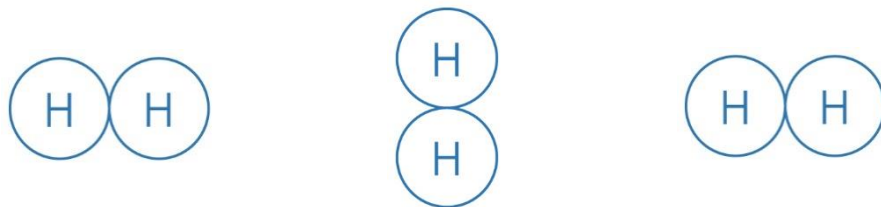


MOLECULAR HYDROGEN 101

A Simple Molecule With
Tremendous Health Benefits



MOLECULAR HYDROGEN 101

Version 2.0

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This EBOOK is not intended as a substitute for
the medical advice of physicians.
The reader should regularly consult a
physician in matters relating to his/her
health and particularly with respect to any
symptoms that may require diagnosis
or medical attention.

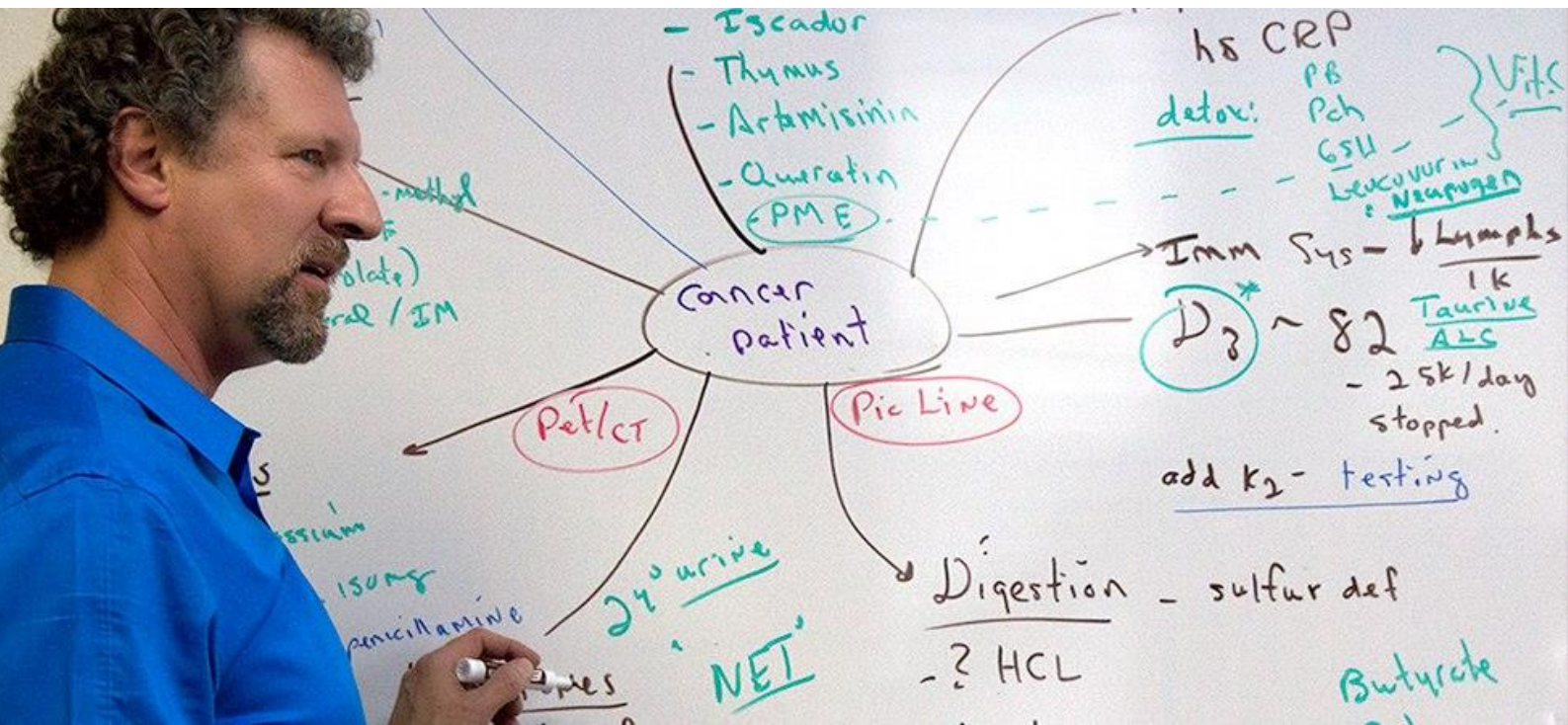
Contents

Letter from the Doctor	4
What is Molecular Hydrogen?	5
Molecular Hydrogen for Health	8
The War Inside Your Cells	9
Your Antioxidant Defense System	10
The Dangers of Free Radicals	12
The Perfect Antioxidant	14
4 Methods of H ₂ Intake	17
Conclusion & Links	19



Letter from the Doctor

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The world is constantly becoming more complicated. So much information is available out there regarding health and wellness, it's often difficult to discern what's real or simply marketing hype. Even in the news you hear about keeping your cholesterol down, preventing cancer, fad diets, the right exercises and so on. Do you ever feel like you can't keep up?

