GETTING TO KNOW GLUTATHIONE

What is glutathione?

Glutathione is a nutrient-like compound that is one of the most versatile and important protective substances in the human body. It is found to varying degrees in all tissues, body fluids, and organ systems, where it plays a variety of roles in health, including:

- elimination of cancer-causing chemicals
- antioxidant
- regeneration of vitamins C and E
- support of immunity
- maintenance of cellular proteins

Where does the body get glutathione?

People obtain glutathione in two ways – from the diet and from internal synthesis. Because of the body's ability to make glutathione, it is not considered an essential nutrient, despite its essential roles. However, under some conditions the amount of glutathione that the body can produce is insufficient to supply all that is needed for optimal health.

The best dietary sources of glutathione are freshly prepared meats, including poultry and fish, fresh fruits, and fresh vegetables (both raw and cooked). Except for fresh-frozen foods, most categories of processed foods have little to no glutathione because of losses during canning, milling, drying, pasteurizing, etc. These include canned fruits, vegetables and meats; cured and dried meats; dried fruits; cereal and grain products; dairy products; sweeteners and condiments.

Internally, the body is able to make its own glutathione from its three constituent amino acids: glutamate, cysteine and glycine. Most diets provide plentiful amounts of these amino acids, and they are present in every protein in the body. Since they are required for the body to synthesize glutathione, they are called "precursors" of glutathione.

Supplemental glutathione was once thought to be ineffective since it does not appreciably raise plasma levels. However, recent studies by John P. Richie, PhD of the Penn State University College of Medicine and other researchers have demonstrated

that glutathione supplements do enhance the glutathione content of critical tissues beyond plasma.

According to glutathione researcher Dean P. Jones, PhD of Emory University School of Medicine, the lungs, intestines, kidneys and some immune cells are able to absorb glutathione directly. At other sites such as the liver it is first broken down into its three amino acids, which are absorbed by the liver and then recombined to make glutathione. In fact, glutathione is so important for liver function that if the body goes 24 hours without food, it will "steal" the precursors from muscles to maintain liver glutathione.

Some plant foods such as broccoli and garlic provide phytonutrients that help activate enzymes involved in the synthesis of glutathione. Therefore, increased intake of these foods may help increase the internal synthesis of glutathione.

The best type of diet to supply the body's need for glutathione is one that is high in fresh fruits and vegetables and whole-cut meats. In contrast, diets that consist largely of processed foods may result in poor glutathione status. In the United States, usual dietary intakes of glutathione range from as low as 3 milligrams to as high as 150 milligrams per day.

How does glutathione support good health?

Glutathione supports a wide array of biologic functions. Its primary role may be detoxification, inferred by the fact that the highest amounts of glutathione are found in the liver and kidneys – organs whose main job is to process all ingested substances and eliminate any toxic components. High amounts are also found in the lung lining fluid, protecting against airborne pollutants, and in the mucus lining of the intestine, barring the absorption of reactive chemicals.

Glutathione is a key player in the body's antioxidant defenses. At a biochemical level this means it can stop oxidative reactions by donating electrons to free radicals, much like other familiar antioxidants such as vitamin C, vitamin E and many carotenoids. [box] However, glutathione goes further: when vitamins C and E are "spent" as antioxidants,

they are regenerated by glutathione. Thus, glutathione not only acts directly to prevent oxidative damage to cells, but also indirectly by supporting a powerful antioxidant team.

Another virtue of the glutathione molecule is its speed. When a cancer-causing chemical threatens to damage a cell's DNA and cause a mutation, glutathione can react with the invader faster than the invader can react with DNA. In this way glutathione intercepts and neutralizes many toxic substances.

These protective functions occur continually in all major organ systems, including the brain, heart, skeletal muscle, skin and immune system, in addition to the liver, kidneys, intestines and lungs.

