

BEYOND THE BLUE ZONE

LIVE TO 100 WITHOUT DISEASE...

100



EVEN IF YOU DRINK, SMOKE
AND AVOID EXERCISE

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AUTHOR OF THE BESTSELLING X-FACTOR REVOLUTION

Beyond The Blue Zone

**Live to 100 Without
Disease... *Even* if You
Drink, Smoke and
Avoid Exercise**

By Jason Kennedy

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Beyond The Blue Zone

Live to 100 Without Disease... Even if You Drink, Smoke and Avoid Exercise

Today the ability to live beyond 100 years of age is more of a reality than ever before.

On December, 2010, the Census Bureau estimated there were 71,991 people who are 100 years or older living in the United States. Japan claims a centenarian population of 47,756. Other countries are also boasting higher populations of people who have reached – and surpassed – the century mark.

It's estimated that by the year 2050, the U.S. will have a population of *over a half million centenarians*.

To be exact, the U.S. Census Bureau predicts that over the next four decades the number of Americans living to 100 and beyond will expand to an astonishing 601,000 people.

These amazing numbers are something our parents could only dream of. They were unheard of in the days of our great and great-great grandparents. And back in the really old times, living beyond 60 or 70 was the stuff of Ponce de Leon and the Fountain of Youth. It was all hype and hoopla without any hard facts.

In modern society we have groundbreaking scientific research on our side. And it's telling us that people who live longer and healthier lives all have something in common:

People who live beyond 100 years of age often have very high levels of an essential nutrient referred to as the “master guardian,” or “master antioxidant.”

This super antioxidant has been dubbed the “master” of many other things as well:

- the master cell protector,
- life extender,
- anti-aging oxidant,
- immune booster and
- the master detoxifier.

This “master guardian” is called ***glutathione, or glutathione sulfhydryl*** (glutathione). It’s a very simple molecule found in every cell of your body.

The reason glutathione is referred to as the master of all these things is because it is, literally, the most influential antioxidant in your body.

It’s the powerhouse defender your body needs to protect itself against aging, disease, toxins and poor health. And as the master antioxidant, it helps maintain normal levels of other antioxidants, such as vitamin C, vitamin E and selenium, which help boost your health even further.

A staggering amount of research shows this critical nutrient may be the secret to preventing age-related diseases like heart disease, dementia, cancer, liver failure and HIV. And glutathione just might solve the mystery of how to achieve an extended lifespan – well into your hundreds – without losing any of your vim and vigor.

You see, it turns out centenarians with the highest glutathione activity have greater physical capacity than those with lower levels.

And it doesn't matter whether you're in your hundreds yet or not. Research shows that people from 60 to 103 who are in top physical and mental health **all have very high levels of glutathione.**^{1 2}

And get this. When Polish researchers compared glutathione levels in sixteen centenarians against nine people in their early twenties, they got a big surprise. Turned out the old folks had significantly higher levels of glutathione activity.

This increase of glutathione establishes a clear relationship to a reduction in disease-causing oxidative damage, thus keeping the centenarians healthy longer.³

The Secret of Disease-Free Aging

Glutathione is your body's most important defense against free radical damage. Free radicals are those pesky molecules that make you grow old before your time. They damage tissue, organs and cells and are believed to be directly related to most age-related diseases.

Here's the thing: When your body is attacked by free radicals it zaps your glutathione levels. Reduced glutathione levels lower your body's ability to fight off oxidative damage – and that makes you even more susceptible to the ravages of aging.

Without an adequate supply of glutathione...

- Toxins begin to build in your body
- Immune response plunges
- Energy-producing cells begin dying off
- Arteries begin to narrow and set off a cascade of cardiovascular problems

- DNA mutations set in and heighten your risk of cancer
- Brain cells die and Alzheimer's plaque starts building up in the brain
- The liver becomes overwhelmed with toxic waste
- Your health plummets

Next thing you know, you're old, sick and tired!

The Women's Health and Aging Study from the prestigious *John Hopkins Medical Institute* is the first to show a relationship between glutathione, aging, disability and disease.

In the study, reduced glutathione activity was directly related to aging in 601 women between the ages of 65 and 100 with disability *and* chronic disease.⁴

Prior to the study from John Hopkins, other research had already revealed that people in a single diseased state, such as heart disease, renal failure or leukemia have much lower levels of circulating glutathione than those who are healthy.

Similar results were found in people who had at least one of six chronic illnesses (arthritis, high blood pressure, heart disease, circulatory symptoms, diabetes or stomach symptoms.) The individuals with chronic illness had lower glutathione levels than those who were disease free.^{5 6}

But there's good news, too. The researchers also discovered that **elderly individuals with higher glutathione levels had lower rates of death and a smaller number of illnesses.** These subjects had lower blood pressure, lower cholesterol, lower body mass index and higher levels of health.

Let me explain what researchers believe happens.

People over 60 who have low glutathione are overcome with oxidative stress and damage leading to illness and death. However, people who make it into their hundreds while remaining healthy, **all have high levels of glutathione.**

Research suggests that the reason so many “older survivors” have higher glutathione activity is because those who are glutathione deficient become ill and pass away.

But those with greater glutathione activity keep going strong and healthy well into their later years.

This is a sad realization but also a very important one. It reinforces the vital role glutathione plays as your master cell protector. And what it all boils down to is that glutathione is the single, most vital nutrient to help you skip the degenerating diseases that are most common – *and almost expected* – in today’s society.

So if you keep your levels of glutathione up, there’s no need to worry. In the following pages I’m going to tell you everything you need to know about this master antioxidant and how to make sure you get plenty of it.

By the time you finish reading you’ll know exactly what glutathione can do for you:

- **Zap disease-causing toxic build-up.** Your body’s most potent detoxifier zaps deadly free radicals and breaks down vicious toxins that alter your DNA. You’ll defend yourself from cancer-causing environmental pollutants, heavy metals and other lethal chemicals you encounter every day.
- **Shield your liver from toxic death** caused by hepatitis, fatty liver and cirrhosis. You’ll learn what

you can do to protect yourself and in some cases even recover from many damaging liver conditions.

- **Turbo-charge your cardiovascular health** and reduce your risk of stroke and heart attack. You'll discover the real cause behind cardiovascular disease, plaque build-up and damaged arteries.
- **Halt the build-up of Alzheimer's plaques** in your brain. Power up your brain function and find out how you can lower your chances of Alzheimer's, Parkinson's and Huntington's disease.
- **Fight off cancer** and suppress tumor development. You'll learn how to stop DNA damage associated with the development of cancer cells, and how to improve your chemotherapy results if you already have this devastating disease.
- **Discover the glutathione-testosterone connection** that helps keep men strong and virile through middle-age and well into their later years.
- **Add years to your life, even if you're HIV positive.** HIV drains your immune system, kills off important blood cells and leaves you open to infectious diseases... even death. You'll uncover the secret to remaining symptom free for years.

Exactly what IS Glutathione?

Glutathione, also known as GSH, is called a “thiol.” And when it comes to your health and longevity, it’s the most important factor in protecting your cells from free radicals and reactive oxygen species that lead to oxidative stress.

These “evil-doers” damage your DNA and disrupt the foundation of your body’s antioxidant system. They are what make you old and sick long before you are ready for it. Glutathione has a whole network set up in your body that works like clockwork to keep you healthy.

Glutathione sulfhydryl (GSH) – the topic of this book – is the key player in your body’s detoxification system and helps keep your entire glutathione network up and running efficiently. Other parts of the GSH system include...

Glutathione S Transferase (GST). This is a complex group of enzymes that work in harmony with glutathione itself. GST binds toxic compounds, like heavy metals, cancer-causing agents and other pollutants to GSH molecules in the liver. Then they are safely excreted in the form of stool and urine.

Glutathione Peroxidases (GPX) have a primary role of protecting cells from free radicals and oxidative damage caused by hydrogen peroxides in the body. Peroxides are easily turned into free radicals and produce oxidation that can damage your cells on a DNA level. Increased glutathione levels help the body produce GPX.

Glutathione disulfide (GSSG) is generated during the reduction of peroxides. It’s basically an oxidized state of glutathione. In healthy individuals, about 10% of the glutathione pool is in the form of GSSG. If the ratio of oxidized glutathione (GSSG) to reduced glutathione (GSH) gets too high, it’s a sign of increased oxidative stress.

Glutathione reductase (GR) has the amazing role of reducing GSSG back into the sulfhydryl form (GSH).

Chapter 1: Defending You from Our Toxic Environment

Each day your body is attacked by toxins that can lead to serious health concerns. Our food supply is filled with toxic substances. Farm animals are pumped with antibiotics, synthetic hormones and other chemicals. Crops of fruits and vegetables are exposed to fertilizers and pesticides. Deepwater fish are loaded with mercury. Packaged foods are filled with unnaturally processed flour, sugars, trans fats and starches.

And that doesn't even account for other environmental pollutants like cigarette smoke, exhaust fumes, heavy metals and hormone-altering chemicals.

These toxic compounds enter your body when they are ingested, absorbed through the skin or inhaled. So whether you eat, drink, touch or breathe these chemicals, they'll find their way into your tissue and organs. And once that happens, it places your body under greater oxidative stress and starts draining your glutathione system.

Remember, glutathione is your body's *master antioxidant*. When your glutathione system is working below par, it's almost impossible to maintain adequate antioxidant protection. To make matters worse, it's believed that glutathione levels automatically start dropping by about age 20. Then, every 10 years it drops by another 10 to 15 percent.

But it doesn't stop there. And there's one more thing you need to hear.

When you have higher exposure to toxic substances your glutathione levels drop even more quickly. It causes your cells to die at a faster rate and increases your chances of liver and kidney disease, cancer, brain disorders and other health concerns associated with aging.

Needless to say, limiting your exposure to these agents is a number one priority for a long and healthy life, especially if you want to live past 100.

The Top 4 Most Dangerous Chemicals in Your Life

Dangerous Chemical #1: Mercury. Consuming fish is the primary source of human exposure to mercury.

This toxic chemical is found in the ocean in the form of methyl mercury and it's absorbed by fish. So when we cook up a batch of seafood that has soaked up a bunch of methyl mercury, it ends up in our bodies. Today researchers agree it's a very real health threat in most regions of the world.

Getting plenty of fish in our diets is a big thing these days. Fish are full of heart-healthy, brain-boosting omega-3 fatty acids. And everyone wants to reap the benefits.

While the amounts of methyl mercury you ingest may be small, it can build up in the human body over time and cause neurological problems. These include tingling of the fingertips and toes, poor coordination and vision problems.

In 2003 Dr. Jane Hightower, an internal medicine specialist in San Francisco, tested mercury levels in 123 patients with vague symptoms. Testing showed 89 percent of them exceeded the maximum blood mercury levels recommended by the Environmental Protection Agency.

However, when 67 of the patients stopped eating fish they all experienced a significant decline in mercury levels.⁷

Now, even researchers are questioning if the mercury from fish may offset the benefits of omega-3 consumption. For example, Finnish men with the highest concentrations of mercury have been found to have the highest death rates from cardiovascular disease, congestive heart failure and stroke.

And when researchers at John Hopkins School of Public Health looked at 634 men in European countries and Israel, they discovered men who suffered heart attack had 15% higher mercury levels than those who had not.^{8 9}

The Environmental Protection Agency recommends eating only 12 ounces of low mercury fish and shellfish per week.

Some low mercury options include shrimp, salmon, Pollock and catfish. They also advise to stick with canned light tuna rather than albacore tuna, since albacore has higher mercury content.

In addition to sticking with low mercury fish, maintaining adequate glutathione levels can help prevent mercury from building up in your body. Glutathione acts as a carrier of mercury. It binds with methyl mercury to help expel it from the body. This helps prevent mercury-related damage to important enzymes and tissue in your body.¹⁰

It's also important to note that other heavy metals in your body may deplete glutathione levels and add to oxidative damage. This includes not only mercury but iron, copper, chromium, vanadium, cadmium and nickel as well.¹¹

If your body is carrying an excess of any of these heavy metals, it's important to boost your glutathione intake to provide a defense against free radical damage and oxidative stress. Otherwise, it will place you at higher risk of liver disease, cancer, heart attack, stroke, diabetes and more.¹²

LEAST MERCURY	MODERATE MERCURY	HIGH MERCURY	HIGHEST MERCURY
Anchovies	Bass (striped, black)	Bluefish	Mackerel (King)
Butterfish	Carp	Grouper*	Marlin*
Catfish	Cod (Alaskan)*	Mackerel*	Orange Roughy*
Clam	Croaker (White Pacific)	(Spanish, Gulf)	Shark*
Crab	Halibut (Atlantic)*	Tuna (Canned Albacore)	Swordfish*
Crawfish	Halibut (Pacific)	Tuna (Yellowfin)*	Tuna (Bigeye, Ahi)*
Crayfish	Jacksmelt		Tilefish*
Flounder*	Lobster		
Haddock (Atlantic)*	Mahi Mahi		
Hake	Monkfish*		
Herring	Perch (freshwater)		
Mackerel (N. Atlantic, Chub)	Sablefish		
Mullet	Skate*		
Oyster	Snapper*		
Perch (Ocean)	Tuna (Canned □ chunk light)		
Plaice	Tuna (Skipjack)*		

LEAST MERCURY	MODERATE MERCURY	HIGH MERCURY	HIGHEST MERCURY
Pollock	Weakfish (Sea Trout)		
Salmon (canned)**	Sea Bass (Chilean)*		
Salmon (fresh)**			
Sardine			
Scallop*			
Shad (American)			
Shrimp*			
Sole (Pacific)			
Squid (Calamari)			
Tilapia			
Trout (freshwater)			
Whitefish			
Whiting			

Source: Natural Resources Defense Council

***Fish in Trouble!** These fish are perilously low in numbers or are caught using environmentally destructive methods. To learn more, see the [Monterey Bay Aquarium](#) and the [Blue Ocean Institute](#), both of which provide guides to fish to enjoy or avoid on the basis of environmental factors.

