

Artificial Receptors to Detect Chiral Carboxylic Anions

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Editorial

Synthetic receptors for neutral substrates are an important target in the science of molecular recognition. In recent years, several synthetic receptors for the binding of aliphatic carboxylic acids via hydrogen bonding have been created. Many carboxylic compounds have chiral centres, which range from pharmaceuticals to tastes and scents. As a result, efforts have been made to design and construct artificial receptors for carboxylic anions. Anions are found all over the place in nature. Chloride is abundant in the oceans; nitrate and sulphate are found in acid rain; and carbonates are important elements of natural formations.

Anions are also essential for life's survival; they are involved in practically every metabolic function, including identification, transport, and transformation. Anions, for example, are found in roughly 70% of all enzyme sites, serve structural functions in many proteins, and are essential for the storage of genetic information (DNA and RNA are poly-anions). X-ray structures have been solved, permitting direct imaging of complexes formed by an enzyme and its anionic substrate, with the complex being stabilised by a network of hydrogen-ionic bonds. The structure of the enzyme porpho-bilinogen de-aminase di-pyrromethane cofactor is very telling. The phenomenon of recognition is fundamental to life. It has not gone unnoticed by chemists, and extensive study has been conducted in try to design and construct artificial receptors. The idea of complementarities underpins molecular recognition. The receptor and the substrate must exhibit geometrical complementarities, which are critical in determining the mutual stickiness of the binding partners, and electronic complementarities via positive/negative charge/dipole or hydrogen interactions.

Several issues must be resolved:

- I. Anions are larger than iso-electronic cations and have a lower charge to radius ratio,
- II. They are stronger solvated; energy must be paid to desolvate the anion before binding, so the stability of the anion complex will be lower than that of the cationic species,
- III. A variety of shapes must be considered
- IV. Anions are susceptible to proton transfer and binding will only be effective in a definite pH window.

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Among the anions, carboxylic anion is a particularly prevalent functional group that has prompted the creation of a number of distinct methods for recognising it. Indeed, carboxylic anions are implicated in a number of biologically interesting molecular recognition processes. Carboxylic acids are found in amino acids, enzymes, antibodies, and metabolic intermediates, where they help to explain their unique biochemical behaviour. Furthermore, hydrogen-bonding configurations involving one or both oxygen atoms of a carboxylic acid play a crucial role in the non-covalent organisation of secondary and tertiary structures of complex biological molecules.

A metal core can directly contribute to anion binding by attracting the anion via electrostatic contact and/or functioning as a Lewis acidic binding site. Metal complexes are significant in anion chemistry because they can introduce a variety of favourable physicochemical features. In most situations, the metal complex is used as a reporter group whose photochemical or red-ox response is altered by the proximal binding of an anion.

Chiral centres can be found in a wide range of chemical compounds, including medicines, tastes, and fragrances. As a result, the scientific and commercial importance of chiral compounds in academic and industrial research has been demonstrated, promoting the development of chiral organic and transition-metal sensors for carboxylic anions. The recognition phenomena might be found primarily in analytical chemistry with the development of techniques such as chromatography, liquid-liquid extraction, and transport. It should be mentioned that biotechnologies and biocatalysis are both developing in the manufacture and purification of chiral compounds containing carboxylates at the same time.