

IMVA Medical News Commentaries
Carbon Dioxide
One of Life's most Essential Nutrients
Part Two

Few people know that a decreased level of carbon dioxide in the blood leads to decreased oxygen supply to the cells in the body including in the brain, heart, kidneys etc. Carbon dioxide (CO₂) was found at the end of the 19th century by scientists Bohr and Verigo to be responsible for the bond between oxygen and haemoglobin. If the level of carbon dioxide in the blood is lower than normal, then this leads to difficulties in releasing oxygen from haemoglobin. Hence the Verigo-Bohr law: *According to the Verigo-Bohr effect, we can state that a CO₂ deficit caused by deep breathing leads to oxygen starvation in the cells of the body.*

What we are staring at here is the primordial yin and yang in human physiology. Oxygen the Yang fire cannot be separated from its Yin counterpart, where these is one there is the other. They cannot be separated from each other depending as they do on the others existence. Pulmonary function measurement is an indicator of general health and vigor and literally the primary measure of potential life span. Our respiration is what balances oxygen with CO₂.

You can see normal breathing in a healthy baby. Normal breathing is invisible, through the nose, and is so quiet that you can hardly hear it. With normal breathing the content of carbon dioxide in alveolar air should be 6.5%. Researchers at the Max Planck Institute for Solar Research in Germany report the sun has been burning more brightly over the last 60 years, accounting for the 1 degree Celsius increase in Earth's temperature over the last 100 years. Dr. Timothy Patterson, professor of geology and director of the Ottawa-Carleton Geoscience Center of Canada's Carleton University, says that "CO₂ variations show little correlation with our planet's climate on long, medium and even short time scales."

So it's really not the carbon we have to worry about it's the more deadly poisons that comes out of the smokestacks of industry, principally mercury which will deny us our future. Carbon dioxide we need and having more in the air is not threatening us in the present or foreseeable future. In fact most people, especially the chronically ill are deficient in carbon dioxide because of the acid conditions paralleled by anxious over-breathing coupled with the lack of exercise.

A Russian doctor named Konstantin Buteyko is most responsible for drawing attention to the importance of carbon dioxide for body metabolism and how the lack of it can cause chronic diseases; this constitutes a major breakthrough in medical science. Yoga teachers the world over labor to help their students with their breathing knowing as they do that breathing is the key to health, relaxation and meditation.

Biologist Dr. Ray Peat tells us that "breathing pure oxygen lowers the oxygen content of tissues; breathing rarefied air, or air with carbon dioxide, oxygenates and energizes the tissues; if this seems upside down, it's because medical physiology has been taught upside down. And respiratory physiology holds the key to the special functions of all the organs, and too many of their basic pathological changes." 1

People who live at very high altitudes live significantly longer; they have a lower incidence of cancer (Weinberg, et al., 1987) and heart disease (Mortimer, et al., 1977), and other degenerative conditions, than people who live near sea level. Dr. Peat continues saying that, "Breathing too much oxygen displaces too much carbon dioxide, provoking an increase in lactic acid; too much lactate displaces both oxygen and carbon dioxide. Lactate itself tends to suppress respiration. Oxygen toxicity and hyperventilation create a systemic deficiency of carbon dioxide. It is this carbon dioxide deficiency that makes breathing more difficult in pure oxygen, that impairs the heart's ability to work, and that increases the resistance of blood vessels, impairing circulation and oxygen delivery to tissues. In conditions that permit greater carbon dioxide retention, circulation is improved and the heart works more effectively. Carbon dioxide inhibits the production of lactic acid, and lactic acid lowers carbon dioxide's concentration in a variety of ways."

The presence of lactic acid, which indicates stress or defective respiration, interferes with energy metabolism in ways that tend to be self-promoting. Harry Rubin's experiments demonstrated that cells become cancerous before genetic changes appear. The mere presence of lactic acid can make cells more susceptible to the transformation into cancer cells. (Mothersill, et al., 1983.) The implications of this for the increased susceptibility to cancer during long term stress are obvious.

The lactic acid system is capable of releasing energy to resynthesize ATP without the involvement of oxygen and is called anaerobic glycolysis. Glycolysis (breakdown of carbohydrates) results in the formation of pyruvic acid and hydrogen ions (H⁺). A build up of H⁺ will make the muscle cells acidic.

“Otto Warburg established that lactic acid production is a fundamental property of cancer. It is, to a great degree, the lactic acid which triggers the defensive reactions of the organism, leading to tissue wasting from excessive glucocorticoid hormone,” says Dr. Peat. Tumors do tend to be efficient at exporting lactate which drops the pH in the milieu of the tumor. The breakdown of glucose or glycogen produces lactate and hydrogen ions - for each lactate molecule, one hydrogen ion is formed.

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Dr. Ray Peat

Thus we can begin to see that it is the lack of carbon dioxide in the body which is a cause of many disturbances in the metabolism of cells and tissues, which, in turn, can lead to disease. Dr Buteyko said, "CO₂ is the main source of nutrition for any living matter on Earth. Plants obtain CO₂ from the air and provide the main source of nourishment for animals, while both plants and animals are nourishment for us. The great resource of CO₂ in the air was formed in pre-historical times when the amount was about 10%.”