On a regular basis I see patients with a variety of health problems starting earlier in life. Just listening to the radio reminds me of the increased rate and risk of autism. When I look around our environment I see more smog, pollution, more health robbing chemicals used to make the products we use on a daily basis.

Even though the information and misinformation may be overwhelming, we can bring it back to the basics. If you could do one thing everyday to help keep or increase your vitality, rejuvenate your body, recover from workouts quicker, and stay healthy, would you take advantage of it?

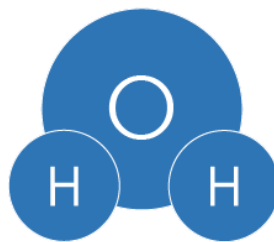
Molecular Hydrogen is a remarkable molecule capable of making a dramatic difference in your health. It's benefits pertain to everyone because it acts on your **antioxidant defense system**, a crucial part of healthy living. This **EBOOK** will give you an overview of how good **Molecular Hydrogen** is, and hopefully it will motivate you to integrate it into your life.

What is Molecular Hydrogen?



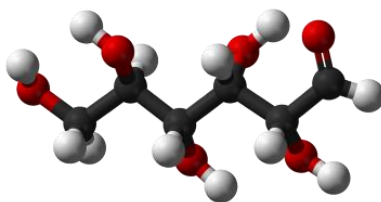
Molecular Hydrogen (H₂)

Molecular Hydrogen (H₂) is a molecule composed of two hydrogen atoms bonded to each other. This molecule does not commonly occur in nature. Most of the time, hydrogen atoms bond to other atoms. For example, two hydrogen atoms are bonded to a single oxygen atom to form a water molecule.



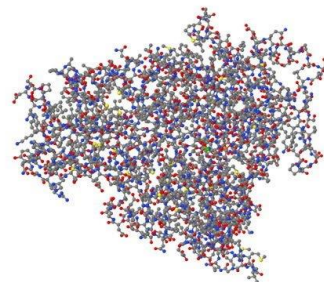
Water (H₂O)

Water is a very important part of our daily lives, and the two hydrogen atoms in water gives water many of its unique properties via [hydrogen bonding](#). Hydrogen atoms are critical components in water as well as many other organic molecules such as carbohydrates, proteins, lipids, and DNA.



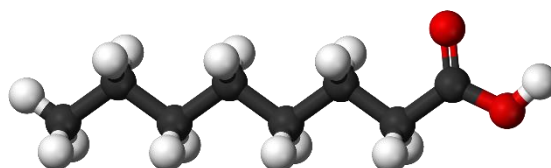
Glucose (Carbohydrate)

Hydrogen is White



Actin (Protein)

Hydrogen is Red



Caprylic Acid (Lipid)

Hydrogen is White

THE PERIODIC TABLE

The periodic table is organized into groups and periods. The groups are color-coded as follows:

- Alkali Metal (Red)
- Alkaline Earth (Orange)
- Transition Metal (Yellow)
- Halogen (Green)
- Semi-Metal (Light Green)
- Non-Metal (Blue)
- Basic Metal (Dark Blue)
- Lanthanide (Purple)
- Actinide (Dark Purple)
- Noble Gas (Pink)

The **Periodic Table** is an arrangement of chemical elements, ordered by their atomic number, which is the number of protons. As you can see, **Hydrogen (H)** is on the very top left corner. Typically the sizes of the atoms get bigger as you go from left to right and from top to bottom. Meaning elements towards the bottom right are larger while elements near the top left are smaller.

HYDROGEN, THE SMALLEST ELEMENT IN EXISTENCE

Hydrogen (H) appears in the top left corner of the periodic table, and is denoted as 1. It contains one proton and one electron with no neutrons. This means that the element hydrogen is the smallest, simplest, and most fundamental element. This makes **Molecular Hydrogen (H₂)** the simplest molecule in existence since it's a bond of two of the smallest atom. For simplicity's sake, we will refer to **Molecular Hydrogen** as **H₂** from now on.

Because **H₂** is so small, it exists as a gas in normal temperatures and pressures. You may have heard of **H₂** being referred to as **hydrogen gas**. **Hydrogen gas** has been the main focus of clean energy because burning it as a fuel generates water vapor as a byproduct instead of the toxic pollution that is produced by burning gasoline. It's also extremely efficient as a fuel, and will be the main [fuel source for cars](#) in the near future.



Burning hydrogen gas and oxygen gas produces efficient energy and water vapor as a byproduct.

HYDROGEN IS EVERYWHERE

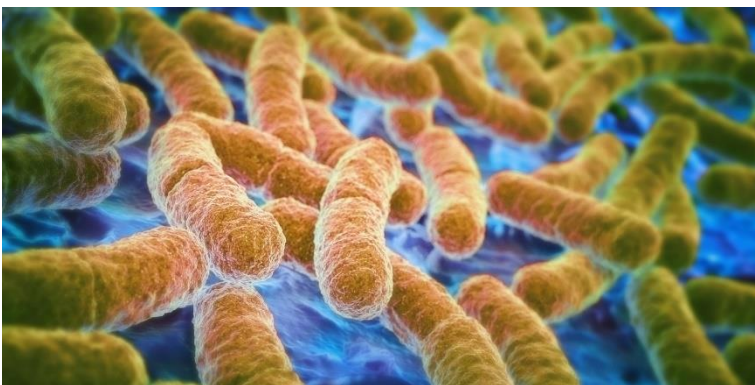
Did you know **hydrogen** composes **75%** of the visible universe? It's the most common element, but **Molecular Hydrogen (H₂)** composes only 1 ppm of Earth's atmosphere.