****Farmed Salmon** may contain PCB's, chemicals with serious long-term health effects.

Dangerous Chemical #2: Lead. While many people believe lead poisoning is a thing of the past, that's not quite accurate. It's true that since 1978 lead has been banned in paint. And it was phased out of gasoline in the U.S. by 1986.

However many homes, schools and workplaces still have old lead paint on their walls. Corroded lead pipes are

another source of dangerous lead particles which may become airborne or enter the water supply.

Lead can also be found in imported or old painted toys, children's jewelry made from lead alloys and some glazed and vinyl products. Once you touch one of these items you can transfer the lead to your mouth.

Lead can damage almost every system and organ in your body and is exceptionally toxic in children. The National Resources Defense Council (NRDC) reports that elevated blood-lead levels in kids increase risk of learning disabilities, behavioral problems, anemia and, in extreme cases, serious brain damage. It not only harms the brain, it can also damage the kidneys and other organs.

Today the threat of lead poisoning is still very much alive. So much, in fact, that in May of 2012 the Centers for Disease Control (CDC) lowered the lead poisoning threshold from 10 micrograms per deciliter of blood to 5 micrograms in children.

This is the one thing officials all appear to agree on; *no level of lead is safe or without damaging health effects.*

Excessive amounts of lead in adults can cause high blood pressure, a decline in mental function, abdominal pain, memory loss and headaches.

But here's the real humdinger. Lead depletes glutathione levels and also causes the production of superoxide in the body. Superoxide is a particularly damaging toxin that contributes to disease and aging.

This free radical and others target cell membranes and place them under oxidative stress that damages your blood lipids, proteins and DNA.^{13 14}

However, restoring adequate stores of glutathione can reinstate antioxidant balance in the body by detoxifying at the cellular level. Alpha lipoic acid (ALA) is an antioxidant that has been shown to enhance glutathione function. In animal models, restoring glutathione levels with ALA has been shown to reduce symptoms of lead-induced oxidative stress.

Of particular interest is its ability to reduce malondialdehyde (MDA) levels in the brain, kidneys and red blood cells, three of the four main targets of lead toxicity. MDA is an indicator of oxidative stress and can cause DNA mutations which may be cancerous.^{15 16}

Dangerous Chemical #3: Radiation. Did you know that nearly half of all radiation exposure in the U.S. is caused by medical exposure? That's what the National Council on Radiation Protection and Measurements (NCRP) says.

According to Dr. Kenneth R. Kase, senior vice president of NCRP, in 2006 CT scans and nuclear medicine alone contributed 36 percent of the total radiation exposure and 75 percent of the medical radiation exposure of the U.S. population.

And believe it or not the numbers get even crazier than that.

In the report NCRP Report No. 160, *Ionizing Radiation Exposure of the Population of the United States*, its estimated that the number of CT scans and nuclear medicine procedures performed in the United States during 2006 was *estimated to be 67 million and 18 million, respectively.*¹⁷

And a recent study published in the *New England Journal of Medicine* showed that *out of nearly a million*

*adults, almost 70 percent received CT scans during a 3-year period with the highest doses at over 50 millisieverts (mSv.)*¹⁸

Now here's the problem: Researchers project that the CT scans completed in that time alone could result in 29,000 future cancers. Other estimates predict one cancer for every 270 middle-aged women who have a CT coronary angiography. However, younger people are at even greater risk. It's suspected that women under age 20 undergoing this procedure have twice the cancer risk of those in middle-age.^{19 20}

While the amount of medical radiation each person is exposed to might startle you, I'm pretty sure you won't be shocked to learn that background radiation accounts for the other half of exposure. Background radiation comes from soil, rocks, radon gas and radiation from space.

The most important thing for you to know is: *all radiation is hazardous to your health.* And while you may not be able to control environmental exposure, you do have some control over the medical procedures you undergo.

The good news is glutathione offers several forms of protection against radiation.

First: glutathione acts as an antioxidant to scavenge free radicals produced by exposure to radiation.

Second: glutathione helps repair damaged DNA molecules. It also helps get oxygen-rich blood delivered throughout the body. When your cells don't have enough oxygen you can have sensitivity to radiation.²¹

Dangerous Chemical #4: Cigarette Smoke. There are more than 4,000 chemicals in cigarette smoke which can

lead to cancer, asthma, emphysema, bronchitis, heart disease and more.

Many of these compounds are known carcinogens and something you would never consider putting in your body. You'll find things like arsenic (poison), cadmium (used in batteries), benzene (an industrial solvent), hydrogen cyanide (an industrial pesticide) and more in a pack of smokes.

And it's not just smokers who feel the effects of these noxious substances. Every time someone lights up, these lethal toxins are released into the environment. So the bottom line is everyone suffers.

And even non-smokers can develop health problems when they breathe in secondhand smoke, including heart disease and lung cancer.

Just take a look at the nasty facts:^{22 23 24 25}

- Cigarette smoking accounts for an estimated 443,000 deaths yearly in the U.S. That's one out of every five deaths.
- More deaths are caused each year by tobacco use than by all deaths from human immunodeficiency virus (HIV), illegal drug use, alcohol use, motor vehicle injuries, suicides and murders combined.
- 90 percent of all lung cancer in men and 80 percent in women is caused by smoking.

Smoking eats away at the antioxidants your body needs to protect itself. Smoking also causes a great deal of inflammation in the lungs. Researchers believe the resulting imbalance between oxidants and antioxidants may be a significant factor in the development of lung disease.²⁶

And despite the claims cigarette manufacturers might make, here's what it boils down to: *Cigarette smoke is toxic to the delicate tissue of your respiratory tract.*

And it's not hard to connect the dots when you learn cigarette smoke also depletes glutathione levels in the cells found in your airways.²⁷

The truth is decades of research reveal that glutathione can reduce the negative effects of smoking.

It's even been suggested that if scientists could genetically or chemically manipulate glutathione levels, it could play an important role in the lung health of smokers.²⁸

The 7 “Hidden” Toxins Poisoning Your Body

The four toxic substances I just talked about are just the tip of the iceberg. Here are 7 more pollutants you're likely to find in your home – and your environment – on a regular basis... *even though you may not be aware of them.*

Hidden Toxin #1: Pesticides and insecticides are used all around the house to kill bugs and weeds.

Over the years a lot of these dangerous products have been taken off the market. But there are still many hazardous chemicals associated with them.

Pesticides bind with glutathione in the liver. Then, with the help of glutathione S transferase GST, they are eliminated from the body in your urine or stool. Believe it or not, many insects that are resistant to pesticides have elevated levels of GST activity.²⁹

Hidden Toxin #2: Formaldehyde is found in numerous household items and has been given a “probable human carcinogen” classification by the EPA. You can find it in glues, particleboard, and insulation... even soaps, shampoos, lotions, toothpaste and disinfectants.

Formaldehyde vapors can cause asthma attacks in some people and has been linked to respiratory allergies in children.

Hidden Toxin #3: Radon is a naturally occurring gas that may seep into your home from the soil or from ground or well water.

It’s most common in areas without adequate ventilation, like basements, lower floors or older buildings. It gives off tiny radioactive particles that can damage the cells of the lungs. As such, radon is a leading cause of cancer in the U.S.

Hidden Toxin #4: Diesel powered machinery and vehicles release toxic exhaust particles into the air.

Most people don’t think about it, but back-up generators, trucks, buses, trains and a lot of heavy equipment are powered by diesel fuel. The bad news is, truck drivers, train engineers and heavy equipment workers exposed to diesel exhaust particles have a much higher incidence of death from lung cancer.^{30 31}

If you’re on the road a lot or work around this type of equipment, your risk is high.

Hidden Toxin #5: Particulate Matter results from burning fossil fuels like oil, diesel, gasoline and coal.

The National Resources Defense Council estimates it may cause as many as 64,000 premature deaths each year

from heart or lung complications. And it turns out the amount of time a person spends in cars, motorcycles, bicycles and public transportation is directly linked with an increase in the risk of heart attack.³²

And it's not restricted to the roadways. Regular exposure to particulate matter in larger metropolitan areas can also increase the risk of heart disease.

When researchers in Boston evaluated patients exposed to ambient particulate air pollution, they discovered elevated risk of heart attack within a few hours to one day after exposure.^{33 34}

Hidden Toxin #6: Polybrominated diphenyl ethers (PBDEs) are flame retardants which can be found in everything from the cushioning in couches, car seats and pillow to the plastics in your television and computer.

The problem is PBDEs aren't chemically bound to the products they're used in so they easily migrate to the surrounding air, dust, soil and water. These days, PBDEs can be found in everything from dairy products to fish.

According to the EPA, this toxic substance can cause damage to the brain and nervous system, disrupt hormone levels and impair learning and memory in children.³⁵

Hidden Toxin #7: Bisphenol A (PBA) is a compound used to manufacture plastics. You can find it in plastic bottles, food containers, helmets, food wraps and more. In the past, it's been linked to breast cancer, and prostate cancer.

More recently studies are finding it promotes oxidative stress and inflammation. People with higher levels of PBA are more inclined to develop heart disease and diabetes.^{36 37}

38

Luckily, glutathione enhances detoxification of all of these compounds by preserving the health and antioxidant status of every cell in your body.

This helps protect you from aging, impaired liver function, cancer, heart disease and many other age-related disorders associated with oxidative damage.

Chapter 2: Glutathione: The Fuel That Powers Your Immune System

Glutathione is essential for a healthy immune system.

In fact, every time your body reacts to a threat, *it immediately draws on its reserves of glutathione to kick your immune system into gear.*

But researchers believe that as you age, immune response becomes compromised. This may be the reason so many elderly individuals are vulnerable to respiratory infections, flu and pneumonia.

Nevertheless, reduced immunity isn't confined to the elderly. You probably know people who seem to catch a cold every time somebody sneezes... or picks up the flu each time it comes around. That person might even be you.

And most folks don't realize their allergies, sinusitis, asthma and irritable bowel syndrome may be a result of lowered immunity.

If any of this sounds familiar, it's time for you to arm your defenses and get your immune response up to par. But before you run off, let's take a look at some of the things that may be throwing your immune system off kilter.

- **Poor diet:** Earlier we talked about some of the foods that may be harmful to your health. Packaged foods contain chemical additives, colorings and preservatives. Other foods contain hormones, fertilizers and pesticides. All of these damage the immune system and leave your body weakened against disease.
- **Too much sugar:** It's hard to avoid sugar these days, but it's a good idea to stay away from it as much as possible. In a study where volunteers were fed sugar, they were less able to fight bacteria than those who did not eat sugar.³⁹
- **Stress:** Research shows a relationship between stress and infectious disease. People who are most stressed experience more colds, flues and other respiratory illnesses than those with less stress.^{40 41}
⁴²
- **Not enough sleep:** Your body requires sleep to rebuild and recharge your immune system. Individuals who do not get enough rest are more likely to develop colds or pneumonia.^{43 44}
- **Medication:** While many people believe prescribed and over-the-counter drugs are "good" for them, they can damage your immune system. Plus, overuse of antibiotics may weaken your defenses when used long-term. It's best to boost your immunity to reduce your dependence on drugs for less serious ailments.
- **Low antioxidant status:** Maintaining good antioxidant balance within your body is extremely important to immune cell function. Getting plenty of glutathione, vitamin E, beta carotene and other

antioxidants is necessary to the immune response across all age groups.⁴⁵

Other things, like alcohol, tobacco, radiation and an inactive lifestyle can also disrupt the delicate balance of your immune health.

Immune Diseases Strike When Your Reserves of Glutathione are Low

If your immune response gets thrown out of whack, your body may produce an inappropriate response.

In some cases, it may become overwhelmed by the extent of a disease, like you see in HIV and AIDS. (See chapter 8 for more about glutathione and HIV.)

However, the most common unwanted immune responses are when the body mistakes a harmless substance as a danger or views healthy tissue as a threat. This is when an *allergic disorder* or *autoimmune disorder* strikes.

Here's how these two disorders work...

Allergic Disorder. Sometimes your body may overreact to completely harmless substances and treat them as foreign invaders by attacking them. In other words, the immune system that normally protects you against foreign bacteria and viruses can turn on you. It can actually cause a worsening of your symptoms! This excessive immune response is called an *allergic disorder*.

For example, asthma may be triggered by pet dander or pollen. While these substances won't really hurt you in any way, your immune system reacts as if they are very dangerous. This overreaction is what triggers the swelling

and narrowing of your airways that leads to coughing and wheezing.

A similar cascade occurs in inflammatory bowel disease. The gut may trigger an abnormal response to bacteria or proteins found in the food you've eaten.

People with a healthy immune response don't have a problem with these foods. But in those with compromised immunity the body goes into attack mode that results in inflammation.

Immune Disorder. In other cases, the immune system may accidentally start to attack tissues and organs that it should normally protect. It sees them as dangerous when no real danger is present. When this occurs, it's known as an *autoimmune disorder* or *autoimmune attack*.

For instance, multiple sclerosis occurs when normal tissue in the brain and spinal cord are identified as "foreign." Your immune system attacks them, causing inflammation and damage to the nerve cells.

In rheumatoid arthritis the immune defenses attack joint tissue. They see it as a "foreign object" and begin breaking the tissue down. This results in chronic inflammation, pain, swelling and damage to the cartilage.

It's important to note that both multiple sclerosis and rheumatoid arthritis are associated with lowered glutathione levels. ***A study out of Denmark showed patients with multiple sclerosis had a 35 to 50 percent reduction in glutathione peroxidase activity.***^{46 47}

Research on rheumatoid arthritis also reveals a significant depletion of glutathione levels. Not only was glutathione reduced by 50 percent, the subjects also had higher levels of malondialdehyde (MDA) which is a high

indicator of oxidative stress. It can also cause cancerous DNA mutations.^{48 49}

Other autoimmune disorders include...

