels of

glutathione in order to function normally, and HIV induces oxidative stress that depletes the cells of glutathione.

Townsend DM, Tew KD, Tapero H.

The Importance of Glutathione in Human Disease. Biomed Pharmacother. 2003

May-June;57(3-4):145-55. Droge W, Holm E.

Role of Cysteine and Glutathione in HIV

Infection and other Diseases Associated with Muscle Wasting and Immunological Dysfunction.

FASEB J, 11(13):1077-89 1997 Nov.

- Lyme Disease: Lyme disease is a seriously complex multi-system acidic inflammatory condition that is triggered by bacterial exotoxins. Glutathione helps to remove exotoxic and/or mycotoxic acids by forming a soluble compound with them, which can then be excreted through the urine or gut. (Can Glutathione Help Lyme Disease Suffers?)

Excerpt from: The Glutathione Report: Optimal Health with the Master Antioxidant, Issue 4, Volume 1, May 2004).

- Natural antibiotic

- Chronic fatigue syndrome: An article in the journal of Medical Hypothesis proposed that glutathione, an antioxidant essential for lymphocyte function, may be depleted in Chronic Fatigue Syndrome patients. Glutathione is needed for both the immune system and for aerobic muscular contraction. The authors proposed that glutathione depletion by an activated immune system also causes the muscular fatigue and myalgia associated with Chronic Fatigue Syndrome (Bounous et al. 1999).

## **(8) Metabolic**

- Athletic enhancement

- Decreases recovery time from physical stress

- Supports hemoglobin in kidney failure

- Diabetes: The blood and tissues of diabetics are marked by critically low glutathione levels. Glutathione depletion may have adverse consequences in diabetic clients independent of glycemic control, and it may weaken the defense against oxidative stress.

De Mattia G, Bravi MC, Laurenti O, Cassone-Faldetta M, Armiento A, Ferri C, Falsano F. Influence of Reduced Glutathione Infusion on Glucose Metabolism in Patients with Non-insulin Dependent Diabetes Mellitus. *Metabolism*. 1998 Aug;47(8):433-8.

Glutathione provides the body with tools to fight off these threats naturally. Healthy people also benefit from elevated glutathione levels through an enhanced ability to fight off acidic toxins, dis-ease, pre-cancerous cells and the aging process itself. Diminished glutathione levels are a symptom of aging and are particularly evident in such ailments as Parkinson's dis-ease and Alzheimer's dis-ease.

Glutathione is also important to physically active people. Many world-class athletes are discovering that well maintained glutathione levels gives them the edge over their competitors, bringing greater strength and endurance, decreased recovery time from injury, less muscle pain and fatigue, and muscle-promoting activity.

### **Putting It All Together**

1) Medical science is still ascertaining all the critical roles played by glutathione in disease resistance and general good health. Clinical evidence links low glutathione levels to the most common illnesses of our time as well as newly emerging diseases.

2) As an essential aid to health, glutathione works as the master antioxidant in our body, optimizes the white blood cells and detoxifies a long list of pollutants and carcinogens or acids. The best way to raise glutathione levels is by eating foods that are high in glutathione such as avocados.

3) Pharmaceutical medicine has created drugs that do this very effectively. They have their uses in critical situations. But they also have side effects and repeated use is clearly inadvisable.

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## **References:**

### **Aging**

It is well known that aging is accompanied by a precipitous fall in glutathione levels. Lower glutathione levels are implicated in many diseases associated with aging including cataracts, Alzheimer's, Parkinson's atherosclerosis and others.

Journal of Clinical Epidemiology 47:1021-26, 1994.

### **Antioxidant Functions**

Antioxidants are well documented and known to play vital roles in health maintenance and disease prevention. Glutathione is your cell's own major antioxidant. Maintaining elevated glutathione levels aids the body's natural antioxidant function.

Biochemical Pharmacology 47: 2114-2123, 1994.

### **Neurological Disease**

Low glutathione levels have been associated with neuro-degenerative diseases such as MS (Multiple Sclerosis), ALS (Lou Gehrig's Disease), Alzheimer's and Parkinson's. The Lancet 344: 796-798, 1994.

### **Cancer**

Glutathione plays a role in eliminating many carcinogens/acids and also maintains and optimizes white blood cell function while providing stronger anti-acidic/anti-tumor defenses.

Cancer Letters 57: 91-94, 1991.

### **Athletic Performance**

Raised glutathione levels help increase strength and endurance. Those interested in physical fitness can benefit from a definite athletic edge.

Journal of Applied Physiology 87: 1381-1385, 1999.