When you think of **hydrogen**, you may think of **positive hydrogen ions (H⁺)** which are also called protons. **pH** is a measurement of the amount of **H⁺ ions** that exist in a liquid. The lower the **pH**, the more protons there are in the liquid and greater the **acidity**. This is different from the hydrogen we are talking about, which is **Molecular Hydrogen (H₂)**.

Is Molecular Hydrogen (H₂) produced anywhere naturally?

In nature, **H₂** is produced by bacteria and algae via anaerobic metabolism. This may account for some of the **H₂** that's detected in our atmosphere even though it's not at a high enough concentration to make a difference in our lives.

For humans, the [bacteria in your intestines](#) generate **H₂** as they ferment unabsorbed carbohydrates. The **H₂** produced in your intestines is either exhaled via your breath or flatulence. Usually the amount of **Molecular Hydrogen** produced by the bacteria in your gut is not enough to provide noticeable therapeutic benefits.



Currently, **NASA** uses **liquid hydrogen** as its fuel of choice for [space exploration](#) because it's the lightest fuel but also extremely energy dense. It has the highest efficiency as a fuel when in combination with liquid oxygen.



Interesting Fact:

A study of Japanese Centenarians (Person who is more than 100 years old) showed that their **breath molecular hydrogen** levels were up to [4x higher than an average healthy person!](#)

Molecular Hydrogen (H₂) for Health

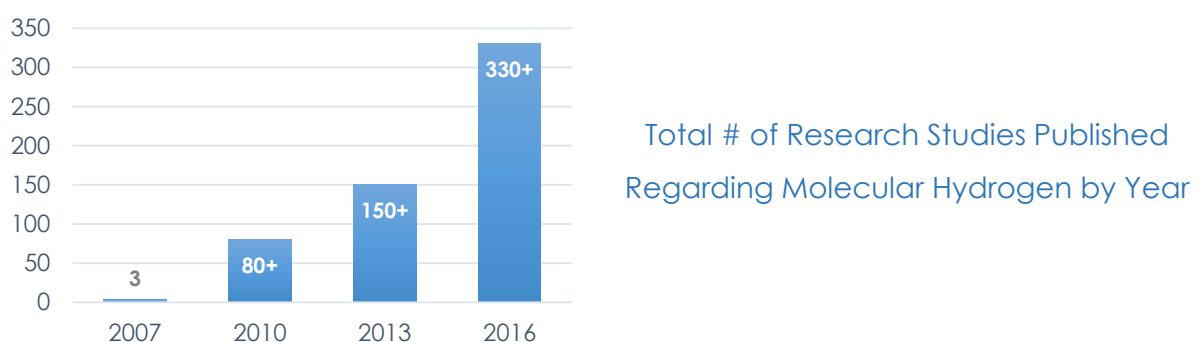
Although **H₂** is a seemingly simple molecule, it provides a variety health benefits that we are still discovering today. The benefits that **H₂** can provide have been confirmed time and again over the last 10 years even though it has been overlooked for a long time. Now over [300 research studies](#) show the benefits of **H₂** in a variety of disease models.

Why haven't I heard that H₂ is good for your health before?

The reason why you probably haven't heard that **H₂** is beneficial for your health is because **“it's too simple”**. **H₂** can't be patented, which means it's not going to be profitable as a pharmaceutical drug. Therefore, not many resources have been allocated to promote **H₂** in mainstream media.

Also, **H₂** seems to be **“good for everything”** at first glance. Since **H₂** works on the **antioxidant defense system** inside your cells, its effects vary from person to person. That's because free radicals affect each of us in different ways. This may be a difficult concept to grasp, and some people end up not believing because it sounds **“too good to be true”**.

Despite these reasons, progressively more academics and researchers have documented the undeniable evidence for the benefits of **H₂** on human health. The [research](#) on molecular hydrogen has grown exponentially over the past 10 years.



As discussed before, the most significant way that **H₂** promotes optimal health is to enhance your **antioxidant defense system** and **neutralize harmful free radicals directly**. This **EBOOK** is a crash course on the importance of having a strong antioxidant defense system and the ways that **H₂** can support your cells and your overall health.

THERE'S A WAR WAGING WITHIN YOUR CELLS



Your cells are **constantly** under attack by [free radicals](#). **Free radicals** are [byproducts of energy production](#) from your **mitochondria**, the engines of your cells. A **free radical** has an **unpaired electron** and wants to satisfy it by taking an **electron** from a molecule nearby. **Free radicals** are short lived, unstable, and react with other molecules to achieve stability. The scientific term for free radical is **Reactive Oxygen Species (ROS)**.



