CARBONIC ANHYDRASE

- **The carbonic anhydrases form a family of enzymes that catalyze the interconversion between carbon dioxide and water and the dissociated ions of carbonic acid (i.e. bicarbonate and hydrogen ions).The active sites of most carbonic anhydrases contains a zinc ion. They are therefore classified as metalloenzyme. The enzyme maintains acid-base balance and helps transport carbon dioxide.**
- **Carbonic anhydrase helps regulate pH and fluid balance. Depending on its location, the role of the enzyme changes slightly. For example, carbonic anhydrase produces acid in the stomach lining. In the kidney, the control of bicarbonate ions influences the water content of the cell. The control of bicarbonate ions also influences the water content in the eyes, and if the enzyme does not work properly, a buildup of fluid can lead to glucoma**.

FUNCTIONS OF CARBONIC ANHYDRASE

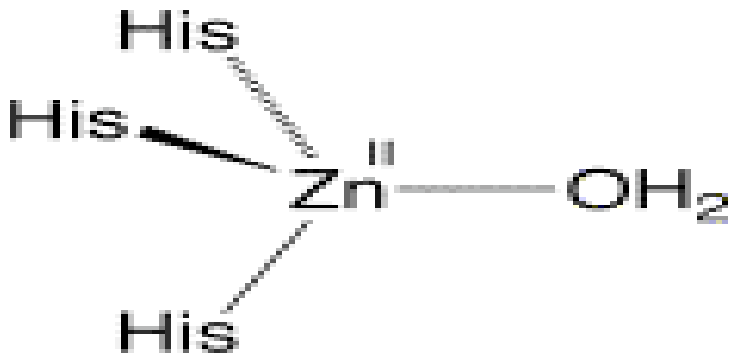
- **Carbonic anhydrase facilitates uptake of carbon dioxide by catalyzing the hydration of CO_2 dissolved in blood to the more soluble bicarbonate (HCO3–). Carbonic anhydrase is one of the fastest enzymes found in nature, with reaction rates on the order of 10^6/s . Furthermore, the enzyme acts reversibly, catalyzing CO_2 uptake and release depending on the availability of protons (H^+) in solution. Therefore, understanding the variations in enzyme kinetics with changes in active site chemistry, and availability of substrates (H_2O, CO_2) and products (H^+, HCO3–), helps clarify the carbonic anhydrase mechanism.**

CARBONIC ANHYDRASE AND LE CHATELIER'S PRINCIPLE

- **To describe equilibrium in the carbonic anhydrase reaction, Le Chatelier's principle is used. The tissues are more acidic than the lungs because carbon dioxide is produced by respiration and it reacts with water in the tissues to produce the hydrogen protons. Because the carbon dioxide concentration is higher, equilibrium shifts to the right, to the bicarbonate side. The opposite is seen in the lungs where carbon dioxide is being released so its concentration is lower so equilibrium shifts to the left towards carbon dioxide to try and raise its concentration.**

ACTIVE SITE STRUCTURE OF CARBONIC ANHYDRASE

A zinc ion (Zn^{2+}), coordinated by three histidine ligands and a water (H_2O), centers the catalytically active site.



$[NNN]Zn^{II}—OH_2$

Carbonic Anhydrase

CATALYTIC CYCLE OF CARBONIC ANHYDRASE