- Chronic fatigue syndrome
- Crohn's disease
- Fibromyalgia
- Guillain Barre
- Lupus
- Psoriasis
- Scleroderma
- Type 1 diabetes
- Vasculitis

Your Private Disease-Fighting Arsenal

The immune response is a complex system designed to seek and destroy foreign invaders, or antigens. These invaders could be allergens, cancer cells, viruses, bacteria... even transplanted organs and grafted tissue. When your body recognizes any of these threats, your immune cells become activated.

The key players in your immune response are a group of white blood cells called lymphocytes. They act as the soldiers, patrolling for signs of infection and arming the defenses. The two major types of lymphocytes are B cells and T cells.

B lymphocytes are the advanced patrol. They seek out targets and produce antibodies that lock on to anything that looks dangerous. Once an antibody latches onto a virus or bacteria, it disables it or tags it for pick-up by other cells. Before a B cell can be activated, it must be stimulated by helper T cells.

A fascinating aspect of the immune response is the ability of B-cells to “remember” certain pathogens. For example, once you’ve had the measles your immune system is quickly able to identify the chemical signature if you are exposed to them a second time. This quick recognition system is what makes you immune against future attack.

T lymphocytes work in tandem with B-cells to protect your health. There are several different kinds of T cells and each has its own function. The most important of these are T4 (CD4) helper cells and T8 (CD8) killer cells.

When CD4 cells spot a virus or antigen, they release molecules telling the immune response to gear up for action. Basically, these cells send out the alarm rallying the troops – telling the B-cells and CD8 cells to multiply and prepare for attack.

Once B cells are activated, they start throwing antibodies at the offending virus or bacteria to neutralize them. But they can only disarm pathogens which are floating around in the body. They can’t touch anything that has already penetrated a cell. And they can’t kill dangerous cells that have become infected or abnormal, such as cancer cells.

That’s where CD8 T-cells jump into action. These are the snipers. They are locked, loaded and ready to kill any cells that have been infiltrated with a bacteria or virus; or appear abnormal in some way. Once killer CD8 cells bind to a target, they deliver a chemical burst that make holes in the bad cell’s membrane and causes it to die.

Both B- and T-cells can only take action against antigens they are matched with. It’s like a lock and key. They only bind with targets they are programmed to identify. For example, a T-cell that recognizes a particular

virus will not be able to latch onto anything except that virus.

However, your immune defense has another type of killer cell beyond CD8 cells. They are called **natural killer cells** (NKC). These are the most aggressive killer cells in the body. If CD8 cells are the snipers, natural killer cells are the mercenaries.

Unlike B- and T-cells, natural killer cells don't have to recognize a specific antigen before they strike. They just know if they see an abnormal cell, they are going to attack. No questions asked. These cells kill on contact to wipe out cancer cells, cells that are infected and cells that are damaged in other ways.

Glutathione is the Master of Your Immune System

When your immune system becomes compromised it may not be able to produce enough immune cells to keep you healthy. For example, people who experience high levels of stress have a lower proportion of both CD4 T-cells and CD8 T-cells. This is likely the reason people who experience excessive stress are more prone to infectious disease and respiratory illnesses.⁵⁰

Glutathione plays an essential part in lymphocyte function, T-cell production, and activation. Adequate levels of glutathione are necessary for T-cells to multiply so they can better fight infection. Glutathione is particularly vital in keeping the CD8 killer cells active and ready to destroy damaged or infected cells.⁵¹

I can't stress it enough. ***Glutathione is the master guardian of your health.*** And it's absolutely essential for your immune health.

Glutathione depletion leads to a significant decrease in the proportion of CD8 killer cells in your body. This depletion also reduces the function of natural killer cells (NKC.) These cells are vital to your long-term health. Without a fully armed immune system, your body is unable to fight off infection, malignancy, fever or to get rid of damaged cells.^{52 53}

In fact, patients with HIV infection, cancer, major injuries, sepsis, Crohn's disease, ulcerative colitis and chronic fatigue syndrome all have similar symptoms. These symptoms include low NKC activity, muscle wasting and muscle fatigue. Patients also have abnormally low levels of two very important glutathione precursors; cysteine and glutamine.⁵⁴

Studies show that boosting glutathione levels with N-acetyl-cysteine (NAC) can almost completely restore natural killer cell activity. It also replenishes glutathione in the T-cells.

In chapter 9 you'll find many other ways to power up your glutathione stores and protect your immunity.^{55 56} But before we look at that, let's check out where your liver stands in all this.

Chapter 3:

Protecting Your Liver Can SAVE Your Life

Your liver – with help from your kidneys and intestines – works around the clock to clear toxins from your blood, tissue and organs.

So it probably won't surprise you to learn that your liver has a higher concentration of glutathione than any other organ in your body. These high levels of glutathione have a very important role in protecting your liver from toxic substances and protecting it from damage.

But it doesn't just protect your liver. It's estimated that about 80 percent of the glutathione produced in the liver is transported to other organs via circulation and bile. Most of that is used by the kidneys, which also carry a major toxic burden.⁵⁷

How Your Liver Safeguards Your Health

- Rids your body of damaging waste products, drugs and other toxic substances
- Metabolizes fats and cholesterol
- Stores vitamins, carbohydrates and iron to give your body energy
- Regulates hormone levels
- Produces bile to help digest food and absorb vital nutrients
- Removes bacteria from the bloodstream to help fight infection
- Regulates blood clotting

Your liver is one of the most important organs in your body. It metabolizes fats and cholesterol and stores carbohydrates to give you energy. It produces blood clotting factors, regulates hormone levels and produces bile to help your body absorb vital nutrients.

It also acts as a processing plant to rid your body of damaging waste products such as drugs, alcohol, heavy metals, toxins and other poisonous substances we talked about in the chapter 2.

And if you want to reach the ripe old age of 90, 100 or 105 in superb health, you'll want to keep your liver in good working order.

You see, when your liver isn't working properly, waste products begin to build up. Other organs, like your kidneys, start working overtime to pick up the slack. Eventually, the stress overload on your system begins to show up in the form of fatigue, headaches, joint pain and depression. Later, more serious conditions may become evident.

When your body accumulates excessive levels of toxins, or when glutathione levels are diminished, liver damage can occur. And on top of that, researchers have discovered that patients with hepatitis, alcoholic liver disease and non-alcoholic cirrhosis all have significant decreases in glutathione levels.⁵⁸

And if that's not bad enough, *if your liver completely fails the rest of your body will shut down within one or two days*. So it's important to keep it in good working order.

But even if you've already experience some liver damage, there's also good news: Your liver can continue to function even if when it's up to 75 percent diseased. That's because the liver has the incredible ability to regenerate

itself from healthy tissue and cells. Plus, as long as there is plenty of glutathione present in your liver, it can safely handle toxic overload and oxidative damage.

No Rest for the Weary: The 3 CRUCIAL Phases of Liver Detoxification

Believe it or not, about 13% of your blood supply is in the liver at any given moment in time. That's where toxic waste is broken down and carried to your intestines for elimination in your stool or to your kidneys for removal during urination. At the same time the good stuff, like nutrients and oxygen, get passed through the intestines (or absorbed) to be delivered to the rest of your body.

The liver has two phases of detoxification. In Phase 1 a complex group of enzymes target toxic chemicals and change them to forms that can be readily dissolved in water. During this phase waste becomes even more lethal because it produces free radicals that are dangerous to your health.

Amazingly enough, Phase 2 of the detoxification process produces natural antioxidant enzymes to neutralize these harmful toxins and get them out of your body through the bowel or urine. This is also where heavy metals, like lead and mercury, get kicked out of your system.

If either phase of this process breaks down it can lead to negative health effects. More importantly, when Phase 2 becomes inefficient, toxins begin to stockpile in your body. They gather in your nerve cells, brain and other tissues where they have disastrous health consequences.

And when toxins begin to accumulate every single organ in your body has to work overtime to keep up. And if

you reach a critical point – where the delicate balance of your liver function gets thrown off track – it can severely affect the day-to-day functioning of the organs in your body.

Your liver works very hard to break down waste, toxins and other vicious substances in a never-ending goal to protect your health. But make no mistake about it. The tremendous toxic burden from our environment is taking its toll. Many scientists agree that the overwhelming number of pollutants we encounter every day may be the leading cause of cancer and liver disease.

So if you want to hang around and play with the great grandkids – maybe even the great GREAT grandkids – it's important to take measures now to protect this vital organ.

Today many forms of liver disease, such as hepatitis C, non-alcoholic fatty liver disease, and liver cancer are on the rise. And the American Liver Foundation says a whopping 30 million people in the U.S. have liver disease. That's one out of ten people.

But remember! Even if you only have 25 percent liver function you can still remain strong, healthy and active in your daily life. So let's talk about some of the disorders that can affect your precious liver health.

What You Should Know: Diseases of the Liver

Hepatitis is one of the most common infections that cause inflammation and damage to the liver. Depending on the type of infection (hepatitis A, B or C) the symptoms may appear flu-like... or there may be no symptoms at all. In some cases, particularly with hepatitis B or C, symptoms may not show up for years. The problem with that is that,

even if you feel fine, the disease can still be spread to others.

There's a lot of information around about hepatitis, but here's what you need to know...

Hepatitis A is a contagious liver infection that usually comes from eating food or water that's been contaminated with feces.

You can also get it from ingesting polluted shellfish or being in close contact with someone who is already infected. Mild cases of hepatitis A often don't require treatment and symptoms will resolve on their own. In other cases symptoms may last for several months. However, the condition is not chronic.^{59 60}

On the bright side, once a person has recovered from hepatitis A they become immune to the virus. So it's unlikely they will ever get it again.

Hepatitis B is a more serious form of infectious hepatitis. It's transmitted through semen, infected blood and other body fluids. In chronic cases the liver may swell leading to liver damage, cirrhosis and liver cancer. Many people who contract this form of hepatitis will carry the infection forever and risk infecting others throughout their lives. There are more than a million people with hepatitis B in the U.S. alone.

Hepatitis C is the most serious type of hepatitis. According to the Centers for Disease Control and Prevention, 75 to 80 percent of people with acute hepatitis C will develop chronic infection that lasts a lifetime and may cause scarring of the liver.

Hepatitis C is now one of the most common reasons for liver transplants in adults. It's usually transmitted through

direct contact with infected blood or unprotected sex. Today 4 million Americans are infected with this chronic liver disease.

Other diseases of the liver include fatty liver, fibrosis, cirrhosis and liver cancer. Although they initially sound less serious than hepatitis, none of these should be taken lightly.

Non-alcoholic fatty liver occurs when fatty deposits – unrelated to alcohol use – form in the liver. This condition is most common in people with insulin resistance or metabolic syndrome, particularly if they are obese. Fatty liver can lead to inflammation, scarring and even cirrhosis. It's estimated that about 25 percent of people in the U.S. have non-alcoholic fatty liver.

(Remember: Your liver creates new pockets of fat in the form of triglycerides when it's not able to get rid of toxins during detoxification... this is a type of defense mechanism your body uses to keep toxins from getting into your bloodstream.)

Fibrosis: All of the liver disease we've talked about so far can lead to liver fibrosis.

When the liver becomes inflamed or damaged, it immediately goes to work trying to repair itself. As this process occurs, healthy liver tissue is replaced by fibrous scar tissue. This can impair blood flow through the liver and reduce its ability to function properly.

Additionally, the build-up of scar tissue is one of the first steps toward the development of cirrhosis.

Cirrhosis occurs when scar tissue begins blocking the flow of blood through the liver. Once this happens the liver filtering process is thrown out of whack. The liver's ability

to metabolize fats and cholesterol breaks down. It has difficulty producing the proteins, hormones and glycogen your body needs. And it can no longer process the toxic wastes in the body.

When the liver can't handle the waste, it causes toxic fluids to build up in the abdominal cavity, a condition known as ascites. To make matters worse, cirrhosis is not reversible.

Liver cancer is often the result of the conditions listed above. It's been suggested that the damage these diseases cause to the liver cells might alter DNA in a way that results in cancerous mutations. And liver cancer is the third leading cause of cancer death in the world.

Common symptoms associated with liver disorders include...

- Jaundice, which appears as a yellow or orange tint on the skin and in the whites of the eyes.
- Bruising very easily due to reduced platelet count.
- Ascites, a condition where fluids accumulate in the abdominal cavity.
- Fatigue, weakness and loss of appetite.
- Disorientation and difficulty thinking and remembering.

Like a Guardian Angel... Glutathione Protects and Shields Your Liver

As you can see, your body simply cannot survive without proper liver function. But it's something hardly anyone thinks about.

The medical establishment has everyone focused on heart health and cholesterol levels as a way to ensure a long and healthy life... but nobody ever tells you to take care of your liver if you want to live healthy and happy to 100.

But guess what. Your liver is every ounce as important to your health as your heart. And glutathione synthesis is critical to making sure it keeps working long and hard. Your liver would cease to function without adequate levels of glutathione.

Skeptical, I don't blame you. But here's what happened when researchers removed the gene (Gclc) responsible for glutathione synthesis in mice.