Another key role of glutathione – one that is biochemically quite complex – is maintaining a balance of oxidative and reduction processes in cells. Oxidation and reduction are terms that refer to the transfer of electrons, and the balance between these two forces is called "redox balance." All the processes of life depend upon cells' ability to maintain the appropriate redox balance; when this is disrupted, protein functions fail and cells die. Glutathione protects cells by maintaining redox balance, both inside the cells and on their surfaces.

There is some evidence that glutathione supports the immune system (1) by stimulating the ability of immune cells to kill bacteria in the lungs and (2) by reducing replication of the influenza virus in the airway passages.

Finally, a more fundamental and evolutionary role of glutathione is to supply the amino acid cysteine to maintain protein synthesis in the event of nutritional deficiency. As a reservoir of this essential amino acid, glutathione acts as one of Nature's safeguards to sustain the body during times of famine.

How much is needed?

Because the level of glutathione varies throughout the body, determining a single optimal level is challenging. The amount the kidneys need, for example, is different that the amount the brain needs, and the amount one might measure in plasma does not

reflect that of other tissues. However, research has been able to show relative changes of glutathione under certain conditions, suggesting that multiple factors affect glutathione status.

One inescapable factor is age. Young, healthy people with diets of fresh foods generally have good glutathione status, but this begins to decline around age 45 and continues to plunge until death. Lower glutathione status has also been associated with obesity, type 2 diabetes, cigarette smoking, alcohol abuse, and taking multiple prescription and non-prescription medications.

Glutathione status is impaired in many disease states including cardiovascular disease, kidney disease, Parkinson disease, lung disease and AIDS, and by chemotherapy treatment.

The common thread through all these conditions and risk factors is an overload of oxidative stress. Under such circumstances, glutathione is being used up faster than it can be produced. Individuals can try to boost their protection by increasing glutathione intake from foods or supplements or both; by eliminating glutathione-destroying habits such as smoking; and by increasing intake of glutathione-promoting foods such as broccoli and cabbage.

Since the best diets provide about 150 milligrams of glutathione daily, 100 milligrams appears to be a reasonable target for healthy people, while those affected by risk factors might want to consider more. The safety of supplemental glutathione has been repeatedly shown in experiments in which people ingested more than 1000 milligrams. Glutathione is marketed in supplements under the brand name, Setria® Glutathione.

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[Box:]

Why do we need antioxidants?

Opposites attract. This is a fundamental force through the natural world – think of the positive and negative ends of a magnet, for example. So it is with electrons, the charged

particles that bond atoms together. An atomic bond consists of two electrons, one positive and one negative. When something removes an electron, the compound becomes unstable and highly reactive: it goes looking for a replacement electron as fast as it can and steals one from the next victim, and that one from another, and so on. The reactive compound with an unpaired electron is called a *free radical*. The reaction set in motion is a *chain reaction*, and the entire process is called *oxidation*.

Unchecked oxidation causes damage to cells and tissues. Oxidative damage is implicated in a wide range of diseases and chronic conditions, including cardiovascular disease, cancer, Parkinson's disease, Alzheimer's disease, diabetes, age-related eye diseases, asthma and inflammatory disorders.

How does it get started? One source of free radicals is simply the normal process of metabolism. We breathe oxygen, which is metabolized to fuel the basic processes of life. Most of it is reduced to water, but about 5 percent escapes and is converted to free radicals. Other common sources of free radicals are ultraviolet radiation, X-rays, tobacco smoke, air pollutants, alcohol and saturated fat. Some immune cells generate free radicals to kill bacteria. Inflammation is a sign of free radical chain reactions.

As a counter-measure, all living beings have evolved with an antioxidant defense system that keeps free radical reactions in check. Vitamins C and E are powerful antioxidants in the human body, both having the capacity to donate electrons without becoming harmful radicals themselves. Glutathione is the most powerful antioxidant of all, and Nature in its wisdom has seen to it that this protective molecule is present throughout the body both inside cells and in the fluids surrounding cells, constantly on patrol for free radicals.

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