



Health & Wellness



A Novel New Antioxidant—It's a Gas!!!



Dr. Kate Thomsen and Silky

It is the stuff of stars, the composition of our sun. It was there at the beginning — at the Big Bang. Now it is the third most abundant element on the Earth's surface. It is the simplest and most abundant of the elements, making up roughly 75% of the mass of the universe. It is the lightest chemical in the periodic table, and it is 14 times lighter than air. It makes up about 0.00005% of the air we breathe. It is colorless, odorless, and tasteless. It can be made from water; It can make water. It's so light, it was used in early airships as a "lifting gas". It lifted the massive airship Hindenburg across the ocean from Frankfurt Germany to Lakehurst NJ. It is a highly flammable gas and in 1937 caused the Hindenburg to become a fireball after reacting with a spark. It is an environmentally-friendly fuel for cars (via fuel cells). It is the basis for nuclear fusion, a clean energy source of the future. In its liquid form, it is used to fuel spacecraft. It is essential in the production of ammonia (for fertilizer) and the processing of fossil fuels. It has an atomic Number of 1 and consists of just one proton and one electron. It's chemical letter is H. It is the first element in the Periodic Table of the Elements. It's Hydrogen.

British scientist Henry Cavendish is credited with discovering Hydrogen in 1766. He noticed a colorless, odorless, flammable gas was formed when he reacted acids with metals. He called it "inflammable air" due to its high flammability. When the gas was burned it produced water and the scientist Antoine Lavoisier named the gas Hydrogen from the words "hydro" (water) and "genes" (creator) meaning water-former.

Hydrogen is ubiquitous on the earth, mostly existing within chemical compounds (e.g., hydrocarbons) and water.

Hydrogen plays a critical role in the human body as well. It is part of many organic compounds, including the water in our bodies. It participates in energy production and various biochemical processes essential for life. Our bodies contain about 2.8 octillion hydrogen atoms! This is from the 60% water and 15% fat, protein and carbohydrate parts of our body mass.

Around 1970 humans began to use hydrogen as a diving gas because it was thought to be non-toxic and biologically inert. In 2007 hydrogen was found to have antioxidant properties. It demonstrated the ability to selectively counteract the most harmful reactive oxygen species (ROS) without neutralizing the beneficial ROS. The landmark study by Dr. Ohta's group published in *Nature Medicine* describes how inhalation of Hydrogen during a stroke injury in rats was able to reduce the tissue damage in the brain caused by the hydroxyl radical.

Examples of reactive oxygen species (ROS) made in our body chemistry include superoxide, hydroxyl radi-

cal and hydrogen peroxide — molecules that burn or bleach our cells from the inside out. They oxidize fats, proteins and DNA by stealing electrons thereby disrupting cell membranes and cellular machinery. ROS are constantly being made by our bodies to clean up the cell residue of living, breathing and eating. While they are useful in small amounts for cleaning up problems (like helping immune cells kill bacteria) they are destructive when they spill everywhere. Situations where ROS become overpowering include overwhelming infection, tissue injuries, exposures to toxicants like UV light, radiation, chemical and air pollution, smoking, alcohol, drugs, heavy metals, mold and the like. When the generation of ROS overwhelms our antioxidant defenses (too much bleach creating too much cell damage) it is called oxidative stress. This is the final common pathway of breakdowns in our optimal functioning from infections, injury and toxicity: too much reactive oxygen (O-) and not enough neutralizing antioxidants.

Our bodies make antioxidants (CoQ10, Glutathione...) to neutralize these ROS. We also intake antioxidants in our food (Vitamins A, C, and E and polyphenols, etc) and supplements. But this new idea, adding Hydrogen gas, very simply adds a Hydrogen to those reactive Oxygens to make harmless water (H₂O!!!). And as a gas, it's bioavailability is more widespread — not depending on just the blood stream for delivery.

Since 2007, the interest in hydrogen as a selective antioxidant has seen steady growth with over 2000 published research papers on the use of Molecular Hydrogen

Therapy in animals, and humans along with cell-based studies. Over 100 of these are human-focused. There have been over 80 registered clinical trials using Molecular Hydrogen therapy.

Therapeutic properties of Molecular Hydrogen have broadened and now include anti-inflammatory and cytoprotective in addition to acting as an antioxidant in chronic disease as well as acute injuries. Positive indications have been found in major disease areas including cardiovascular diseases, cancer, respiratory diseases, central nervous system disorders, infections and many more. There have been no known serious adverse effects reported in human trials. The nonprofit organization, The Molecular Hydrogen Institute (molecularhydrogeninstitute.org), provides education, research, and awareness of molecular hydrogen's therapeutic potential. It provides a rich collection of links to the scientific studies by clinical category.

There are 4 methods of delivering molecular hydrogen: inhalation, injection, drinking hydrogen water and topical application. Inhalation consists of a mixture of hydrogen gas mixed with oxygen or air and inhaled through a nasal cannula or mask. The concentration of hydrogen is 1 — 4% by volume in air. There are limits to this method as the gas is flammable above 4%. Ingestion of Hydrogen rich water is the most common delivery method for daily use. The hydrogen can be bubbled into the water or generated by dropping a magnesium based tablet that releases hydrogen into the water. The concentration ranges from 0.6 — 1.6mM/L (1.2 —

3.2mg/L). Even at this low concentration, regular consumption of hydrogen rich water has shown measurable biological effects. Direct delivery by injection of hydrogen saturated saline gives a higher bioavailability than inhalation or ingestion but is not readily available except in research settings. Hydrogen baths or foot baths, where the gas is dissolved in warm water, have shown skin-protective and anti-inflammatory benefits. Modulation of gut bacteria capable of producing hydrogen (certain strains of *Bacteroides* and *Clostridium*) can be attempted via dietary intervention.

Molecular Hydrogen is becoming a better known, easy to apply, safe and effective therapy for our time. Challenges may remain in standardizing treatment regimens and verifying efficacy, but there is enough evidence to affirm its benefits. I believe the daily use of Molecular Hydrogen, whether inhaling it via commercially available equipment or drinking hydrogen rich water while it bubbles is a smart preventive or therapeutic strategy for humans as they age and are living on an ever more polluted planet.

Dr. Kate Thomsen's office for holistic health care is located in Pennington, NJ. She is trained in Family Medicine, and Board Certified in Integrative Medicine. She is an Institute for Functional Medicine Certified Practitioner. She has been practicing Functional Medicine for 26 years. For more information see www.drkatethomsen.com or call the office at 609-818-9700.