Researchers deleted the Gclc gene from a group mice at around 14 days after birth. Dramatic changes occurred in cells of the mice that immediately led to oxidative damage and abnormal lipid retention (fats, triglycerides) in the liver. Inflammation set in and liver tissue began to die. And just one month after birth (two weeks later,) the mice died of liver failure.⁶¹

Now I know you're not a mouse. But for the record, human studies have done a pretty good job of backing up the importance of glutathione in liver health and function, especially when it comes to some of the liver disorders we just talked about. Take a look at these studies:

- Italian researchers evaluated 35 alcoholics, 20 patients with non-alcoholic liver disease and 15 control subjects. Both the alcoholic and non-alcoholic subjects had decreased glutathione activity in the liver. The researchers concluded

reduced glutathione was a contributing factor to liver injury.⁶²

- Research from Japan had similar results. They found that patients with chronic hepatitis, viral hepatitis, non-alcoholic liver cirrhosis and alcoholic liver disease all had a significant decrease in glutathione levels. They determined these patients were more susceptible to oxidative stress and liver injury.⁶³
- Another study out of Italy showed patients with hepatitis C had a significant reduction of glutathione in the liver, blood plasma and white blood cells.⁶⁴
- And when scientists in Turkey compared glutathione levels in patients with hepatitis B, C and cirrhosis, they discovered the subjects all had reduced glutathione levels.⁶⁵

The fact is, maintaining adequate glutathione levels can help protect your liver and assist in recovery from many damaging conditions.

For example, alpha lipoic acid, a substance that increases total glutathione levels in the liver and blood, has successfully been used to treat numerous liver conditions, including alcohol damage, mushroom poisoning and metal poisoning.⁶⁶

N-acetylcysteine (NAC) is another compound that boosts glutathione synthesis in the liver. It's especially helpful in minimizing liver toxicity associated with overuse of acetaminophen. Acetaminophen can lead to irreversible liver damage and even death in acute overdose. However, when NAC is administered within 10 hours of ingestion, the risk of liver damage is very low.^{67 68}

Chapter 4: Clear Away Decades of Deadly Plaque Buildup

Cardiovascular disease is the number one killer in the U.S. today.

The CDC reports that one out of every three deaths is a direct result of heart disease or stroke, accounting for 2,200 deaths per day. Additionally, it's estimated that over 80 million people are currently suffering some form of cardiovascular disorder.

These days it seems like everyone in their 40's and 50's is just waiting for cardiovascular disease to strike. It's so commonplace that we don't even question it anymore. It's a given. It will happen. So people throughout the U.S. are popping statin drugs hoping – but never quite believing – that they won't be the next victim.

That's no way to live! When you understand what *really* happens in the progression of cardiovascular issues you can rest easier, quit worrying and begin to realize you truly *can* beat – *and even bypass* – this life-taking reaper.

Remember! Your goal is to be hardy and healthy well into your hundreds. So let's take a look at the facts.

There are many factors involved in the progression of cardiovascular disease. Excess weight, poor diet, stress,

lack of exercise and exposure to environmental toxins all have links to it.

But almost all cardiovascular issues begin with something called atherosclerosis. This is the plaque build-up in your arteries and blood vessels that blocks blood flow to your heart, brain and extremities. Atherosclerosis is the leading cause of heart attacks, strokes and peripheral artery disease.

While most people have been led to believe cholesterol is the main reason plaque builds up in the arteries, this is only partially true.

You see, atherosclerosis is an inflammatory cascade that begins with endothelial dysfunction. ***Every person who has atherosclerosis is also dealing with endothelial dysfunction.***

In a nutshell, endothelial cells form the inner surface of your blood vessels, providing a barrier that protects the vessel wall. They keep the arteries smooth and toned so blood can flow easily.

But once they become damaged, toxins and fatty lipids are able to penetrate the cell walls. Over time fats, cholesterol, platelets, calcium and other materials begin to accumulate and form atherosclerotic lesions.

As these materials continue to build-up, blood flow may become restricted or blocked, depriving your organs and muscles of oxygen-rich blood. Reduced blood supply to your organs is called an “ischemic” condition.

Once again, oxidative stress may be the major culprit. Research has repeatedly made the link between free radicals and oxidative damage in people with cardiovascular problems.^{69 70 71}

As a matter of fact one study, which used data from 533 in the World Health Organization's MONICA study protocol, found that the frequency of ischemic heart disease was **65.3% higher** in people with oxidative stress.⁷²

And research out of Germany is just as enlightening. German researchers followed 281 patients with coronary artery disease for four and a half years. During that time, they determined that endothelial dysfunction and increased oxidative stress predicted the risk of cardiovascular events, such as heart attack or stroke, in the patients.⁷³

One of the many contributing factors to endothelial dysfunction is diminished nitric oxide bioactivity. Nitric oxide (NO) helps maintain vessel tone, controls blood clotting factors, regulates blood pressure and much, much more. But when nitric oxide activity is diminished negative events occur...^{74 75}

- ✓ Hypertension strikes
- ✓ Arteries constrict
- ✓ Vascular inflammation sets in
- ✓ Atherosclerotic lesions begin to develop
- ✓ Blood clots, heart attack or stroke may occur

Clearly, NO is an important defender against the progression of vascular conditions. In fact, reduced NO bioactivity is thought to be one of the central factors most common in cardiovascular disease.

Research performed at the National Heart, Lung and Blood institute in Bethesda, Maryland has good news on this front. They recruited 17 patients with atherosclerosis or its risk factors. When researchers administered glutathione into the large artery of the thigh they were able to enhance NO activity and improve endothelial dysfunction in the patients.⁷⁶

What About Cholesterol?

While cholesterol isn't the direct cause of atherosclerosis, it does play a role in plaque build-up once endothelial damage and poor vessel tone sets in. Let me explain how it works...

Cholesterol is manufactured by your liver and you'll never guess what it's used for. This is going to be a huge surprise, so hold on to your hat.

One of the primary functions of cholesterol is to repair body tissue damaged by stress. This includes oxidative stress caused by poor diet, environmental pollutants and heavy metals.

How crazy is that? The thing we've always thought as "bad" actually has a positive health role.

But there are some limitations when it comes to *cause and effect*. I'll tell you exactly what those are right now...

Cholesterol combines with protein and fat to create a "lipoprotein." These lipoproteins are used to carry the fat, protein and cholesterol through your bloodstream. But not all lipoproteins are created equal.

Lipoproteins that have a low concentration of protein versus cholesterol are stickier. These are known as LDL (low density lipoprotein) cholesterol – or "bad" cholesterol.

As LDL travels through your bloodstream it delivers cholesterol where it's needed. That's exactly what it's supposed to do, so it's not a bad thing. But it tends to build up in the artery walls, especially where there is endothelial damage.

That's where high density lipoproteins (HDL) come in. They have a higher concentration of protein than cholesterol, so they move more easily through the bloodstream. What's more, as they pass the debris left behind by LDL they pick it up and carry it away for disposal.

That's why HDL is referred to as the "good" cholesterol.

Steve Riechman, a researcher in the Department of Health and Kinesiology at Texas A&M University says: *"Our tissues need cholesterol, and LDL delivers it. HDL, the good cholesterol, cleans up after the repair is done."*⁷⁷

So the big question you have to ask yourself is this. Why is everyone so worried about their cholesterol levels?

The problem occurs when you have too many LDL particles in the bloodstream and not enough HDL to mop up after them. You see, when you have damage in the delicate lining of your arteries and blood vessels, LDL cholesterol is deposited to repair the damage. It acts like a band-aid to allow the area to heal.

The more frequently this occurs, the more likely it is that fats, cholesterol and other debris circulating in the LDL particles will start attaching to the sticky patch. Oxidized LDL may penetrate the endothelium and cause even further damage.

And without enough HDL to clean up afterward, the build-up will continue unchecked. Next thing you know, your arteries are all clogged up.

Well here's an interesting tidbit. Researchers have been working with a new form of glutathione that's super

absorbable. It's called "liposomal glutathione." And while there's not a lot of news on it yet, one groundbreaking study showed it has astonishing effects on cholesterol, LDL and atherosclerosis. (Later in the book, I'll show you how to find liposomal glutathione and how to take it.)

During the two month study liposomal glutathione reduced oxidized LDL uptake by 17 percent.

That's good news for your arteries since oxidized LDL is a major cause of plaque build-up. The study had great news there, too. **The liposomal glutathione also reduced the plaque buildup (atherosclerotic lesions) by 30%.⁷⁸**

The Fatal Effects of Clogged Arteries

As you may have guessed, the conditions above can all lead to serious health consequences. If you're not convinced, just remember that one out of every three deaths is due to stroke or heart attack and account for 2,200 deaths each and every day.

Here's what can happen if you don't take control of your arterial health soon...

Coronary heart disease, or coronary artery disease, is the most common cause of heart attacks. This is a condition which occurs when plaque builds up in the *coronary* arteries. These are the arteries that supply your heart with oxygen rich blood.

When plaque builds up it narrows the opening of the arteries. This reduces blood flow to the heart and can lead to chest pain or a heart attack. It also increases your chances of developing a blood clot, which could completely halt the blood supply to certain areas of the heart muscle.

When blood supply to the heart is stopped, healthy heart tissue becomes damaged and is replaced with scar tissue. While this scarring is important in the healing process, it also has a negative impact. For starters, it doesn't help contract and pump your heart the way healthy tissue does.

Worse, as more scar tissue builds up it increases your chance of developing congestive heart failure.

Carotid artery disease occurs when plaque builds up in the *carotid* arteries, which are found on each side of your neck.

Blockages or narrowing of the carotid arteries decreases blood flow to the brain. This severely reduces blood flow (ischemia) to the brain and is the cause of about 90 percent of strokes.

There are two different types of ischemic stroke.

The first is called a *thrombotic stroke* and is responsible for an estimated 50 percent of all strokes. This type of stroke occurs when the artery is narrowed due to plaque, the fatty deposits and cholesterol that build up in the carotid arteries.

When the plaque cracks or breaks open a blood clot may form on the surface of the plaque (thrombosis) and block the artery altogether. This cuts off the supply of blood, oxygen and nutrients to the brain causing a stroke.

The second type of ischemic stroke is an *embolic stroke*. This is when a blood clot is formed elsewhere in your body and travels through your bloodstream into your brain. When the clot tries to enter a blood vessel too small

to pass through it ends up blocking the vessel. This disrupts blood flow and may result in a stroke.

Peripheral artery disease – also known as peripheral vascular disease – is another vascular disease caused by plaque build-up. It's basically the narrowing of blood vessels and restriction of blood flow to areas other than the heart and brain; like the arms, legs, kidneys and other areas.

The most common areas affected are usually the legs and pelvic region.

When you lose adequate blood flow to the legs it can result in pain, numbness and infection. Symptoms include varicose veins, shiny skin on the legs and feet and painful cramping in the calves, hips, thighs or buttocks. Individuals with peripheral artery disease are more likely to have other vascular complications involving the brain and heart.

Sidestep Heart Disease With Glutathione

Studies repeatedly demonstrate that patients with cardiovascular disease have more free radical activity and oxidative damage. And it turns out glutathione levels may be one of the deciding factors when it comes to your cardiovascular health.

In one study researchers measured glutathione levels in 58 patients with proven coronary artery disease. When they stacked the results up against 50 healthy patients, those with coronary artery disease had glutathione levels about 20 percent lower than the healthy controls.⁷⁹

Another study comes from the United Kingdom's Royal Infirmary.

The researchers took blood samples from 8 patients in a row. All of the patients had 75% blockage in at least three coronary vessels and were getting prepped for coronary bypass operations. When compared to 8 healthy control subjects guess what the researchers discovered.

Once again, the heart bypass patients had lower glutathione levels.⁸⁰

Other research shows that people who have suffered from heart attack, stroke and brain hemorrhage all had lower blood plasma levels of glutathione.

At the same time, elevated total glutathione levels were associated with decreased risk of these events.⁸¹

When you add it all together it's easy to see why glutathione is such an important antioxidant when it comes to your cardiovascular health. It helps increase the availability of nitric oxide and improve endothelial function. It reduces oxidized LDL cholesterol and plaque build-up in the arteries.

But hang onto your seat, because there's a lot more to learn about glutathione. If you think it's great for your cardiovascular system, just wait until you see what it can do for your mental health.

Chapter 5: Do You REALLY Have to Lose Your Mind as You Age?

Declining mental health is one of the biggest concerns associated with aging. The concept of forgetting how to do even the simplest things, like cooking or telling time, is very scary. It's even scarier to imagine what it would feel like if you were unable to remember the people, places and events that are the foundation of your life.

It's estimated that between 5 and 8 percent of all people over the age of 65 will be affected by some form of dementia. But this number grows exponentially as you age. According to the Cleveland Clinic, half of people 85 or older are believed to suffer from dementia.

When dementia strikes it affects mental function associated with memory, reasoning, thinking and language. It may also result in personality changes such as moodiness, agitation and emotional instability.

Just imagine how awful it would be to hit the ripe old age of 100 in perfect health, only to discover your mind has become a wasteland of useless memorabilia loaded with forgotten context.

I don't know about you. But if I'm going to bypass the century mark, I want *all* of my mental facilities to accompany me on my journey.

Here's what you can expect when the onset of dementia begins disrupting cognitive function:

Visuospatial memory is the ability to use visual information to develop spatial relationships between objects. It's what allows you to immediately recognize shapes, like a square or triangle.

It also gives you a "mental map" of shapes, dimensions and distances that help orient you in every day life; the location of the bed in your house, how far it is from home to the grocery store... and exactly how to get there.

Once older people begin forgetting where they parked their car or find themselves lost in familiar surroundings, it's typically a symptom of visuospatial impairment.

Episodic memory relates to memory specific to events and experiences. It's the storybook of your life – from falling off your bicycle when you were five to celebrating the birth of your first grandchild. People with diminished episodic memory often have difficulty learning and remembering new information.

Semantic memory refers to general knowledge like how to spell, what the things around you are used for and concepts not related to personal experience. And when it comes to dementia, it's probably one of the biggest worries.

Suddenly you can't remember how to string letters together to form a word. You forget what a screwdriver used for or that you have to turn on the television to get a picture.

