

The Pseudoscience of Oxygen Therapy

Many claims associated with the safety and efficacy of so-called "oxygen therapy" using hydrogen peroxide and ozone are unfounded and unlikely to be true.

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Many health-related claims have been made in the popular literature, on radio talk shows, and on the Internet regarding so-called "oxygen therapy." Oxygen therapy as discussed in this article refers to such practices as oral ingestion (drinking) of hydrogen peroxide, administration of hydrogen peroxide enemas, and inhalation of ozone without appropriate medical supervision. These practices should not be confused with medically approved oxygen therapy, which involves administration of oxygen at elevated concentrations (hyperbaric oxygen) and medically supervised administration of hydrogen peroxide and ozone under carefully controlled clinical conditions, although even some of these medical treatments remain controversial.

Ostensibly, the rationale behind oxygen therapy is to provide the body with "healthful, life-giving oxygen" as a sort of pick-me-up for healthy people, and to provide an additional weapon of last resort in the medical arsenal against a variety of diseases including cancer and AIDS. Many claims regarding the safety and efficacy of oxygen therapy as a stimulant and for treatment of a host of illnesses are commonly touted by advocates of oxygen therapy. Visitors to oxygen therapy Internet sites read that "patients with cancer, AIDS, tuberculosis, arthritis, heart disease, and stroke are cured by therapeutic oxygen therapy almost without exception" and that "health sciences have been trying to find the primary physical cause of all diseases and the cure-all that this basic principle would yield. Now both have been found" through the use of oxygen therapy. Along with such health claims, the sales of concentrated hydrogen peroxide and ozone generators are frequently promoted.

Oxygen therapy, like many other popular health fads, is based upon a little bit of science, a little bit of charlatanry, and a whole lot of wishful thinking. Unfortunately, oxygen therapy may harbor dangers that are as yet unrecognized by the average person. This is largely due to the fact that proper scientific evaluation of oxygen therapy has not been conducted and is not likely to be conducted because medically unsupervised, in-home, do-it-yourself oxygen therapy is based upon a poorly conceived, poorly controlled, and fundamentally flawed approach.

Another interesting and characteristic aspect of the oxygen therapy fad is the notion that a conspiracy exists between the government Food and Drug Administration (FDA) and big drug companies; they have clandestinely banded together in order to prevent the good news about oxygen therapy from getting out. According to the oxygen therapy literature, this has occurred because "drug companies cannot patent hydrogen peroxide and ozone and their widespread use in oxygen therapy would reduce sales of antibiotics." As a further example, readers of oxygen therapy literature are informed that "the FDA fights a cynical battle against doctors who are determined that their patients will not die from diseases such as AIDS" that are curable by oxygen therapy. This is very similar to claims made by UFO enthusiasts that crashed flying saucers are stored under tight security at secret government installations.

I am not in favor of government regulation or prohibition of oxygen therapy; I merely wish to provide additional information for anyone who is interested in this subject.

Oxygen is Toxic

As strange as it may seem, oxygen is in fact toxic. This statement seems counterintuitive because oxygen is necessary to sustain life. How, then, can oxygen be both necessary to sustain life and toxic? The answer to this question lies in the fact that all aerobic organisms, including humans, derive the energy necessary to carry out their life functions by consuming food and combining

this food with oxygen. The resulting metabolic chemical reactions release energy that is harnessed to carry out such diverse functions as heart contractions that pump blood, leg muscle contractions that propel the body, and in mammals, regulation of body temperature. Aerobic metabolism is a wonderfully efficient way of extracting needed energy from food, but all aerobic organisms pay a price for this adaptation to Earth's oxygen-rich atmosphere; we are subject to attack from powerful toxins derived from oxygen. For a good introduction to this topic see *Free Radicals in Biology and Medicine*, Halliwell and Gutteridge, 1995.