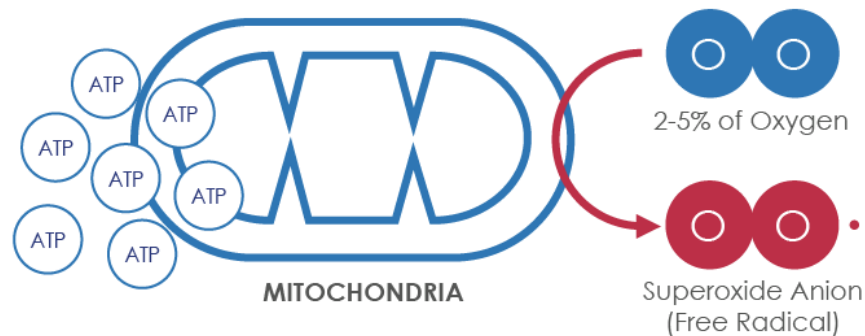
Imagine a car engine burning gasoline for fuel. What's the byproduct? Smog, or more specifically, **carbon monoxide**. **Carbon Monoxide** is so toxic that inhaling it can be fatal. Free radicals appear in a similar fashion as a waste product of energy production in your cells. **Free radicals** are like the **carbon monoxide** of your cells.

Normally, your antioxidant defense system can take care of **free radicals** before they inflict any harm. But as you age and toxins overload your system, your antioxidant system becomes sluggish and **free radicals** begin to wreak havoc inside your cells.

Long-term free radical damage, also called **oxidative stress**, has been linked to [aging](#) and most chronic diseases such as [cancer](#), [diabetes](#), [neurodegenerative diseases](#), [cardiovascular disease](#) and more. That's why antioxidants have been a primary focus and keyword in the nutritional supplement industry since the beginning.

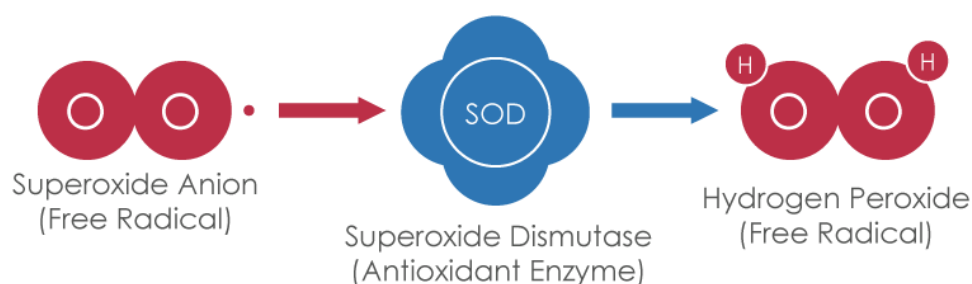
YOUR ANTIOXIDANT DEFENSE SYSTEM

FREE RADICALS ARE CONSTANTLY PRODUCED IN YOUR MITOCHONDRIA



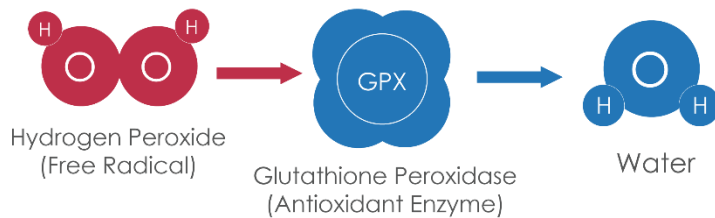
Mitochondria are responsible for [producing energy](#) in the form of **ATP** (currency of energy in your cells), but they also produce **free radicals** as a toxic byproduct. Oxygen is critical in driving energy production. Unfortunately, [2-5% of the oxygen](#) utilized in energy production convert into **Free Radicals** called [Superoxide Anions](#).

ANTIOXIDANTS PROTECT YOUR CELLS FROM FREE RADICAL DAMAGE - STEP 1



Within your cells there are **antioxidant enzymes** such as **Superoxide Dismutase** that neutralizes a **Superoxide Anion** and converts it into **Hydrogen Peroxide**. **Hydrogen Peroxide** is a weak free radical that is useful in your cells. Your immune system uses **Hydrogen Peroxide** to kill bacteria and to signal to the rest of your immune system if there is an injury to tissue. Typically when you get a cut, **Hydrogen Peroxide** is generated which then [signals your white blood cells](#) to mobilize to the cut.

ANTIOXIDANTS PROTECT YOUR CELLS FROM FREE RADICAL DAMAGE – STEP 2



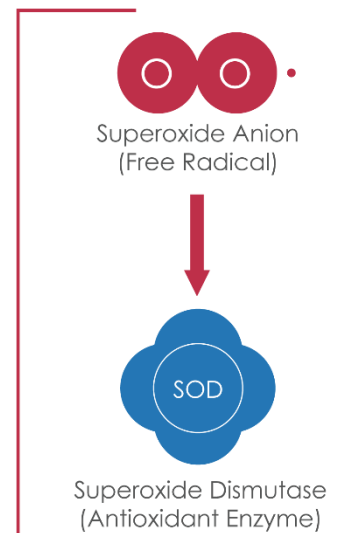
Another antioxidant enzyme is **Glutathione Peroxidase (GPX)**. Two **GPXs** convert one **Hydrogen Peroxide** into two molecules of **water**. During this reaction the two **GPXs** bond together to form **Glutathione Disulfide (GDS)**. **GDS** needs be recycled by another enzyme to convert back into 2 **GPXs** ready to take on more **Hydrogen Peroxide** molecules. This means that **GPX** is not always readily available and there's a limit to its function as an antioxidant.

This two-step process of eliminating free radicals inside your cells is crucial for the health of your cells. If there's not enough **Superoxide Dismutase** and **Glutathione Peroxidase** available, **Superoxide Anion** and **Hydrogen Peroxide** can build-up in your cells. These free radicals themselves may not be that bad, but they [react with each other](#) to form a deadly free radical, the **Hydroxyl Radical**.