### **Toxins, Pollution and Radiation**

Glutathione detoxifies a variety of pollutants, carcinogens and poisons including many found in fuel exhaust and cigarette smoke. It also retards damage from radiation exposure due to the eroding ozone layer.

Annual Reviews of Biochemistry 52: 711-760, 1983

### **AIDS**

Glutathione levels correspond to poor survival of AIDS patients. Much documentation demonstrates the role of enhanced glutathione levels in AIDS.

Proceedings of the National Academy of Science, USA 94: 1967-72, 1997.

### **Heart Disease, Stroke and Cholesterol**

Raised glutathione levels fight the oxidation of fats circulating in the bloodstream including cholesterol, retarding the process of plaque formation in the arteries leading to most heart attacks and strokes.

Nutrition Reviews 54: 1-30, 1996.

### **Diabetes**

Diabetics are more prone to 'out-fectious' and circulatory problems leading to heart disease, kidney failure and blindness. Glutathione protects against the complications of diabetes.

Clinical Science 91:575-582, 1996

## **Lung Disease**

Doctors have used glutathione-promoting drugs to treat many lung diseases including asthma, chronic bronchitis and emphysema. New and potentially therapeutic roles can be found for cigarette smoke damage, pulmonary fibrosis and other illnesses.

American Journal of Medical Science 307:119-127, 1994

## **Digestive Disorders**

Glutathione protects the body from inflammation of gastritis, stomach ulcers, pancreatitis and inflammatory bowel disease including ulcerative colitis and Crohn's disease.

Gut 42: 485-492, 1998

## **Hepatitis**

The liver is a major storehouse for glutathione. Glutathione is impaired in alcohol hepatitis as well as in viral (acidic) hepatitis including hepatitis A, B, and C. Raised glutathione levels help restore liver function.

American Journal of gastroenterology 91: 2569-2573, 1996

## **Kidney Disease**

Those with kidney failure or on dialysis suffer from high levels of oxidative (acidic) stress and decreased glutathione levels. Raised glutathione levels help prevent anemia.

Nephron 61: 404-408, 1992

## **Pregnancy, Lactation and Childbirth**

Glutathione's role in fetal and placental development is critical. It also acts in the placenta to detoxify pollutants before they can reach the developing child. Many complications of pregnancy have been linked with poor glutathione levels.

Early Human Development 37: 167-174, 1994

## **What Doctors and Experts Say About Glutathione**

*“Glutathione or “GSH” has been called the “master antioxidant”, and regulates the actions of lesser antioxidants such as vitamin C, and vitamin E within the body. “We literally cannot survive without this antioxidant.”*

### **Earl Mindell, R.Ph., Ph.D. “What You Should Know about the Super Antioxidant Miracle”**

*“No other antioxidant is as important to overall health as glutathione. It is the regulator and regenerator of immune cells and the most valuable detoxifying agent in the human body. Low levels are associated with hepatic dysfunction, immune dysfunction, cardiac disease, premature aging, and death.”*

### **Lorna R. Vanderhaeghe & Patrick J.D. Bouic, Ph.D. “The Immune System Cure”**

*“Glutathione is the major endogenous antioxidant produced by the cell. Glutathione participates directly in the neutralization of free radicals, reactive oxygen compounds, and maintains exogenous antioxidants such as vitamins C and E in their reduced (active) forms. In addition, through direct conjugation, glutathione plays a role in the detoxification of many xenobiotics (foreign compounds) both organic and inorganic. Research suggests that abnormally low glutathione levels may increase your risk for Heart Attack.”*

### **Eric Topol, MD, New England Journal of Medicine.**

*“Glutathione has potent anti-viral properties – if tissue and serum glutathione levels are significantly increased, the replication of most pathogens are slowed or stopped. Conversely, glutathione deficiency produces a pro-viral effect.”*

### **Paul Cheney, M.D.,Ph.D.**

**and expert in the treatment of Chronic Fatigue Syndrome.**

*“As we age, there is a precipitous drop in glutathione levels. Lower glutathione levels have been implicated in many diseases associated with aging.”*

**Journal of Clinical Epidemiology**

**47: 1021-28 1994**

*“Glutathione plays a role in eliminating many carcinogens as well as maintaining immune function.”*

**Cancer Letters**

**57: 91-94 1991**

*“Strong muscular activity, such as that experienced by athletes, generates oxyradicals [free radicals] leading to muscle fatigue and poorer performance. Glutathione neutralizes these radicals.”*

**Sport Medicine**

**21: 213-238, 1996**

*“Glutathione detoxifies many pollutants, carcinogens, and poisons, including many in fuel exhaust and cigarette smoke. It retards damage from radiation such as seen with loss of the ozone.”*

**Annual Reviews of Biochemistry**

**52: 711-780 1983**