Many of these toxins belong to a group of chemical species

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called *free radicals*. More specifically, some of the free radicals derived from reactions involving oxygen are called *oxygen-centered free radicals* or *free radical oxidants*. Unfortunately, oxygen, which is present in the atmosphere as O_2 (oxygen molecules), is readily converted during the course of metabolic chemical reactions to a variety of powerful free radical oxidants (For an advanced discussion of oxygen chemistry and thermodynamics see Sawyer 1991). Free radical oxidants owe their toxicity to their ability to react with biomolecules (e.g., lipids, proteins, and DNA). Some free radical oxidants can react only with certain biomolecules while others can react with virtually all biomolecules (Halliwell and Gutteridge 1995; Kruk 1998).

Reactions between free radical oxidants and biomolecules frequently lead to alterations of the affected biomolecules that are quite harmful. When their concentrations are high, free radical oxidants can kill cells and destroy tissue. In fact, free radical oxidants are thought to be involved in such diverse phenomena as aging, heart disease, carcinogenesis, and Alzheimer's disease. All aerobic organisms have had to evolve sophisticated defense mechanisms against the continual onslaught of free radical oxidants. Advances in our understanding of their involvement in disease has prompted medical authorities to advise eating foods and taking dietary supplements that are rich in antioxidants.

Hydrogen Peroxide and Ozone as Sources of Toxic Free Radical Oxidants

Hydrogen peroxide (H_2O_2) is a familiar component of most home medicine chests. An examination of the ubiquitous brown bottle reveals that it contains a 3 percent hydrogen peroxide solution stabilized by a preservative. The preservative

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slows the gradual decomposition of hydrogen peroxide into water and oxygen. This dilute solution of hydrogen peroxide is a useful antiseptic and is frequently employed to rinse the mouth or to treat minor scrapes and cuts. Hydrogen peroxide at concentrations higher than 3 percent can be highly corrosive to tissues and cause severe burns. In addition, consumption of hydrogen peroxide may cause acute gas embolism and is a recognized genotoxin (substance that alters genetic material).

The hydrogen peroxide prescribed for use in oxygen therapy is at a 35 percent concentration—high enough to cause severe burns unless diluted. It is described by oxygen therapy enthusiasts as “good for a multitude of uses, internally and externally” because “our bodies are lacking in adequate hydrogen peroxide to function properly.” They go on to say that “if there is insufficient oxygen for the cell to burn it, sugar will be converted into carbon monoxide” and that “cells cannot become diseased if they are supplied with sufficient oxygen.” These claims, which undoubtedly sound scientific to the average person, are patently absurd.

It is further asserted by oxygen therapy advocates that 3 percent hydrogen peroxide solutions available in drug stores are unsuitable for oxygen therapy because of the added stabilizer and that the 35 percent food-grade hydrogen peroxide, available by them through the mail, is essential. Of course, no explanation is given regarding the mechanism by which the stabilizer reduces the efficacy of hydrogen peroxide in oxygen therapy.

As mentioned previously, hydrogen peroxide slowly decomposes to water and oxygen. However, it can also react rapidly, under conditions present in the body, to form a particularly powerful and very toxic free radical oxidant called hydroxyl radical. Hydroxyl radicals are composed of a hydrogen atom and an

oxygen atom that has an unpaired electron attached to it. The hydroxyl radical exhibits extraordinarily high reactivity towards almost any biomolecule and leads to changes that are similar to those caused by exposure to ionizing radiation.

Ozone is a gas at room temperature and pressure. It has a particularly strong, pungent, and irritating odor. This odor can occasionally be noticed after lightning strikes during particularly vigorous thunder storms or after operating electric motors. The electric discharge causes the splitting of an oxygen molecule (O_2 , two oxygen atoms bound together) present in the air into separate oxygen atoms. The separated oxygen atoms are very reactive and can attach to another oxygen molecule, forming ozone (O_3 , three oxygen atoms bound together). Ozone dissolves in water, forming several chemical species including hydroxyl radicals. Breathing ozone causes severe irritation of the lungs and mucous membranes and ultimately to changes in lung tissue that resemble exposure to ionizing radiation.