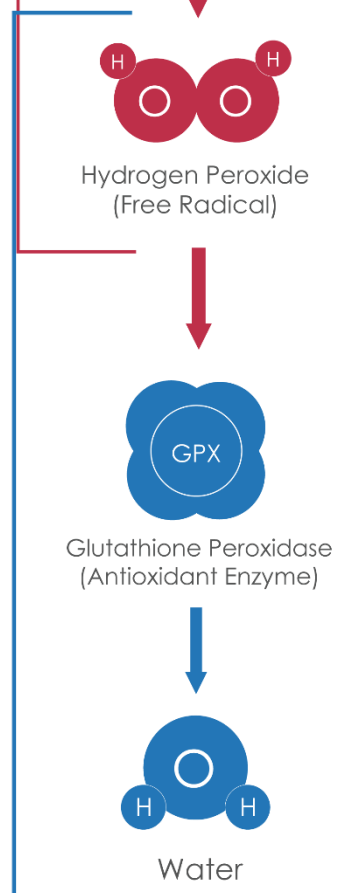
Depending on your **diet**, **lifestyle**, and **environment**, your cells can end up creating more free radicals than your antioxidant enzymes can handle. And it doesn't help that as you age your antioxidant enzymes dwindle naturally. When excess free radicals are formed inside your cells, it results in serious consequences for your health.

The 2-STEP FREE RADICAL BREAKDOWN PROCESS

STEP 1



STEP 2



EXCESS FREE RADICALS ARE DANGEROUS TO YOUR CELLS

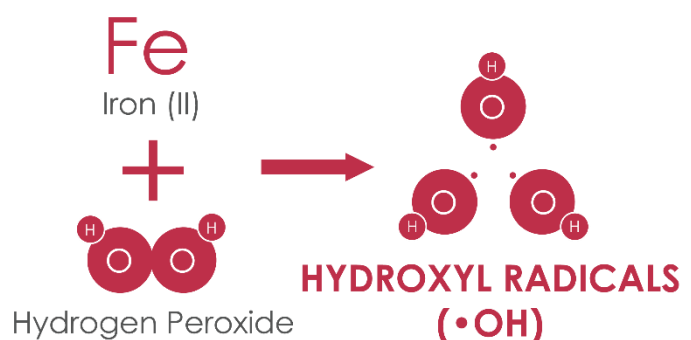
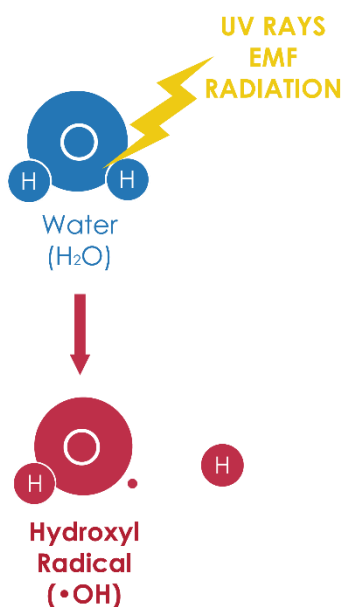


CHECK YOURSELF!

No matter how healthy you are, free radicals are generated inside your cells **EVERY SECOND**. Worse still, the circles above show the **most common contributors** to extra free radicals inside your cells. **Check how many of them you are exposed to daily.**

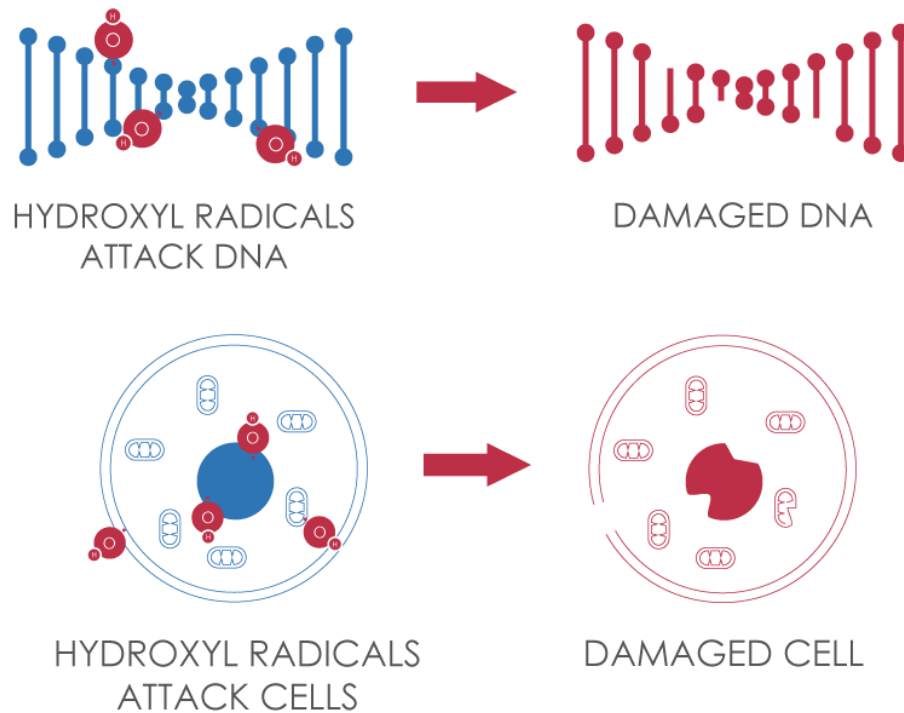
THE MOST DANGEROUS FREE RADICAL HYDROXYL RADICAL

When free radicals aren't eliminated quickly, they convert into more dangerous free radicals. For example, Hydrogen Peroxide readily converts into the most dangerous **Hydroxyl Radicals** in the presence of Iron (in blood cells) or other transition metals.



