Acid / Alkaline Buffering Systems

The body's pH Buffer systems correct both excess acidity and alkalinity, but here the focus is on acid-buffering systems, since over-acidity in the body is the "problem of the day"

Overview of Body's Acid- Buffering Systems

- The body's first step to counter acidosis - is to try and buffer excess acid with alkaline mineral bicarbonates in the blood and lungs.

- If sufficient alkalizing minerals are unavailable - the body begins to sweep the extra acids into the tissues, especially muscles and joints. This is known as lactic acid 'buildup' and is experienced as pain.

- If all else fails - the body will precipitate acids out of solution in the form of solid crystals and salts, realized as gallstones, kidney stones, uric acid crystals, plaque, and cholesterol crystals.

Technical Details of Body's Acid Buffering Systems

- An acid buffer is made up of a buffering pair:

  (a) A weak acid (capable of donating a H^+ and thus lowering pH);

  (b) The acid's conjugate base (Capable of accepting H^+, and thus raising pH)

- An acid-buffering system is likened to a sponge which soaks up H+ ions - When an acid is added to a solution, the pH change can be minimized by the adequate presence of buffers, and to have this effect, *acid buffers have to be a weak acid themselves.*

- For example, carbonic acid (H2CO3) is an acid buffer:
  Since carbon dioxide and water are the principal end products from carbohydrate, protein and fat breakdown, carbon dioxide (CO_2) is the most abundant acid-forming substance produced by the body. CO_2 + water (H_2O) in the blood forms **carbonic acid** (H_2CO_3) a weak acid which

ionizes to give H^+ (hydrogen ion) and HCO_3^- (bicarbonate ion). The *H+ in strong acids are completely dissociated*, but the *H+ in weak acids are only partially dissociated* and are efficient at preventing pH changes.

3 main acid / alkaline buffer systems

- In functional equilibrium with each other, there are three main buffer systems contributing to the regulation of the acid-base balance:

  (1) Chemical Buffer Systems - in blood, lymph, and intra/extracellular fluids;

  (2) Respiratory Compensation (Gaseous exchange in the lungs) – breathing out CO2 deals with much of our acid excess.

  (3) Renal Mechanisms (Excretory functions of the kidneys) - the kidneys serve primarily to excrete protons created during the breakdown of different acids. This excretory system is needed because the typical diet tends to present more H+ ions (protons) than alkalizing substances that might neutralize them.