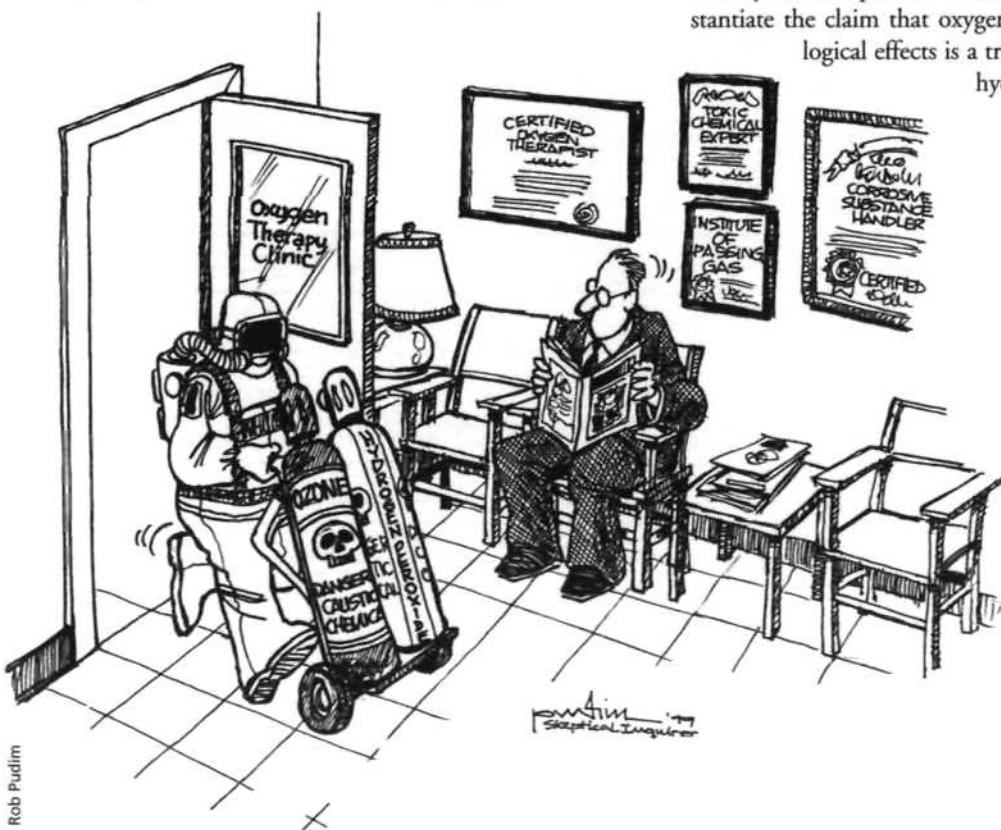
That hydrogen peroxide and ozone exposures cause changes in cells and tissue that are similar to exposure to ionizing radiation is not at all surprising. When living organisms are exposed to gamma radiation, the very energetic gamma photons are absorbed by water molecules, which gain so much energy that they split apart to form hydroxyl radicals.

Unsubstantiated “Scientific” Claims

Claims of psychological benefits from oxygen therapy are potentially valid but are unsubstantiated. If ingestion of hydrogen peroxide or ozone inhalation causes a beneficial psychological change such as stimulation or relief from depression, it may be entirely due to a placebo effect. What is needed in order to substantiate the claim that oxygen therapy has beneficial psychological effects is a trial in which volunteers are given

hydrogen peroxide or ozone and placebo along with subsequent quantitative psychological evaluations. Such an experiment may not be ethically permissible, however, since there is evidence to suggest that ingestion of hydrogen peroxide and inhalation of ozone both pose a risk of adverse health effects.

This situation is somewhat reminiscent of the claims made many years ago concerning the psychological benefits of consuming radium water. Near the turn of the century, many older men were convinced that they felt more vigorous (particularly with regard to sexual performance) after a suitable regimen of radium water consumption.



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Unfortunately, radium water was found to cause particularly horrific side effects, including destruction of bone tissue in the jaw and skull, and is (hopefully) no longer considered to be a healthful tonic. However, any future medically supervised study of the psychological effects of consuming radium water is not likely given the well-documented gruesome side effects.