Hydroxyl Radicals can also be produced in your cells when you are exposed to [Radiation](#), [UV rays](#), or [Electromagnetic frequencies \(EMF\)](#). These are highly energetic waves that penetrate into your cells and break up water. Sometimes water splits into a **Hydroxyl Radical** as shown in the figure to the left.

Hydroxyl Radicals are highly reactive free radicals that will steal an electron from any other molecule, thereby damaging them. Notice how similar they are in structure to **water**. All they need is a **hydrogen atom** and an **electron** to become water. Their desire to stabilize into water is so powerful that they can easily rip off hydrogen atoms and electrons from any molecule around them to satisfy themselves. Usually the victims are DNA, proteins, and lipids that make up your cells.



FREE RADICAL DAMAGE IN YOUR CELLS IS CALLED **OXIDATIVE STRESS**

Oxidative Stress occurs when there is a disturbance in the balance of free radicals and antioxidants leading to the formation of **Hydroxyl Radicals** that cause irreversible damage to cellular molecules. **Oxidative Stress** is known as the cause of many different health challenges and it affects each individual differently [depending on genetics](#).

If you feel that you're not as healthy as you should be, the root cause is most likely **Oxidative Stress**. You need to boost your antioxidant defense system so that it can neutralize excess free radicals efficiently. You can enhance the antioxidants inside your cells by supplementing your diet with [antioxidant-rich foods](#), following a healthier lifestyle, and utilizing **H2**.

Molecular Hydrogen

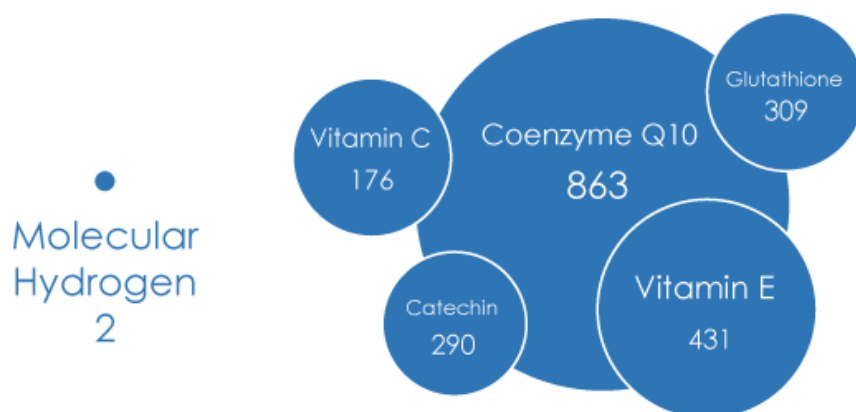
The Perfect Antioxidant

Many supplement companies claim that their antioxidant formula is the best. Although some of these formulas are effective, no other antioxidants have the ability to act in the multiple ways that **Molecular Hydrogen(H₂)** does to protect you from oxidative stress. **H₂** is **the Perfect Antioxidant**.

Why is Molecular Hydrogen (H₂) the Perfect Antioxidant?

1. SIZE

H₂ is the smallest antioxidant in existence. Other antioxidants such as **Vitamin C** or **Vitamin E** are very large molecules compared to **H₂** and need to go through your digestive tract, absorbed in your intestines, travel through your blood, and enter into your cells before they can eliminate free radicals.



H₂ is so small that it can penetrate through your stomach lining to begin acting inside your cells immediately. **H₂** is also in a gaseous state, so it basically floats through your cells ([rapid diffusion](#)) and performs its function as an antioxidant undeterred by the normal mechanisms that prevent other antioxidants from moving freely through the body.

H₂ can also cross the **Blood-Brain-Barrier** easily due to its small size whereas other antioxidants have a difficult time getting through or can't get through at all. The brain is highly susceptible to **oxidative stress** because it [consumes 20% of the oxygen you breathe](#) despite being only being 2% of your body's weight. So it's very important to protect your brain with antioxidants since it's especially vulnerable.

