Unique WATER™
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2. A Scientific Introduction to the Damage Caused by Carbon Dioxide in the Body

Carbon dioxide is a well known greenhouse gas. It exists in the normal atmosphere at the very low concentration of three hundred parts per million (0.03 percent). The hundred trillion (hundred million million) cells that constitute the human body produce carbon dioxide gas continuously from the metabolism of food. This carbon dioxide is expelled eventually from the body via the lungs and, to a lesser extent, via the skin. Indeed, an average person breathes out half to one kilogram (300 to 600 litres) of carbon dioxide per day. This exhaled carbon dioxide becomes part of the carbon dioxide gas in the atmosphere.

Body cells are seventy-five to eighty-five percent water. The adult human body is about sixty percent water overall. The carbon dioxide gas concentrations produced in body cells cause acidic conditions in the intracellular water of the cells. The acidic conditions arise because of the following:

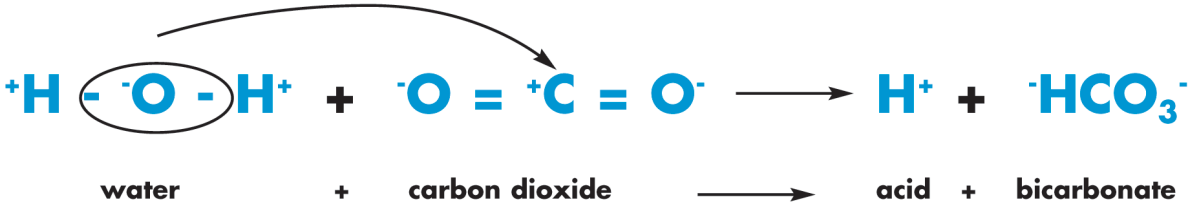
i. In the body, intracellular carbon dioxide concentrations and carbon dioxide gas partial pressures are high (carbon dioxide concentrations are at least 60,000 parts per million).

ii. Carbon dioxide dissolves readily in water with about half a litre of carbon dioxide gas dissolving in the equivalent of one litre of intracellular water.

iii. Carbon dioxide is a partially-charged polar molecule that acts as a substrate in the formation of acids. The carbon dioxide molecule (CO_2) is more accurately represented by the formula:

iv. Water (H_2O) is also a partially-charged polar molecule. The water molecule is more accurately represented by the formula:

When carbon dioxide gas is dissolved in water, the partial positive charge on the carbon atom of a carbon dioxide molecule attracts the partial negative charge on the oxygen atom of a water molecule to form acid (strictly, a proton) and a bicarbonate group:



Overall, about one molecule of carbon dioxide in five hundred reacts as described above with a water molecule to form acid in a body cell. This is the main source of acid in the human body. If acid production occurs too quickly, and there is too large a concentration of acid, then toxic effects and cell damage occur in the body. Quantitatively, even a small increase in acidity has dramatic effects on cell function. For example, small increases in acid concentration affect the shape and activity of enzymes and other proteins in body cells. This alters the activity of a range of metabolic processes to the detriment of body cell function. Nerve cell and muscle cell excitability is altered also detrimentally. This affects neuromuscular function. In addition, the cell organelles called mitochondria cannot maintain optimum function in the presence of acid concentrations. Because mitochondria are responsible for the vast majority of energy production (adenosine triphosphate or ATP synthesis) in body cells, excess carbon dioxide and acid concentrations result in a drop in energy production throughout all body cells. Normal body function cannot be maintained.
The body becomes fatigued and ages.

At the organisational level of body organs, carbon dioxide and acid concentrations are acutely detrimental to organ function. For example, carbon dioxide and acid are so dangerous to brain function that the brain uses concentrations of these substances to directly affect cerebral blood flow. Cerebral blood flow greatly increases in the presence of carbon dioxide and acid so that excess carbon dioxide and acid are eliminated quickly via the increased blood flow. An increase in blood flow also allows higher concentrations of oxygen to reach brain cells. High concentrations of oxygen are vitally important in the brain because brain cells can survive only on aerobic metabolism and have no capacity to survive under the anaerobic conditions caused by carbon dioxide concentrations. Indeed, carbon dioxide is so toxic to the brain that it is used routinely throughout the world to euthanase laboratory animals.

Perhaps the greatest damage produced by excess carbon dioxide and acid concentrations in the body occurs when intracellular organelles called lysosomes either breakdown in cells or are released into tissues. The acids that exist inside lysosomes, and similar cell organelles such as phagosomes, endosomes and ruffled membranes, originate from carbon dioxide concentrations and can contribute to the destruction of body molecules, body cells and body tissues.

One scientific theory of ageing and fatigue states that lysosomes may contribute to constant body destruction and this may be responsible for the visible appearance of ageing and for physical ageing and fatigue per se. This explains also why old cells and tissues appear more vulnerable to pathology and disease than young cells and tissues. That is, in old cells and tissues, there has been a greater exposure to the acids and destructive enzymes of lysosomes. The ability to maintain cell and tissue function is impaired.