Working memory and **executive function** involve active reasoning and comprehension.

Working memory temporarily stores all of the information you need to process difficult mental tasks, while executive function is responsible for the mental manipulation required to form concepts and solve problems. Dementia patients often experience deficits in both of these areas.

It's interesting to note that medical authorities don't consider dementia a disease.

Instead, it's viewed as a group of symptoms related to other health conditions which affect the brain. Some of the disorders that can cause dementia include Alzheimer's disease, Huntington's disease, Parkinson's disease, vascular disorders (stroke,) metabolic disturbances and even heart and lung problems.

There are two common denominators found in all of these diseases: *A high degree of oxidative stress and decreased levels of glutathione.*

Alzheimer's Disease

According to the Alzheimer's Association 5.4 million Americans have Alzheimer's Disease. It's the sixth leading cause of death in the U.S. and the likelihood of developing it doubles about every five years after age 65. After age 85, the risk reaches nearly 50 percent.

People with Alzheimer's disease experience a decline in mental function that can cause them to become lost or disoriented, even in familiar surroundings. This is caused by impairment of visuospatial memory. And it's one of the first symptoms associated with Alzheimer's.

However, the hallmark of this devastating disorder is episodic memory loss – a condition where memorable events and situations become forgotten.

If you've ever spent time with someone who is experiencing this devastating loss of memories, you know exactly how painful it is to watch them struggle to remember even the simplest events or conversations.

Alzheimer's disease is characterized by the accumulation of amyloid plaques (*amyloid b*) and neurofibrillary tangles.

Let me explain...

In a healthy brain, amyloid plaques are broken down and eliminated. But in someone with Alzheimer's disease, the plaques build up around the nerve cells in the brain and affect brain activity.

Neurofibrillary tangles are found inside the brain's cell. They appear as thread-like tangles which are composed of a protein called tau. In normal circumstances tau itself isn't harmful. But the irregular tangles found in Alzheimer's patients aren't normal and they cause cell death.

So the big question you have to ask yourself is this: What causes these peculiar changes in the Alzheimer's brain?

Early Symptoms of Alzheimer's

- Loss of short-term memory
- Forgetting words, names and places
- Losing things
- Disorientation
- Depression or mood swings
- Loss of motivation
- Difficulty with math calculations
- Inability to make decisions

It turns out the answer is pretty simple. Study after study links the development of senile plaques and neurofibrillary tangles with *excessive oxidative stress*.

What's worse, amyloid b causes further oxidative damage through protein oxidation, free radical formation and neuronal death.^{82 83 84}

It also appears that over-expression of a certain gene (APP) may increase the secretion of toxic amyloid b peptides. However, glutathione is able to tone down the APP gene expression and *offer protection against these devastating plaques*.

It may also help diminish the toxic effect of amyloid b in the Alzheimer brain and protect against reactive oxygen species.^{85 86}

One thing you should be aware of is this; Alzheimer's patients with low plasma levels of glutathione have more severe cognitive impairment than those with higher glutathione. In fact, the link is so strong that glutathione levels are a significant and independent predictor of cognitive scores in patients.

The good news is boosting glutathione levels can help improve cognitive function after only 3 to 6 months of treatment.^{87 88}

With that in mind, I'll bet it won't surprise you to hear that elevation of glutathione is one of the most effective ways to reduce oxidative stress in Alzheimer's disease.

There's no doubt about it. Glutathione content is significantly decreased in patients with Alzheimer's disease.

Parkinson's Disease

Parkinson's is a degenerative disorder of the central nervous system that affects the way your body moves. Key symptoms associated with Parkinson's include tremors, stiffness, slow movement and impaired balance.

While Parkinson's disease (PD) itself is not a form of dementia, some people with PD may experience memory problems, a slowed thought process and other cognitive impairment followed by full-blown dementia in the late stages of the disease.

PD occurs when nerve cells in a certain part of the brain, called the *substantia nigra*, die or become impaired. These nerve cells produce dopamine, which plays an important role in behavior, cognition, attention, learning and mood.

It also helps your brain tell your muscles to move the way you want them to.

When you have Parkinson's disease, these dopamine producing neurons break down and cause you to lose the ability to accurately control movement. It's estimated that about 60 to 80 percent of dopamine-producing cells in the substantia nigra are lost by the time symptoms appear.

It all comes down to this... *Glutathione depletion leaves the nigral neurons open to toxic free radical exposure.*

As such, it's believed a loss of glutathione is the earliest marker of nigral cell loss. Research conducted by the Parkinson's Disease Society Research Laboratories in London support this belief.

Their research showed patients dying of Parkinson's disease had a 40 percent reduction of nigral glutathione compared to the control subjects. And when the researchers measured the ratio of reduced glutathione to oxidized glutathione – which is an indicator of cellular health – the results pointed to oxidative stress as a major cause of nigral cell death in PD.^{89 90}

Huntington's Disease

Huntington's disease (HD) is a progressive disorder that causes various parts of the brain to deteriorate. Huntington's victims may experience involuntary jerking and twitching, mental impairment and mood changes.

As the disease progresses it may become difficult to reason, find words for conversation, retain new information or focus on something for more than a few minutes.

Huntington's is a genetic disease with no known cure. However, there is very strong evidence from both human and animal models which suggests oxidative damage may have an active part in neuronal death and degeneration in the HD brain.^{91 92}

Just take a look at one of the few human studies analyzing the relationship between oxidative damage and glutathione in patients with the disease...

The participants included 19 Huntington's patients, 11 HD gene carriers and 22 healthy individuals. As you might guess, oxidative stress was more pronounced in the HD patients and HD carriers than the control subjects.

And get this... the higher the oxidation, the worse their outcomes were on the verbal fluency test and their scores for uncontrolled, jerky movements (chorea).

But that's not all the researchers discovered. They also found that glutathione levels were reduced by 28 percent in the HD patients and 27 percent in carriers when compared to the healthy subjects.

In the study, the authors note that decreased glutathione levels are indicative of oxidative stress, and further go on to state the data suggests that oxidative stress occurs *before* the onset of HD symptoms.

*“The current results demonstrate the presence of oxidative stress in HD patients illustrated by a higher plasma level of lipid peroxidation products and a lower level of oxidant-protective glutathione as compared to healthy controls.”*⁹³

It couldn't be more clear that boosting glutathione has great value in protecting both your mental and physical health as you age.

Chapter 6: Cancer and the Glutathione Connection

Cancer is one of the most dreaded diseases in America. It's like a parasite invading your body. The cancer cells develop their own network of blood vessels. They siphon nourishment away from your body's main blood supply and cluster into tumors that invade healthy tissue.

Your body is sapped of energy and releases toxic poisons that leave you feeling weak and listless. These poisons penetrate you to the core, turning normal cells into killer troops that multiply out of control and never want to die.

Behind heart disease, cancer is the second leading cause of death in the U.S. Almost 570,000 million cancer deaths were projected in 2010 along with 1.5 million new cancer diagnoses.

It's one of the most devastating illnesses of modern day life. And the different types of cancer that invade our lives are overwhelming.

There are leukemias, lymphomas, melanomas, tumors and carcinomas. Breast cancer, prostate cancer, lung cancer, colon cancer... and much, much more.

No one wants to go through the long, drawn out trauma of cancer or face an untimely death that will crush the hearts of their loved ones.

So let me tell you exactly how cancer works... and how you can protect yourself.

Cancer is caused by changes in a cell's DNA. In some cases it's believed to be genetic. But in today's world, environmental factors are a key contributor to these changes.

The American Cancer Society now says that only about 5% of cancers are strongly related to hereditary factors.

The other 95% result from damage that occurs over your lifetime. Smoking, chemicals, radiation, medical treatments, pollution, food additives and other toxic agents all add to your cancer risk.

The compounds that lead to cancer are called *carcinogens*.

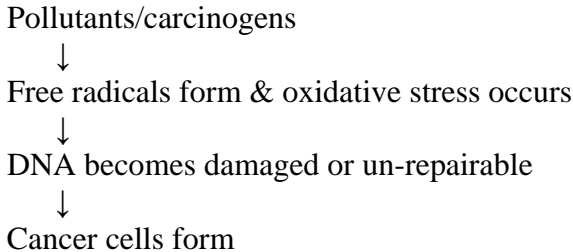
Exposure to these cancer-causing agents may cause cells to start replicating at an uncontrollable rate. This increases the chance of DNA damage and may lead to development of cancerous tissue. As this process blossoms out of control, healthy tissue is pushed aside and the cancerous cells take over.

It's important to understand that even if a single cell in your body starts to multiply uncontrollably it can begin a deadly cascade.

Here's how it works. Carcinogens generate free radicals and other reactive species (RS.) These are powerful oxidizing agents that damage DNA and lead to

uncontrollable growth of mutated cells. This, in turn, promotes the development of malignancy.

Even if the DNA isn't attacked directly, the enzymes that repair oxidative DNA may become impaired. Either way, increased RS is widely accepted as a major cause of cancer.



The Most Common Types of Cancer... and the Deadliest

The most common type of cancer in the U.S. is prostate cancer, with breast and lung cancer following right on its heels.

And by far, the most deadly is lung cancer. The thing to keep in mind is that all cancers involve oxidative stress and mutation of the DNA that controls cell division.

I'll tell you more about what you can do to prevent these mutations from occurring at the end of this chapter.

But first, let's talk about some of the most common types of cancer and some of the risk factors involved.

Prostate cancer* symptoms don't usually occur until it's relatively advanced. At that stage it shows itself in the way you urinate. A weak or interrupted flow, difficulty

starting and stopping, frequent nighttime trips to the bathroom and pain or burning may all appear as symptoms of prostate cancer. Achy hips, spine and ribs can occur in advanced cases which have spread to the bones.

According to the American Cancer Society, 97% of cases of prostate cancer occur in men 50 years of age and older.

And recent research from the National Cancer Institute shows men who eat high amounts of processed meats have an increased risk of advanced prostate cancer. Further, they found eating grilled or barbecued red meat adds a 36% increase in risk.⁹⁴

Breast cancer* can be detected at an early stage through self-breast exams.

Any lumps or other changes in feel should be reported to your physician immediately. Other changes in the breast, such as discharge, swelling, tenderness or thickening may also be an indication that something is wrong.

Excess weight, use of hormone replacement drugs or contraceptives and excess alcohol intake can all increase a woman's risk of breast cancer.^{95 96 97}

Eating meats cooked at high temperatures has also been linked to breast cancer. Women in the Iowa Women's Health Study who consistently consumed meats that were very well done had a 4.62 times higher risk of breast cancer than those who ate their meat rare or medium done.

And the more often they ate well-done meat, the greater their risk.⁹⁸

*It's important to note that today there's quite a controversy raging about the use of cancer-

screening techniques used for both prostate and breast cancer detection.

The PSA test for male prostate cancer tends to throw off “false-positive” results. This occurs when PSA levels are elevated, but there is no cancer present. In fact, only 25% to 33% of men with elevated PSA levels actually have prostate cancer. This means 66% to 75% of men undergo risky medical procedures only to be told they do not have cancer of the prostate. On the flip-side, false negative results may also appear. This can happen when prostate cancer is present, but PSA levels are in normal range.⁹⁹

Mammogram detection for breast cancer has similar limitations. They may result in a false-positive reading when no cancer is apparent. And these screenings also miss up to 20% of breast cancers.

Another concern with mammograms is the radiation exposure to the breast. While the dose is low, repeated exposure can potentially increase cancer risk.

Lung cancer accounts for about 28% of all cancer deaths. Persistent cough, chest pain, bloody sputum and repeated bouts of pneumonia or bronchitis are all symptoms of this deadly disease.

We’ve already discussed that smoking tobacco products is a key factor in lung cancer.

But other things may also contribute to your risk. The American Cancer Society notes that exposure to radon gas, which we talked about earlier, is the second leading cause of lung cancer in Europe and North America. Metals (such

as chromium, cadmium and arsenic,) radiation and air pollution may also weigh in on your risk.

Colon cancer typically strikes after the age of 50. While it probably won't make itself known in the early stages of the disease, advanced stages may result in bloody stool, rectal bleeding and abdominal cramping. Obesity, alcohol consumption and a high intake of processed meats are all associated with increased risk of colon cancer.^{100 101}
¹⁰²

Skin cancer isn't reported to the cancer registries, so it's hard to know exactly how many cases there are each year. But it's estimated that around 3.5 million cases were diagnosed in the U.S. in 2006.

The good news is that less than 5 percent of skin cancers result in melanoma. The important thing to watch for is a change in size, shape or color of a mole or growth. Also watch out for any sores or skin irritations that refuse to heal.

Pancreatic cancer shows a startling ratio of deaths in relationship with new diagnoses. The estimates from the American Cancer Society show 37,390 deaths versus 43,920 new cases for 2012. This may be due to the fact that survival rates are very low in patients diagnosed with this form of cancer. The one year survival rate is 26% while 5 year survival rates are only 6%.

Sadly, there is no early screening available for pancreatic cancer. And because symptoms are not specific to the disease (weight loss, abdominal pain) it may be difficult to get an early diagnosis. Research shows that smoking cigarettes causes up to a 75% increase in the risk of pancreatic cancer compared to non-smokers. Additional factors include diabetes and obesity.^{103 104}

Liver cancer is another form of cancer with low survival rates; 14% survival over a 5 year period. The majority of liver cancer in the U.S. is directly attributed to alcohol-related cirrhosis and non-alcoholic fatty liver disease. Additionally, about half the cases are associated with Hepatitis B and C. (See chapter 3 for more about liver health.)

Other types of cancer (bladder, kidney, leukemia, ovarian, lymphoma, etc.) all have a similar thread. Excess weight, smoking, radiation, chemical exposure, diet and altered immune function – which all produce oxidative stress – contribute to the risk of developing any and all of these cancers.