2. Selectivity

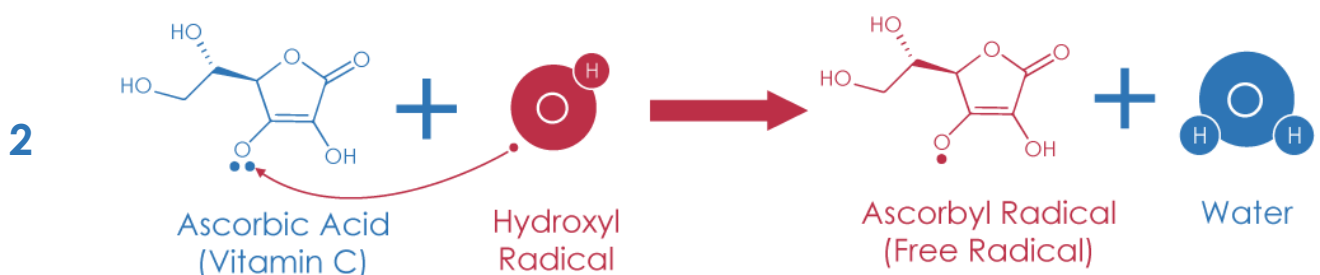
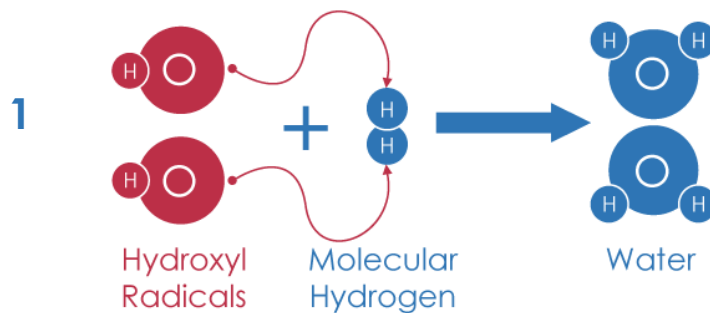
H₂ is selective and targets [only hydroxyl radicals](#). This is a key benefit because **H₂** only eliminates the harmful free radicals but does not directly affect useful free radicals such as **hydrogen peroxide** or **nitric oxide**. Like we mentioned before, **hydrogen peroxide** is used by the immune cells to kill bacteria, and **nitric oxide** is a signaling molecule that helps open and close blood vessels that divert blood to different areas of the body.

Other antioxidants are not selective but rather neutralize **any free radical** in their vicinity. Non-selective free radical elimination may disrupt the balance of free radicals to antioxidants inside the cells leading to a negative effect on your body.



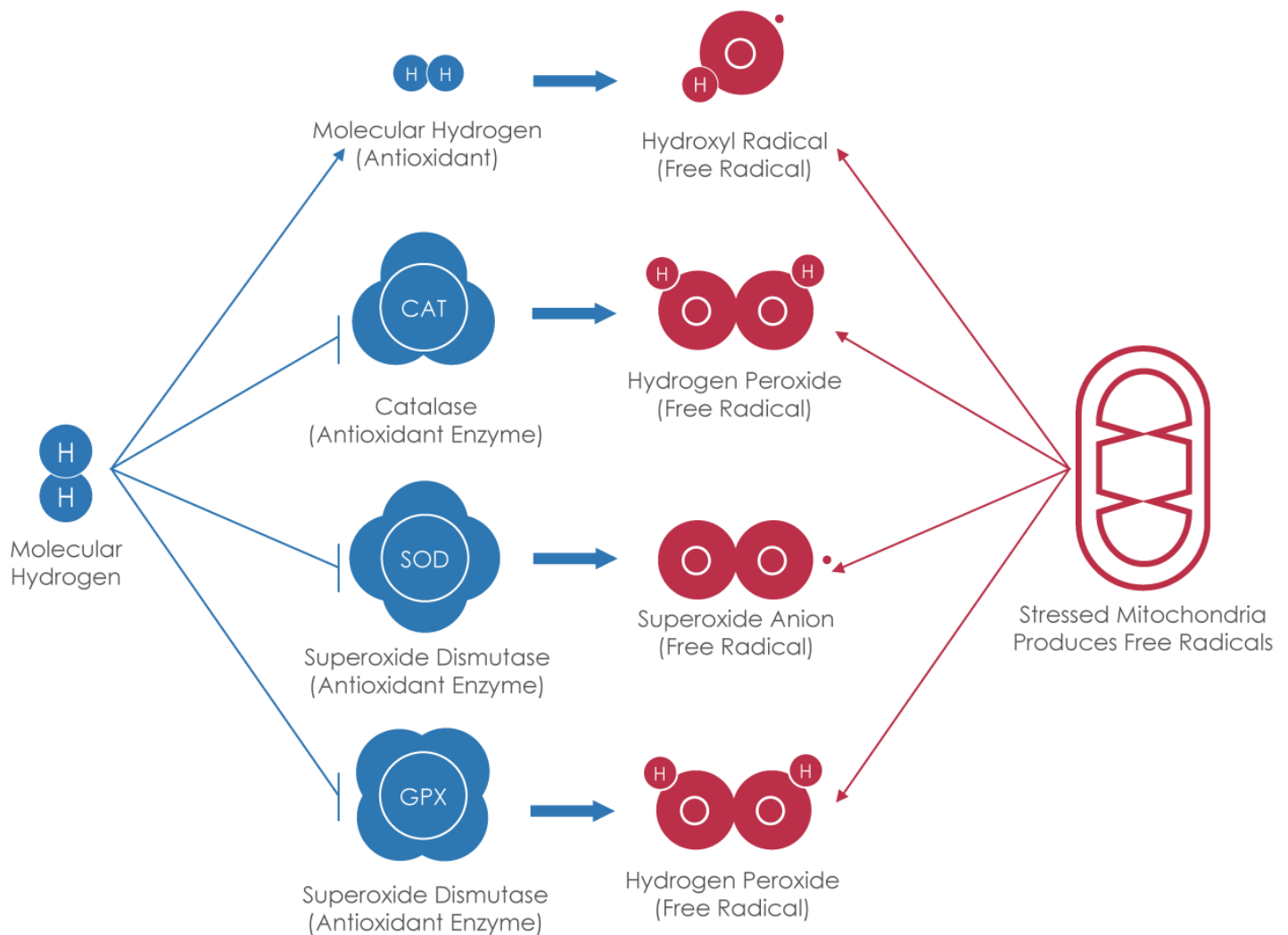
3. Zero Toxicity

Each molecule of **H₂** can convert two **hydroxyl radicals** into **water**, hydrating your cells in the process (Figure 1). Therefore, even at high concentrations, **H₂** has [zero toxicity](#). Any excess **H₂** simply gets released from the body. Other antioxidants become **weak free radicals** themselves after neutralizing free radicals. For example, **Ascorbic Acid** (Vitamin C) becomes an [Ascorbyl Radical](#) (Figure 2).