The best way to produce carbon dioxide is from physical activity but most people with chronic illness and cancer unfortunately do not exercise. Understanding how important sodium bicarbonate can be to the chronically ill person involves understanding the basic physiology of carbon dioxide. This leads us directly to our breath and we must understand and take conscious control of it so we optimize our breathing and CO₂ and thus Oxygen levels. Over breathing really is a kind of self suffocation when taken to the extreme because we are driving down CO₂ levels and that actually decreases oxygen to the cells.

There are different techniques designed for increasing carbon dioxide levels in the blood. Dr Buteyko developed a system where by breathing techniques controlled asthma. The ancient yogis with their yogic breathing and NASA controls spaceship climates with these issues in mind. Natural medicine makes proper breathing important because the central mechanism to maintain CO₂ levels is correct breathing.² The clinical choice often is IV injection of bicarbonate in emergency situations but the rest of us can take the easy inexpensive way using oral sodium bicarbonate. In a future essay I will be talking about transdermal sodium bicarbonate administration which is especially important for children.

Sodium bicarbonate can be put in large quantities in baths with inexpensive magneisum bath flakes to make an exceptional therapeutic bath and it can be made into a simple lotion with water and applied directly to the skin. Early testimonies about this will surprise many clinicians who underestimate the importance and use of transdermal medicine. About 80% of the CO₂ formed by metabolism is transported from tissues to lungs as bicarbonate ions dissolved in the water phases of red cells and plasma. The catalyzed hydration of CO₂ to bicarbonate takes place in the erythrocytes but most of the bicarbonate thus formed must be exchanged with extracellular chloride to make full use of the carbon dioxide transporting capacity of the blood. This is an important reason why magnesium chloride is not only the ideal form of magnesium but also the reason to combine magnesium chloride with bicarbonate. Chloride is another basic substance that runs parallel biological processes.

The anion transport capacity of the red cell membrane is among the largest ionic transport capacities of any biological membrane. Exchange diffusion of chloride and bicarbonate is nevertheless a rate-limiting step for the transfer of CO₂ from tissues to lungs.³

Baking soda (sodium bicarbonate) immediately reacts when it mixes with stomach acid. $\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$. That is: Sodium bicarbonate + stomach acid yields salt + water + carbon dioxide. This is the physiological reason why bicarbonate is such an effective medicine; it instantly offers a return to more normal CO₂ levels which drives more Oxygen into the tissues. This is not something cancer cells enjoy.

CO₂ is a gas at room temperature, and consists of a central carbon atom and two oxygen atoms arranged in a linear fashion. When dissolved into water, the CO₂ becomes hydrated to form carbonic acid (H₂CO₃). This hydration step

takes a few seconds, though that may seem fast, many organisms from bacteria to humans use an enzyme called carbonic anhydrase to greatly speed up the process.

Once carbonic acid forms, it very quickly equilibrates with the other acids and bases in solution. It can, for example, lose one or two protons (H^+). The extent to which this happens depends upon the pH and a variety of other factors. In seawater at pH 8.1, most of it (87 percent) will lose one proton to form bicarbonate, a small amount will lose two protons to form carbonate (13 percent), and a very small amount will remain as H_2CO_3 ($<>1$ percent). All of these forms, however, interconvert faster than the blink of an eye, so one cannot identify one as carbonate and one as bicarbonate for more than a tiny fraction of a second. All one can really say is that on average X percent is in the form of bicarbonate, and Y percent in the form of carbonate.⁴

A bicarbonate anion is considered "labile" since at a proper concentration of hydrogen ion (H^+) it may be converted to carbonic acid (H_2CO_3) and thence to its volatile form, carbon dioxide (CO_2). Little did this clinician know that a lack of carbon dioxide is itself a starting point for different disturbances in the body. If a carbon dioxide deficiency continues for a long time then it can be responsible for diseases, ageing and even cancer.

Sodium (Na^+) is the principal cation of the extracellular fluid and bicarbonate (HCO_3^-) is a normal constituent of body fluids and the normal plasma level ranges from 24 to 31 mEq/liter.

So now that we know something about carbon dioxide its not something we need to be afraid of and certainly we don't want anyone putting a tax on it for the trees, at least, are loving that there is more of it in the air. If there is any truth in the fact that more CO_2 in the air has a warming affect then perhaps in the end we will be thankful when it gets really cold that it is not as cold as it might be if we had not filled the air with so much of it due to human activity.

That does not mean we do not have a huge pollution problem that is harming everyone especially in the northern hemisphere. People in cities everywhere are exposed to unacceptable levels of air pollution that are killing people. And again it is the mercury that is put out to the tune of about 20 tons a day that is the real threat to the future of humanity not the carbon dioxide. Remember it's only about a gram of mercury that will pollute a lake so 20 tons a day is threatening and even causing neurological disorders like autism downwind of smokestacks. This is just one more lesson to teach us that we trust the wrong people to decide the future destiny of our lives. Parents especially need to be aware for their children's lives are in the wrong hands.

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