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Metal Complex Affects Enzyme Activates

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ABSTRACT

Coordination compounds can also affect some enzyme activities. We know that small molecules are able to selectively inhibiting a particular enzyme, which are usually organic compounds. Controlling enzyme activity by coordination compounds plays an important role in discovering new inorganic drug candidates [19]. Furthermore, the advantage that metal-binding compounds and metal complexes can provide such kind of unique properties contributing to enzyme inhibition that are not found in conventional in conventional organic molecules [20]. The mechanisms that how they control the enzyme activity varies from different complexes. Some compounds directly bind to the active side of the enzyme and blocking access of the substrate to the enzyme. In contrast to those binding directly to active site, some complexes bind to the non active site of substrate or enzyme, changing their conformation in order to prevent the correct binding of substrate to enzyme. Other enzyme itself contains coordination structure and functions the catalysis. There are many other kinds of mechanisms as well but in this article we mainly talk about the following examples.

Keywords: Enzyme, Organic Compounds, Porphyrins

I. INTRODUCTION

A. Enzyme inhibition by binding to an active site of the enzyme.

Porphyrins are typical enzyme inhibitor, which inhibit the activity of acetylcholinesterase (AChE)[21][22]. Tetraphenylporphyrin (**Figure 2**) can form different kind of metal complex with different functions by changing the coordination center (e.g. Fe, Zn, Cu, Co, etc.). A common example, which can be found in the structure of myoglobin and hemoglobin in our body, is the tetraphenylporphyrin complex with Fe as coordination center. Monosulfonatetetraphenylporphyrin (TPPS1) is able to forms a 1:1 complex with electric eel AChE, changing its conformation and thus inhibit the enzyme activity. White and Harmon (2002) have observed changes by measuring the absorbance of both TPPS1 and AChE. They reported that TPPS1 is an effective reversible competitive inhibitor of AChE, which means that TPPS1 competes directly with the normal substrate for an enzymatic binding site of AChE. Therefore the coordination compound acts as a competitive inhibitor that binding the active site of AChE in order to reduce the concentration of free enzyme available for substrate binding.

B. Metal complexes can promote nucleophilic catalysis by water ionization. The metal complexes are able to cause water ionization through the metal ion in coordination center. The metal ion provides charge that enables it to bind with water molecules, making the water molecule more acidic than free one. Thus, OH- ion can exist in environment with pH below neutral. Then it promotes the nucleophilic catalysis.One typical

example is the catalytic mechanism of carbonic anhydrase. Carbonic anhydrase is an enzyme catalyzes the reaction as shown below.

Typical example of this reaction is metal complex structure with Zn2+ ion as coordination center (**Figure 3**). The water molecule first binds to the fourth liganding position of Zn2+ ion, resulting in water ionization. The Zn2+bound OH- becomes a potent nucleophile, which can attack the CO2, converting it into HCO3-. At last the catalytic site is regenerated back to the initial state and ready to catalyze another CO2.

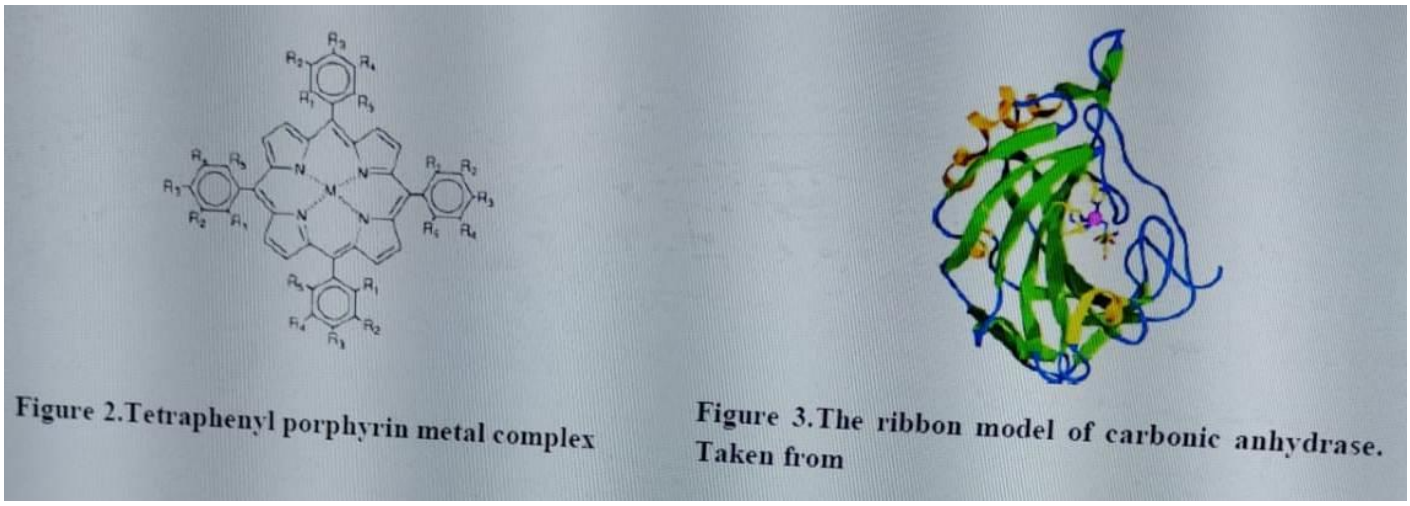

Figure 2.Tetraphenyl porphyrin metal complex

Figure 3.The ribbon model of carbonic anhydrase. Taken from

There are obvious and crucial role of coordination metal complex in biological pathway and processes. The works cited in this review brought us to ainsights on how metal trafficking in organism affects the biological pathway and the whole biological process. As we seek to understand the role of coordination metal complex in biology, there will be more research opportunities to develop better strategies for intercepting and manipulate biological pathway and processes. Moreover, innovative research on the design, functionality, and reactivity of a certain metal complex can enlighten new biological applications for metal complex such as a new MRI agent or a DNA-probing agent.

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