4. Synergy

H2 not only neutralizes **hydroxyl radicals** directly, it helps [enhance your antioxidant enzymes](#) such as **glutathione peroxidase**, **superoxide dismutase**, and **catalase**. Each specific antioxidant enzyme and molecular hydrogen itself take care of different types of free radicals. All of these antioxidants work together to ensure there are no excess free radicals that can cause oxidative stress damage inside your cells.



As shown in the figure above, **H2** is able to support your antioxidant enzymes and directly eliminate the most dangerous **hydroxyl radicals**. **H2** offers full protection against free radicals without disrupting the balance of free radicals and antioxidants inside your cells.

Molecular Hydrogen is clearly superior to all other antioxidants due to these four reasons. There are a couple ways to incorporate Molecular Hydrogen into your life which we will discuss in the next section.

4 Ways to get Molecular Hydrogen into Your Cells

Currently there are four main methods of H₂ intake that are currently being used around the world. Two of the methods are in hospital or clinical settings and the remaining two methods are more practical and common.

1. H₂ Inhalation

H₂ can be inhaled by hooking up a facemask or nasal cannula to a H₂ gas generator device. Inhaled H₂ gas acts more rapidly than other methods of intake so it's a suitable defense against acute (sudden) oxidative stress. (I.E. stroke, athletes, inflammation.)

H₂ gas inhalation has been used in hospital settings under the care of a healthcare practitioner in Asia. Although H₂ gas inhalation seems to have great benefits, it's impractical for everyday use.



2. H₂ Saline Injection

Another method of H₂ intake used in hospital settings is the H₂ saline injection. A bag of saline (salt water) is infused with H₂ gas which is then injected directly into the blood stream of patients. This method is the most accurate way to measure the amount of hydrogen that is administered to a patient.

This method is popular in Japan where H₂ industry is the most advanced. H₂ is widely recognized as a therapeutic molecule and many products and services are based around H₂. However, this method is only viable in clinical settings. In the United States, this won't be available in the near future due to restrictions set by the FDA.



3. H₂ Water

The most common method of consuming H₂ is drinking H₂ enriched water, simply called **Hydrogen Water**. Alkaline ionizer machines were the first sources of hydrogen water (although at a very low concentrations).

Recently there are more hydrogen specific water machines being released all over the world. There are also **Ready To Drink** Hydrogen Water in aluminum packages.

Although very practical, there are two drawbacks to hydrogen water for everyday use.

1. Since H₂ gas escapes water readily, you need to drink the water quickly after it's produced to get the maximum amount of H₂. Hydrogen water contained in a glass or plastic bottle will lose H₂ very rapidly. Aluminum containers keep H₂ in water for a longer period of time.
2. Most hydrogen water generator devices can be pricey, ranging from \$1,000.00 to \$3,500.00+. When researching Hydrogen Water Devices, make sure that you are getting a product that produces at least **0.50ppm** of H₂ in the water consistently since that's been the **minimum concentration** that showed signs of health benefits. Currently, the best devices generate water that has up to **1.20ppm** of H₂.

4. H₂ Supplements

H₂ supplements are the easiest method to get H₂ into your body on a daily basis. Just pop a few capsules or tablets and high concentrations of H₂ will be produced inside your stomach in a few minutes. There are a few H₂ dietary supplement products currently available on the market.





The Universe is 75% Hydrogen, making it the most abundant element in the Universe. How is it that something so ubiquitous can be so useful for human health? Interestingly enough, the healthiest form of hydrogen, H₂, is typically not readily available. But when it's made available inside your cells, it becomes the master protector, guardian angel molecule. There's something that seems so designed about it. We hope that you will continue to do your own research and spread the word about what molecular hydrogen can do for your friends and family.

SHARE THE KNOWLEDGE ABOUT MOLECULAR HYDROGEN

We hope that through this EBOOK you gained a better understanding of how **H₂** works inside your cells to provide a plethora of health benefits. It's been 5 years since we began educating people about **Molecular Hydrogen** and its versatility, and it's amazing to see how people are finally starting to catch on.

There are many organizations and researchers out there that are delving into the mysteries of **Molecular Hydrogen**. There's so much more to learn and research so that we can fully understand and utilize the benefits of **H₂**. We hope that you can become one of us. Constantly learning about and teaching **H₂** so that more people can take advantage of this amazing molecule. **Thanks for reading!**

SOME USEFUL LINKS FOR FURTHER RESEARCH

[PUBMED Molecular Hydrogen Research](#)

[Medical Gas Research](#)

[Molecular Hydrogen Studies](#)

[Molecular Hydrogen Research Summaries](#)

[Molecular Hydrogen Videos with Dr. Elen](#)

[Molecular Hydrogen Foundation](#)