Some oxygen therapy advocates claim that hydrogen peroxide consumption and ozone inhalation are "completely safe." This is clearly unlikely. It has also been claimed that ingestion of hydrogen peroxide is "every bit as safe as taking a bath or putting gasoline in your car," but the accuracy of this claim is impossible to assess. There is certainly some drowning risk associated with taking a bath and there is undoubtedly a health risk associated with putting gasoline in your car as a result of exposure to volatile aromatic hydrocarbons via inhalation. Finally, the oxygen therapy gurus advise that "you may experience nausea, sleepiness, unusual fatigue, skin eruptions, diarrhea, colds, infections, boils, etc." and that "these are natural cleansing processes." These symptoms are, in fact, much more likely to represent some of the toxic effects of oxygen therapy.

Another fallacious tactic used by oxygen therapy advocates is to invoke the argument that "if there were any truth at all to claims that oxygen therapy is harmful to humans, the evidence would have been clear forty years ago." This is akin to taking the position that a statement which cannot be disproven must therefore be true. This of course represents a philosophy that is the antithesis of the scientific outlook put forth by "experts" representing themselves as "scientific."

Much scientific evidence exists in support of the claim that hydrogen peroxide and ozone are capable of destroying a wide variety of disease agents. The hydroxyl radicals derived from hydrogen peroxide and ozone are fully capable of killing cancer cells just as they are fully capable of destroying the AIDS virus. Unfortunately, hydroxyl radicals are also fully capable of altering and killing normal, healthy cells.

The Fundamental Flaw in the Oxygen Therapy Approach

The fundamental flaw in the oxygen therapy approach is that it completely ignores the need to exploit the substantial toxicity of free radical oxidants selectively. In other words, an attempt must be made to limit, as much as possible, exposure of normal, healthy cells to free radical oxidants. Oxygen therapy proponents argue erroneously that "enzymes present in the body are fully capable of protecting against any damage inflicted by free radical oxidants to healthy cells" during oxygen therapy. This is untrue even with regard to naturally occurring free radical oxidant concentration levels and is certainly untrue when the body is deliberately swamped with free radical oxidants during oxygen therapy. Oxygen therapy proponents claim that "disease organisms are of primitive evolutionary origin and thus

require less oxygen and can only survive in low oxygen environments." This is more pseudoscientific nonsense.

Other Approaches with Real Promise

Many selective approaches for killing cancer cells and viruses are already being widely exploited by medicine. For example, in one therapy tumor cells are selectively exposed to gamma radiation from a cobalt-60 source. As much as possible, the exposure is limited to diseased tissue. Put simply, the aim is to kill a much larger number of tumor cells than normal cells. Other modern approaches have included removal of blood from the body and treating the blood *in-vitro* (outside the body) with oxidants such as ozone to kill the virus responsible for AIDS.

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Other highly successful cancer treatments such as photodynamic therapy (PDT) have involved shining light on cancer cells after the administration of a dye that is taken up by cells. The light causes the dye to form powerful oxidants from oxygen molecules that attack and kill nearby cells (Marcus 1992). In some approaches, the difference in the rate of release of the dye by cancer cells versus healthy cells is exploited in order to time the light exposure. Healthy cells have been found to release certain dyes more rapidly than diseased cells. It is thus only necessary to wait until the dye has cleared from the healthy cells, while still remaining in the cancer cells and then switch on the light, selectively killing the cancer cells and leaving the healthy cells essentially unaffected.

The safety and efficacy of oxygen therapy, as described in the popular literature, is based upon unsubstantiated claims and is not likely to be safe and effective as a rejuvenating tonic or as a treatment for cancer and infectious diseases. Furthermore, the promotion and use of powerful chemical oxidants such as hydrogen peroxide and ozone without proper medical supervision is dangerous and irresponsible. It is my hope that individuals tragically stricken with life-threatening diseases will consult with a competent health care practitioner before embarking on any course of home treatment. Safer and more effective treatments are constantly being developed by rigorous scientific studies and are offered in clinics throughout the world.

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