Projected Cancers for the year 2012

Cancer Type	Estimated New Cases	Estimated Deaths
Bladder	73,510	14,880
Breast (Female – Male)	226,870 – 2,190	39,510 – 410
Colon and Rectal (Combined)	143,460	51,690
Endometrial	47,130	8,010
Kidney (Renal Cell) Cancer	59,588	12,484
Leukemia (All Types)	47,150	23,540
Liver	28,720	20,550
Lung (Including Bronchus)	226,160	160,340
Melanoma	76,250	9,180
Non-Hodgkin Lymphoma	70,130	18,940
Pancreatic	43,920	37,390
Prostate	241,740	28,170

Thyroid	56,460	1,780
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Source: American Cancer Society

Antioxidants are your natural defense against cancer. Research shows that high levels of these protective nutrients can guard against the environmental toxins that attack your body every day.

High levels of antioxidants have been shown to protect against all types of cancer. And even if you already have cancer, you can help keep it under control with antioxidants by slowing the rate of growth and boosting your immune response.

Repair Your DNA and Avoid Cancer Altogether

One way to avoid cancer is by locking yourself into a hermetically sealed room and only eating fresh foods filled with antioxidants, minerals and vitamins.

Since that's probably not an option, the first thing you can do is start watching out for the carcinogens in your life.

- ✓ Avoid cigarettes, tobacco products and tobacco smoke.
- ✓ Reduce exposure to solvents, gas fumes and automobile exhaust.
- ✓ Stick with organic pesticides and fertilizers.
- ✓ Stay away from processed meats containing nitrites or nitrates.
- ✓ Don't eat meats that are well-done, barbecued or pan fried. Meats cooked at high temperatures produce cancer-causing heterocyclic amines.
- ✓ Watch out for starchy fried foods (they release a carcinogen called acrylamide).
- ✓ Reduce or stop alcohol consumption.

- ✓ Select quality grass-fed beef and cage free poultry.

Another way to cut down your cancer risk is to reduce oxidative damage. Glutathione has the power to mop up free radicals at the cellular level. But that's not all it does. **It can also help in the synthesis and repair of damaged DNA.**

And get this: glutathione is so powerful against cancer that medical scientists have recently been developing formulas that target the glutathione detoxification system and help to improve chemotherapy results.¹⁰⁵

The medical community's interest in glutathione isn't unfounded. A number of studies performed since 1984 indicate glutathione-boosting NAC has the potential to prevent cancer. NAC is a precursor of intracellular glutathione, which improves antioxidant activity and helps in the detoxification process.

Of particular interest is the protective effect it has on DNA damage and the development of cancer cells. For instance, one study out of Italy shows boosting glutathione levels with N-acetyl-L-cysteine inhibits spontaneous mutations, suppresses the development of tumors and helps stop carcinogens from bonding with DNA.^{106 107}

In another, NAC was administered to children with lymphoblastic leukemia who were undergoing chemotherapy. Twenty children were given NAC and vitamin E while another twenty received no supplementation.

Toxicity from chemotherapy and radiotherapy was reduced in the group taking NAC. Additionally, NAC helped reduce the occurrence of hepatitis and lowered the need for blood transfusions.¹⁰⁸

Studies also suggest selenium reduces oxidative stress and protects against cancer by enhancing glutathione. Higher glutathione levels increases glutathione peroxidases (GPX) activity. This is the group of enzymes that reduce hydrogen peroxides in your body that may damage your cells on a DNA level.

Research shows that supplementing with just 50 to 100 mcg of selenium daily for 15 weeks can increase GPX activity.¹⁰⁹

In an interesting study conducted at seven dermatology clinics in the U.S., researchers set out to see how selenium supplementation affected skin cancer.

The trial period was long-term; from 1983 through 1991 and involved 1312 patients with a history of skin cancers. What the researchers discovered was very exciting...

While the selenium supplementation did not significantly reduce the number of skin cancers, it did have a very positive impact on other cancers. The people taking selenium had fewer incidences of lung, colon and prostate cancer.

They also had a significant reduction in total cancer deaths. Sadly, there were almost twice as many deaths in the non-selenium group. And when it came to total cancers, the folks who weren't treated with selenium had about 54% more cancers than those who took the supplement.¹¹⁰

Additional studies on selenium are just as revealing...

Lung cancer: A recent meta-analysis of 16 studies associated higher toenail selenium levels with a 54 percent reduction in risk of lung cancer.¹¹¹

Bladder cancer: A review of seven published studies on bladder cancer and selenium was conducted in Spain. The authors report that “...results suggest a beneficial effect of high selenium intake for bladder cancer risk.”¹¹²

Prostate cancer: In one study men with higher levels of toenail selenium had a 65 percent lower risk of developing prostate cancer. In another, men with the lowest levels of plasma selenium were 4 to 5 times more likely to develop prostate cancer.^{113 114}

Breast cancer: Low selenium concentrations have also been found in women with breast cancer. Women with higher selenium intake have fewer incidences of breast cancer.^{115 116}

Chapter 7: For Men Only: Keep Your Sexual Potency as You Age

As men age, their testosterone levels gradually decline. According to the Mayo Clinic, the drop in testosterone is typically about 1 percent a year after age 30. And a recent study suggests that approximately 24 percent of men over the age of 30 have low testosterone. That’s about 1 in 4 men.¹¹⁷

This steady decline in the production of testosterone may result in *andropause*, which is often called male menopause.

Men experiencing andropause often suffer from erectile dysfunction and become impotent in the bedroom. That’s a curse no man wants to live with.

And to make matters even worse, it’s not the only problem associated with testosterone loss. Andropause can also lead to excess belly fat, loss of muscle strength and the development of breast tissue, or “man-boobs.”

In other words, all of the things that make you a man – like a lean muscular physique and healthy sex drive – begin to disappear.

This loss of manhood leads to even further complications. Men going through these changes often experience...

- Irritability and mood swings
- Anxiety, nervousness and indecision
- Decreased energy and feelings of fatigue
- Interrupted sleep and insomnia

As if that's not bad enough, once testosterone levels diminish, your risk of certain diseases skyrockets.

Heart disease: Men with low testosterone levels have been shown to have higher cholesterol and triglyceride levels than men within normal testosterone ranges.

Men are also more likely to have plaque build-up in the arteries which can lead to heart attack and stroke. Even worse, low testosterone levels in men with coronary heart disease could more than double your risk of cardiovascular death.^{118 119 120}

Alzheimer's and dementia: Study after study shows that men who develop Alzheimer's have reduced testosterone levels prior to the onset of Alzheimer's symptoms. The link is strong enough that researchers suggest amounts of free testosterone can be used to predict your chances of developing Alzheimer's disease.^{121 122}

Diabetes: Research shows that around 57% of men with type 2 diabetes have reduced free testosterone levels. Some researchers even suggest testosterone levels may be a predictor of diabetes risk. The connection between diabetes is so strong the Endocrine Society now recommends that all men with type 2 diabetes have their testosterone levels measured.¹²³

While you may think growing fat, sick, weak and impotent is simply part of the normal aging process, it's simply not true. The secret lies in maintaining healthy testosterone levels as you age.

Glutathione is the Secret to MORE Testosterone

About 96% of the testosterone found in the male body is produced in “Leydig cells,” which are located in the testes. Amazingly, only 2.5 percent of the testicle is composed of Leydig cells. The rest of it consists of connective tissue and blood vessels.

But guess what? As your testicles age, the total number of Leydig cells available to manufacture testosterone decreases. Some research shows a 44% reduction of Leydig cells in older men. **That's a loss of nearly half of these testosterone-producing cells.**¹²⁴

And if you have low glutathione levels, it could make matters even worse. **In animal models, glutathione depletion in the Leydig cells is associated with a 40% to 50% decrease in testosterone production.**

So if you're already working at 44% capacity from Leydig cell loss... then add glutathione deficiency on top of it, you may be producing only 20% to 25% of the testosterone you did when you were younger.¹²⁵

Further research shows GPX (glutathione peroxidases) activity in Leydig cells is significantly decreased with age.

If you recall from earlier in this book, GPX protects cells from free radicals and oxidative damage caused by hydrogen peroxides in the body. Studies suggest reduced

function of Leydig cells may be, in part, caused by lowered antioxidant status.¹²⁶

As the master antioxidant, glutathione has the ability to support all of the antioxidant activity in your body and offer cells – including Leydig cells – the support they need to battle free radical damage and oxidative stress.

And if you're experiencing lackluster performance in the bedroom, there's one more thing you need to consider.

In addition to maintaining adequate testosterone levels, it's also important to keep the blood flowing to the penis.

Nitric oxide (NO) is used by the inner lining of the blood vessels to relax smooth muscle and increase blood flow. Smooth muscle relaxation is essential to developing and maintaining a firm erection.

An inability to remain rigid may be due to reduced NO activity and increased oxidative stress caused by free radical damage. Supplementation with glutathione enhances NO activity and improves vascular function of the blood vessels.^{127 128}

Aging Males' Symptoms (AMS) Rating Scale

Symptoms of Aging Men – Score symptoms:

1 - no symptoms, 2 - mild, 3 - moderate, 4 - severe and 5 - very severe

Symptom	Rating
1. Deterioration of well-being	_____
2. Complaints in joints or muscles	_____
3. Sweating	_____
4. Sleep disturbances	_____
5. Increased need for sleep	_____
6. Irritability	_____
7. Nervousness	_____
8. Anxiety	_____
9. Exhaustion or decreased energy	_____
10. Decrease in muscular strength	_____
11. Depressed mood	_____
12. Feeling of having passed the zenith in life	_____
13. Wish to be dead or feeling totally discouraged	_____
14. Decrease in beard growth	_____
15. Decrease in potency	_____
16. Decrease in frequency of morning erections	_____
17. Decrease in libido or sexual activity	_____

Source: Bain J. Andropause. Testosterone replacement therapy for aging men. Can Fam Physician. 2001 Jan;47:91-7.

For each line item, rank your symptoms using the scale above. Then, total your score (make sure to count all lines.) It can range anywhere from 17 to 85.

If your score is greater than 50, chances are good you're beginning to experience the mid-life changes associated with andropause.

Chapter 8:

Glutathione Can Extend Your Life Span... Even if You HAVE the HIV Virus

Human immunodeficiency virus (HIV) wears down the immune system.

While many people can live with this disorder for decades without symptoms, it can also progress into acquired immune deficiency syndrome (AIDS) in just a few short years. AIDS is the late stage of HIV where the body is literally wasting away.

Most people infected by HIV develop flu-like symptoms anywhere from a few weeks to a month after the virus enters the body. Some of the symptoms include fever, muscle aches, headache, sore throat and swollen lymph glands.

Then, after a week or two, it goes away. This makes it difficult to identify the source of the symptoms as anything other than a bad case of the flu. And it may take up to ten years or more before further problems arise.

The thing to remember if you have HIV is *even if you have no symptoms, the infection is still eating away at your immune response*. With this in mind, it's very important to begin taking care of yourself immediately. The more

quickly you begin supporting your immune system, the better your chances of survival.

When HIV strikes it systematically begins destroying a type of blood cell called CD4 cells, or T-cells. CD4 T-cells protect against infections and are crucial in your body's defense against disease. When you have HIV, the virus becomes part of the cells and replicates as the cells multiply. As HIV continues to gobble up your CD4 cells, your body increasingly loses the ability to fight infection.

Once your immune function is decreased, it opens the door to “opportunistic infections” that can further damage your immune system. Some of these infections include:

- Candidiasis (thrush) – a fungal infection that can affect the mouth, throat and vagina
- Pneumonia, especially pneumocystis pneumonia, a fungal infection that almost always affects the lungs and can result in death
- Tuberculosis, another bacterial infection that targets the lungs
- Herpes, either in the form of cold sores or genital herpes are common in HIV patients
- Cervical cancer and lymphoma
- Numerous viral, bacterial and fungal invasions

Untreated early HIV infection is also associated with cardiovascular, kidney and liver disease. And later stages of HIV may result in “wasting syndrome,” a term used to describe loss of weight and muscle mass accompanied by diarrhea or weakness and fever.

Protect Yourself from the HIV Invasion

When it comes to your immune health, HIV is like a double-edged sword. On one side, HIV patients have higher

levels oxidative stress. On the other, the disease itself increases the oxidative stress process. So it's a double-whammy to your body's major defense system.¹²⁹

I don't want to get too technical about it, but oxidative stress activates replication of HIV and damages cellular DNA. Both of these are chief factors that help the disease invade every single cell in your body. To top it off, HIV patients have abnormally low levels of glutathione. And make no mistake about it; low glutathione levels promote HIV expression and impair T-cell function.^{130 131}

T-cell function is a big part of the HIV story, so stick with me for just a few more minutes while I explain...

The two most important T-cells associated with HIV are CD4 and CD8. We talked about CD4 earlier. These are the cells that try to fight off the infection by multiplying.

But remember! The HIV virus becomes a part of the CD4 T-cells. So as they multiply, the HIV virus gets copied with them. Over time, the number of CD4 cells in the body run down.

That's when CD8 T-cells jump in and try to rescue your health. They do this by blocking the replication of CD4 in people with HIV and killing off cells that express HIV. They also lower your viral load.

And get this: *The longer CD8 cells are able to suppress replication of the HIV contaminated CD4 cells, the longer you can live without symptoms of the disease.*^{132 133 134}

Stop Killer HIV Cells from Invading Your Body and Add Years to Your Life

Keeping vital CD8 T-cells in good working order for as long as possible is essential to your long-term health and an increased lifespan. And the more you can do to protect your CD4 cells at the same time will add to a better life expectancy.

But here's the wrinkle: glutathione levels in CD4 and CD8 cells are significantly lower in HIV patients compared to healthy people. And by significant, I don't mean a little bit significant. I mean a *lot* significant.

In later stages of infection, glutathione levels in CD4 and CD8 are reduced by almost 40 percent. Research shows that glutathione deficiency, particularly in CD4 T-cells, could take an additional two to three years off your life.^{135 136}

Knowing this gives you a huge advantage in the fight against HIV. Why? Because further research confirms that, just by supplementing with NAC, you can slow down the decline of CD4 T-cells and boost glutathione levels to about 89% of par.

That's just a measly 11% lower than people who aren't infected with the disease. And it could mean the world to you in the form of a longer and healthier lifespan.^{137 138}

In a study published in *Immunology Today*, German researchers made the following observation...

“...patients with manifest AIDS may improve substantially on NAC therapy but cannot be cured.... However, it is possible that treatment of HIV infected patients in the early stages of the disease with NAC may help to prevent the progression to AIDS. About 90% of the HIV-infected individuals are still in the pre-AIDS

stages, and NAC is a relatively safe and inexpensive drug.”¹³⁹

Other research shows whey protein can also improve glutathione levels and reduce the effects of wasting syndrome. In a very small study, HIV patients were given a bovine whey protein called Immunocal. They started off drinking .29 ounces daily and increased the amount to 1.38 ounces by the end of the 12-week study.

All of the patients put on anywhere from 2.5% to 5% added body weight. Glutathione levels improved in the patients and, in one case, glutathione was increased by 70%, bringing the patient back to normal glutathione levels.¹⁴⁰

The power behind Immunocal’s glutathione-boosting activity is so powerful that in 1997 the CDC Aids Daily Summary stated, “Laboratory studies have shown that a new whey protein concentrate, called Immunocal, can inhibit HIV replication while also stimulating the production of glutathione, an amino acid that helps control the progression of the virus.”

All in all, there is hope for survival if you’re HIV positive. By improving glutathione activity you can remain symptom free longer, add years to your life and potentially prevent the progression to AIDS. This is all good news in the fight against AIDS.

Chapter 9: How to Boost Your Glutathione Levels

Glutathione is produced naturally inside your body from three amino acids; glutamate, glycine and cysteine. These are the building blocks, or precursors, to healthy glutathione synthesis and they are readily available in our food supply.

Problem is, in addition to the toxic assault on our bodies from the pollution and chemicals around us, we don't always eat the way we should. And a lot of the foods we put into our mouths, like sugars, processed flours, trans fats and processed meats are just as toxic as the environment.

If you're not getting the nutrients your body needs to produce glutathione, your levels will drop.

To ramp up your glutathione levels I'll bet your first thought is to run out to the health foods store and buy a glutathione supplement.

Not a good idea.

It may sound bizarre, but your body doesn't readily absorb standard oral glutathione formulas.

Even if you try mega-dosing it won't offer much support; it's destroyed by your digestive system before it has a chance to get to your cells.

Don't worry. There are many glutathione precursors that work synergistically in your body to boost your glutathione levels and keep them up to par. Here are just a few nutrients that can improve your glutathione production.

N-Acetyl-Cysteine (NAC) is the most frequently used supplement in human glutathione studies. Entire papers have been written on NAC, linking its glutathione-boosting activity to everything from the flu to cancer, HIV, heart disease, heavy metal poisoning and more.¹⁴¹

NAC has been used clinically for more than 40 years. It's best known for its ability to breakdown thick mucus in the respiratory tract and lungs through improved glutathione status. And because of its ability to protect the liver, it's used extensively by emergency care workers to treat cases of acetaminophen poisoning.

In recent years more and more NAC studies have focused on conditions linked to oxidative stress and low glutathione levels, such as heart disease, cancer and HIV infection.

Here are some things you should know about NAC:

- ✓ NAC has been shown to enhance the detoxification process in both the liver and the lungs. It appears the protective effects are a direct result of increased glutathione metabolism and the alteration of carcinogens into less toxic compounds.¹⁴²
- ✓ Boosting glutathione levels with NAC can stop DNA damage associated with the development of cancer cells. It suppresses the development of

tumors and helps stop carcinogens from bonding with DNA. It also reduces toxicity from chemotherapy and radiotherapy.^{143 144 145}

- ✓ NAC may be helpful in some psychological disorders that stress both your mind and body. Patients with schizophrenia, bipolar disorder and depression all have something in common – decreased levels of glutathione in the brain. NAC appears to increase brain glutathione levels. And when Alzheimer’s patients were given NAC for six months, they showed improvement in nearly every cognitive outcome measured.^{146 147 148}
- ✓ HIV patients have glutathione levels about 30% of normal. Supplementation with NAC can bring those levels back up to about 89% of par.¹⁴⁹

Food sources of cysteine include poultry, yogurt, red peppers, garlic, soybeans, egg yolks, onions broccoli and wheat germ.

However, some experts say the amount of cysteine found in these foods is not enough and suggest the best source is through supplementation. You can find N-acetylcysteine at your local health food store.

Typical doses range from 250 mg to 1,500 mg per day depending on your own individual needs.

NOTE: If you take NAC for an extended period, make sure you take extra vitamin C, and extra minerals like zinc, copper, etc. as NAC can pull these minerals out of your blood.

Alpha lipoic acid (ALA) increases the uptake of cysteine into your cells which, in turn, helps improve glutathione production. ALA also binds with certain

metals. This reduces the formation of free radicals and adds a further boost to glutathione levels.¹⁵⁰

One of the most intense areas of research on ALA is in association with the damage diabetes and hyperglycemia causes to the lining of your blood vessels (the endothelium).

These blood sugar abnormalities generate an excess of free radicals which produce oxidative stress and impair nitric oxide activity.

If you recall our discussion in Chapter 4, the root of almost all cardiovascular problems starts with endothelial dysfunction and low levels of nitric oxide.

Once the endothelium is compromised, atherosclerosis begins to develop. Adequate nitric oxide helps keep the endothelium toned and relaxes the smooth muscle to keep the blood flowing smoothly.

Due to the arterial damage caused by diabetes and glucose problems, people with these conditions are at much higher risk of heart disease and cardiovascular complications.

In fact, if you're diabetic you are 2 to 4 times more likely to die of cardiac causes than your non-diabetic counterparts. So it's important to stop the destructive ravages of uncontrolled blood sugar in its tracks.

Alpha lipoic acid helps improve glycemic control associated with diabetes, stops free radical damage and improves glutathione activity.

Studies show it also improves endothelial function – partly by balancing oxidative stress and the antioxidant defense system, and partly by increasing nitric oxide action

to widen and relax the smooth muscle of the arteries. ^{151 152}
153

Over the past five years or so, researchers have begun investigating ALA's potential to ward off dementia and Alzheimer's disease. Thus far, the results are very promising.

ALA appears to improve the structure and function of cells responsible for energy. It also restores the activity of key enzymes and increase production of acetylcholine, a neurotransmitter that improves brain function and memory. When patients with moderate dementia were given 600 mg of ALA it resulted in a stabilization of cognitive function and the disease progressed more slowly. ^{154 155 156 157}

Organ meats like liver, heart and kidneys are the best natural sources of alpha lipoic acid. It can also be found in brewer's yeast and green, leafy vegetables. And of course, you can take it as a supplement. Most offer ALA as a 600 mg dose per day.

Selenium. If you don't get enough selenium it can cause a decrease in glutathione peroxidases (GPX) activity. We talked about GPX earlier in the book. It's a group of antioxidant enzymes that reduce hydrogen peroxides in your body. Peroxides are easily turned into free radicals that may damage your cells on a DNA level. This, in turn, leaves you wide open for many of today's major health issues.

Research shows that supplementing with just 50 to 100 mcg of selenium daily for 15 weeks can increase GPX activity. Plus, it significantly increases the percentage of CD4 T-cells. Remember, CD4 T-cells are the ones that protect your body against disease and infections. So the

earlier you can rally a response from them during illness, the better your outcome will be.¹⁵⁸

The best news about selenium is in the battle against cancer. Using data from 27 countries, researchers at the University of California found selenium levels were significantly associated with cancers of the large intestine, rectum, prostate, breast, lung and with leukemia. A lesser link was found for cancers of the pancreas, skin and bladder. The authors also noted a connection between selenium concentrations and cancer deaths.¹⁵⁹

Foods with the highest selenium content include Brazil nuts, fish, shellfish, meat, poultry eggs, mushrooms and sunflower seeds. Try and get 100 to 200 micrograms of selenium a day. And keep in mind, the dose is in MICRO-grams... the dose for this mineral is much smaller than most others.

Glutamine is a precursor of glutathione. It is especially good at protecting the liver by increasing glutathione stores in liver tissue and reducing oxidative stress. It also helps your liver break down ammonia and proteins into urea. This is a waste product that is processed through your kidneys and removed from the body in urine.^{160 161}

Cancer patients have abnormally low glutamine levels. Part of the reason for these low levels is because cancer cells gobble up glutamine.

This has led scientists to question whether supplemental glutamine may support tumor growth. So while cancer patients are severely lacking in this critical nutrient, some physicians get a little anxious at the idea of increasing glutamine levels.

However, 36 clinical studies in the past two decades have shown glutamine supplementation helps promote a beneficial outcome for cancer patients.

The majority of these studies show it can lead to clinical improvement without increasing tumor growth. It helps boost the immune system, reduces cancer cell formation and increases cell turnover.¹⁶²

B2 (riboflavin) acts as an antioxidant by reducing free radical damage in the body. This antioxidant activity is largely due to riboflavin's ability to regenerate glutathione in the body. However, in patients who are deficient in B2, glutathione synthesis becomes impaired.

The good news is that getting as little as 5 milligrams of riboflavin daily in your b-complex supplement can stimulate glutathione activity.¹⁶³

Natural sources of riboflavin include mushrooms, yogurt, milk, egg yolks, spinach, fish and leafy greens.

Immunocal (whey protein concentrate) is a doctor-designed formula that supplies your body with the building blocks it needs to produce glutathione in your cells. It's a natural source of the glutathione precursor cysteine and has been the topic of many studies in recent years because of its ability to boost glutathione levels.

Earlier we talked about the excellent results achieved by HIV patients taking this whey protein supplement. In one HIV patient glutathione was increased by 70%.

Further research using healthy subjects shows whey protein increased glutathione levels by approximately 24% after only 2 weeks. In cystic fibrosis patients the levels were increased by 46.6% in just three months.^{164 165 166}

Immunocal's amazing glutathione-boosting activity may offer protection against some forms of cancer. Researchers in Canada administered Immunocal to 6 patients with breast cancer, one with liver of the pancreas and another with liver cancer.

After six months of treatment, the results indicated that whey protein made tumor cells more vulnerable to treatment with chemotherapy.¹⁶⁷

Other research shows Immunocal may be effective for...

- Improving liver function in patients with chronic hepatitis B¹⁶⁸
- Protecting against neurodegenerative diseases that affect the nervous system¹⁶⁹
- Increasing glutathione status in individuals with cystic fibrosis¹⁷⁰

Immunocal is available worldwide without a prescription. For more info, check out their website: <http://www.immunocal.com>

Liposomal glutathione is a groundbreaking new form of glutathione that's 100 times more potent than normal glutathione.¹⁷¹

Regular (non-liposomal) glutathione supplements don't get absorbed very well by your body. They have to be digested, passed through stomach acid, sent to the liver and metabolized before they even have a chance of getting delivered to the bloodstream.

And by that time there's so little left that it's hardly worth the cost or effort.

That's what makes liposomal glutathione such an enormous scientific breakthrough. Quite simply, liposomes are made from the same type of material that your cell

membranes are composed of – something called phospholipids.

When you wrap glutathione up in these liposomes it is able to immediately penetrate cell walls and pass into the bloodstream.

It basically bypasses the entire digestive system and goes to work pronto! This is cutting edge nanotechnology at work. And it's *very exciting*.

In a very interesting study from 2010, researchers concerned about radioactive terrorism injected rats with a radioisotope called 60CO (cobalt-60.) This radioisotope has been identified as a high-risk terror threat.

Next, they divided the rats into several groups. One group was administered oral glutathione, another given l-cysteine and a third took liposomal glutathione.

The liposomal glutathione reduced 60CO levels in nearly all tissues by 12%-43% compared to non-liposomal glutathione. And in the end, non-liposomal glutathione was the least effective of all treatments.¹⁷²

While you may not be overly concerned by the idea of a radioactive terrorism threat, these results show how much more powerful – and absorbable – liposomal glutathione is over regular glutathione supplementation.

And if it's that potent when it comes to ridding your body of radioactive isotopes, just imagine how much more effective it will be when it comes to the rest of your health!

- Crush free radicals and oxidative damage in their tracks
- Power-up your liver to avoid deadly liver cancer and cirrhosis

- Slash your risk of heart disease and stroke
- Side-step the shattering effects of dementia and Alzheimer's
- Defeat cancer and protect your cells from DNA damage
- Turbo-charge your masculinity – even if you're past middle age
- Put the brakes on HIV progression to AIDS
- Live longer, healthier and well into your 100s!

But don't you don't have to take my word for it. Just take a look at what researchers from Texas A&M University have to say about glutathione...

“Glutathione deficiency contributes to oxidative stress, which plays a key role in aging and the pathogenesis of many diseases (including kwashiorkor, seizure, Alzheimer's disease, Parkinson's disease, liver disease, cystic fibrosis, sickle cell anemia, HIV, AIDS, cancer, heart attack, stroke, and diabetes). New knowledge of the nutritional regulation of glutathione metabolism is critical for the development of effective strategies to improve health and to treat these diseases.”¹⁷³

Remember, glutathione is your body's most important defense against free radical damage, oxidative stress, aging and disease.

Glutathione protects your entire antioxidant system to keep you strong, healthy and active so you can enjoy life to the fullest as you age.

You can use any of the supplements listed earlier in this chapter to boost your glutathione levels.

However I recommend using liposomal glutathione.

There are several brands available, such as ReadiSorb, Lypo-Spheric and Absorbot. Check online or at your local health food store.

Chapter 10: Selected Studies from the United States Library of Medicine

This chapter is designed to help you better understand, and to more easily reference, discuss and share the major studies covered in this book.

If you talk to your doctor about glutathione, it will be easier if you have the studies showing glutathione's effectiveness and proven track record.

Most doctors receive little to no training in diet and nutrition. In fact, in many medical schools, nutrition is an elective and not a required course. So expect some confusion.

But with this book in hand, you now have the evidence that shows beyond a shadow of a doubt that glutathione protects your liver, heart and brain. It helps improve your outcome if you are HIV positive, have liver disease or cancer. As you age it can slow down the progression of Alzheimer's, Parkinson's and Huntington's diseases. And for men, it can boost your masculinity so you don't end up weak, fat and impotent.

First, let's have a quick look at where these studies come from and how they are cataloged.

PubMed: Your FREE Source of Clinical Studies From the Highest-Rated Medical Journals

The U.S. Government maintains a vast medical library as part of the National Institutes of Health and is home to over 20 million citations and clinical studies.

Known as “PubMed,” this online collection is available to you free of charge.

To give you an idea of just how big PubMed has become, here’s a direct quote from the quick start guide on their website:

“PubMed is a free resource that is developed and maintained by the National Center for Biotechnology Information (NCBI), at the U.S. National Library of Medicine (NLM), located at the National Institutes of Health (NIH).

PubMed comprises over 20 million citations for biomedical literature from MEDLINE, life science journals, and online books. PubMed citations and abstracts include the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and preclinical sciences. PubMed also provides access to additional relevant Web sites and links to the other NCBI molecular biology resources.”

How to Use This Section

Following you will find the basic, vital information from the major studies mentioned in this book and how to find them for further research and/or reference.

To help you find your way around, you will see the following subheads in each example:

- **Study:** The study name as it appears in the publication.
- **Reference Number:** This refers to the footnote found in this book.
- **Journal Name:** The name of the publication where the study was published.
- **PubMed ID (PMID):** The PubMed identification number listed for this study.
- **Source:** Where the study came from.
- **Findings:** The key results from the study.

To find a particular study on the PubMed website, simply enter the PubMed ID number into the search window on the PubMed homepage.

Here is their website: <http://www.ncbi.nlm.nih.gov/pubmed>

Studies on Glutathione and Aging

Study: Low activity of superoxide dismutase and high activity of glutathione reductase in erythrocytes from centenarians.

Journal Name: Age Ageing. 1998 Sep;27(5):643-8.

PubMed ID (PMID): 12675104

Source: Department of Environmental Medicine, Odense University, Winsløwparken 17, DK-5000 Odense C, Denmark. HR.ANDERSEN@Winsloew.OU.DK

Findings: Glutathione activity in centenarians between the ages of 100-105 was significantly higher than people between 60-79 years old. The study concluded that centenarians with the highest glutathione levels have greater functional capacity and increased survival.

Study: High blood glutathione levels accompany excellent physical and mental health in women ages 60 to 103 years.

Journal Name: J Lab Clin Med. 2002 Dec;140(6):413-7.

PubMed ID (PMID): 12486409

Source: Department of Biochemistry, University of Louisville, KY 40292, USA. calang@louisville.edu

Findings: Over a 5-year period, healthy women between the ages of 60 and 103 who were in the top physical and mental health had very high blood levels of glutathione. Study authors concluded that “high glutathione concentrations... are characteristic of long-lived women.”

Study: Glutathione and morbidity in a community-based sample of elderly.

Journal Name: J Clin Epidemiol. 1994 Sep;47(9):1021-6.

PubMed ID (PMID): 7730904

Source: Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor 48109, USA.

Findings: Higher levels of glutathione were associated a lower number of illnesses, lower cholesterol, lower blood pressure, lower body mass index and higher levels of health. Conversely, people with arthritis, diabetes and heart disease had lower glutathione levels than those who were disease free.

Studies on Glutathione and Toxins

Study: Mercury toxicity and antioxidants: Part 1: role of glutathione and alpha-lipoic acid in the treatment of mercury toxicity.

Journal Name: Altern Med Rev. 2002 Dec;7(6):456-71.

PubMed ID (PMID): 12495372

Findings: Glutathione depletion and glutathione supplementation have specific effects on mercury toxicity, both by altering antioxidant status in the body and by directly affecting excretion of mercury and other heavy metals in the bile.

Study: Role of glutathione in the radiation response of mammalian cells in vitro and in vivo.

Journal Name: Pharmacol Ther. 1990;47(1):117-36.

PubMed ID (PMID): 2195553

Source: Joint Center for Radiation Therapy, Harvard Medical School, Boston, MA 02115.

Findings: Glutathione acts as an antioxidant to scavenge free radicals produced by exposure to radiation. It helps repair damaged DNA molecules, assists in getting oxygen-rich blood throughout the body and reduce sensitivity to radiation.

Studies on Glutathione and Liver Disease

Study: Hepatocyte-specific Gclc deletion leads to rapid onset of steatosis with mitochondrial injury and liver failure.

Journal Name: Hepatology. 2007 May;45(5):1118-28.

PubMed ID (PMID): 17464988

Source: Department of Environmental Health, University of Cincinnati Medical Center, Cincinnati, OH 45267-0056, and Center for Immunology and Inflammatory Disease, Massachusetts General Hospital, Boston, USA.

Findings: When researchers deleted the gene responsible for glutathione synthesis in mice, dramatic changes occurred in their cells that immediately led to oxidative damage and abnormal lipid retention (fats, triglycerides) in the liver. Inflammation set in and liver

tissue began to die. In one month after birth the mice died of liver failure.

Study: Hepatic glutathione content in patients with alcoholic and non alcoholic liver diseases.

Journal Name: Life Sci. 1988;43(12):991-8.

PubMed ID (PMID): 3172971

Source: Istituto di Clinica Medica I, Universita' di Bari, Italy.

Findings: 35 chronic alcoholics, 20 patients with non-alcoholic liver disease and 15 control subjects were tested for levels of liver glutathione. The patients with alcoholic and non-alcoholic liver had decreased glutathione levels. Researchers believe the lower levels of glutathione in the liver may contribute to liver injury and risk of toxicity.

Studies on Glutathione and Heart Disease

Study: Glutathione reverses endothelial dysfunction and improves nitric oxide bioavailability.

Journal Name: J Am Coll Cardiol. 1999 Aug;34(2):507-14.

PubMed ID (PMID): 10440166

Source: Cardiology Branch, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland 20892-1650, USA.

Findings: 17 patients with atherosclerosis or its risk factors were recruited. When researchers administered glutathione into the large artery of the thigh they were able to enhance NO activity and improve endothelial dysfunction in the patients.

Study: Anti-oxidant and anti-atherogenic properties of liposomal glutathione: studies in vitro, and in the atherosclerotic apolipoprotein E-deficient mice.

Journal Name: Atherosclerosis. 2007 Dec;195(2):e61-8

PubMed ID (PMID): 17588583

Source: The Lipid Research Laboratory, Technion Faculty of Medicine, The Rappaport Family Institute for Research in the Medical Sciences, Rambam Medical Center, Haifa 31096, Israel.

Findings: Liposomal glutathione reduced oxidized LDL uptake by 17%. It also shrank cholesterol mass in white blood cells (24%) and atherosclerotic lesions (30%) in atherosclerotic mice.

Study: Relationship between plasma glutathione levels and cardiovascular disease in a defined population: the Hisayama study.

Journal Name: Stroke. 2004 Sep;35(9):2072-7.

PubMed ID (PMID): 15256685

Source: Department of Medicine and Clinical Science, Graduate School of Medical Sciences, Kyushu University, Maidashi 3-1-1, Higashi-ku, Fukuoka City, 812-8582 Japan. haru-sz@d7.dion.ne.jp

Findings: Subjects who suffered from heart attack, stroke and brain hemorrhage all had significantly lower blood plasma levels of glutathione. Higher glutathione levels were associated with decreased risk of these events.

Studies on Glutathione and Dementia

Study: Alzheimer's disease and total plasma aminothiols.

Journal Name: Biol Psychiatry. 2003 Feb 1;53(3):254-60.

PubMed ID (PMID): 12559659

Source: University of Wales College of Medicine, Wrexham, UK.

Findings: Alzheimer's patients with low plasma levels of glutathione have more severe cognitive impairment than those with higher glutathione. The link is so strong that glutathione levels are a significant and independent predictor of cognitive scores in patients.

Study: Alterations in glutathione levels in Parkinson's disease and other neurodegenerative disorders affecting basal ganglia.

Journal Name: Ann Neurol. 1994 Sep;36(3):348-55.

PubMed ID (PMID): 8080242

Source: Parkinson's Disease Society Experimental Research Laboratories, Pharmacology Group, Biomedical Sciences Division, King's College London, UK.

Findings: Patients dying of Parkinson's disease had a 40 percent reduction of nigral glutathione compared to the control subjects. Additionally, the glutathione/GSSG ratio in the substantia nigra points to oxidative stress as a major cause of nigral cell death in PD.

Study: Oxidative stress parameters in plasma of Huntington's disease patients, asymptomatic Huntington's disease gene carriers and healthy subjects: a cross-sectional study.

Journal Name: J Neurol. 2007 Dec;254(12):1676-83.

PubMed ID (PMID): 17990062

Source: Dept. of Neurology, University Clinical Hospital Center Zagreb, Zagreb University School of Medicine, Kispatićeva, Zagreb, Croatia.
natasa.klepac@zg.htnet.hr

Findings: Huntington's Disease patients had higher plasma lipid peroxidation (an indicator of oxidative stress) and lower levels of antioxidant-protective glutathione than healthy controls.

Studies on Glutathione and Cancer

Study: Antioxidant activity and other mechanisms of thiols involved in chemoprevention of mutation and cancer.

Journal Name: Am J Med. 1991 Sep 30;91(3C):122S-130S.

PubMed ID (PMID): 1928203

Source: Institute of Hygiene and Preventive Medicine, University of Genoa, Italy.

Findings: N-acetylcysteine (NAC) is a precursor of intracellular glutathione. Boosting glutathione levels NAC inhibits spontaneous mutations, suppresses the development of tumors and helps stop carcinogens from bonding with DNA.

Study: Effects of selenium supplementation for cancer prevention in patients with carcinoma of the skin. A randomized controlled trial. Nutritional Prevention of Cancer Study Group.

Journal Name: JAMA. 1996 Dec 25;276(24):1957-63.

PubMed ID (PMID): 8971064

Source: Arizona Cancer Center, College of Medicine, University of Arizona, Tucson, USA.

Findings: Patients supplementing with the glutathione precursor selenium had fewer incidences of lung, colon and prostate cancers. They also had a significant reduction in

total cancer deaths. There were almost twice as many deaths in the non-selenium group. Patients who were not treated with selenium had about 54 percent more cancers than those who took the supplement.

Studies on Glutathione and Testosterone

Study: Effect of glutathione depletion on Leydig cell steroidogenesis in young and old brown Norway rats.

Journal Name: Endocrinology. 2008
May;149(5):2612-9.

PubMed ID (PMID): 18202138

Source: Division of Reproductive Biology, Department of Biochemistry and Molecular Biology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland 21205, USA. hchen@jhsph.edu

Findings: In this animal model, glutathione depletion of the Leydig cells was associated with a 40 to 50 percent decrease in testosterone production.

Study: Aging and the brown Norway rat leydig cell antioxidant defense system.

Journal Name: J Androl. 2006 Mar-Apr;27(2):240-7.

PubMed ID (PMID): 16304208

Source: Division of Reproductive Biology, Department of Biochemistry and Molecular Biology, Johns Hopkins

University Bloomberg School of Public Health, Baltimore, Maryland 21205, USA. lluo@jhsph.edu

Findings: In this animal model, GPX (glutathione peroxidases) activity in Leydig cells was significantly decreased with age. Study authors suggest reduced function of Leydig cells to produce steroid hormones like testosterone may be, in part, caused by lowered antioxidant status.

Studies on Glutathione and HIV

Study: Intracellular glutathione levels in T cell subsets decrease in HIV-infected individuals.

Journal Name: AIDS Res Hum Retroviruses. 1992 Feb;8(2):305-11.

PubMed ID (PMID): 1540417

Source: Department of Genetics, Stanford University School of Medicine, CA.

Findings: In later stages of HIV infection, glutathione levels in CD4 and CD8 T-cells are reduced by almost 40 percent. These findings suggest that low intracellular glutathione levels may be an important factor in HIV infection and in the resulting immunodeficiency.

Study: Glutathione deficiency is associated with impaired survival in HIV disease.

Journal Name: Proc Natl Acad Sci U S A. 1997 Mar 4;94(5):1967-72.

PubMed ID (PMID): 9050888

Source: Department of Genetics, Stanford University Medical School, CA 94305-5125, USA.

Findings: Glutathione deficiency in CD4 T-cells is associated with a marked decreased survival. N-acetylcysteine replenishes glutathione and may improve survival rates. As such, glutathione deficiency is a key marker of survival in HIV disease.

Study: N-acetylcysteine replenishes glutathione in HIV infection.

Journal Name: Eur J Clin Invest. 2000 Oct;30(10):915-29.

PubMed ID (PMID): 11029607

Source: Department of Genetics, Stanford University, USA.

Findings: Treatment with glutathione precursor N-acetylcysteine (NAC) replenished whole blood glutathione and T-cell glutathione in HIV infected individuals. After 8 weeks of treatment with NAC, glutathione levels were brought up to 89 percent of uninfected controls.

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