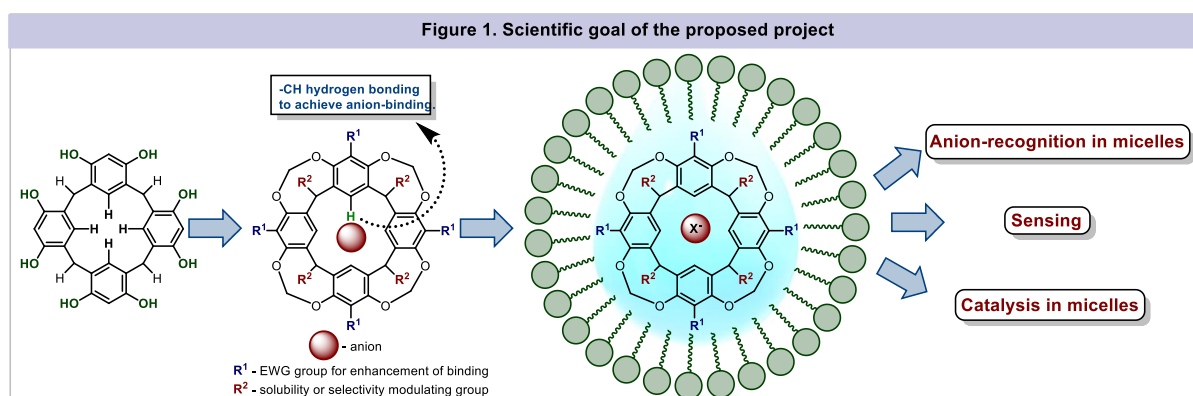


## CH-BINDING ANION RECEPTORS FOR CATALYSIS AND SENSING IN MICELLAR MEDIA

Deepshikha Priyadarshini, Institute of Organic Chemistry, Polish Academy of Sciences

**Anions**—atoms or molecules with a negative charge—play a fundamental role in both living (biotic) and non-living (abiotic) environments. The most abundant anion, **chloride**, is critical as an electrolyte in nearly all physiological processes within our bodies. It's also linked to diseases like **cystic fibrosis**, where a problem with chloride channels leads to severe health complications. Anions also have a significant environmental impact. **Sulfate** is a major component of acid rain. **Nitrate** is a widespread contaminant in groundwater, primarily due to runoff from agricultural fertilizers. Furthermore, **pertechnetate**, a radioactive byproduct from nuclear fuel reprocessing, poses a significant pollution hazard. Beyond environmental concerns, anions are fundamental to biological processes, playing key roles in cellular energy metabolism. Surprisingly, over 70% of the molecules that enzymes use to function (substrates and cofactors) are anionic. Anionic molecules like **RNA** or **DNA** carry genetic instructions and control their translation. **ATP**, **phosphocreatine**, and other high-energy anionic phosphate derivatives manage the energetics of cellular processes.

Given these crucial roles, it's not surprising that the scientific community focused on **supramolecular chemistry** has dedicated significant research efforts to designing and synthesizing receptors capable of selectively recognizing, capturing, extracting, and sensing anions. However, owing to certain factors such as the diverse shapes and sizes of anions, their inherent high hydration free energies, pH sensitivity etc, the design of anion receptors is considered quite strenuous.



In this project, we plan to synthesize a new class of anion binders based on **resorcin[4]arenes**. These binders will interact with anions using the **non-classical CH...anion interactions, rather than the typical OH or NH interactions**. This type of interaction offers distinct advantages, including high chemical stability, insensitivity to changes in pH, high ability to dissolve in fats (lipophilicity), and unusual selectivity profiles. These characteristics make them particularly valuable for specialized applications, such as transporting anions through lipid bilayers (the fatty layers, that make up cell membranes), where traditional receptors are often less efficient.

Despite these significant advantages, the design of CH-binding receptors presents some challenges. A major one is their lipophilic nature, which limits their usefulness in aqueous environments—environments crucial for sensing and biological applications. Within this project, we plan to address this challenge by incorporating these receptors into **micelles** and then test this system for its ability to sense relevant anions and also to catalyse organic reactions. It's important to note that micellar media are not only compatible with biological samples but are also considered a "green" or environmentally friendly approach.

As a result of this project, we will have a set of novel anion receptors that operate through a non-trivial mechanism i.e. via CH hydrogen bonding. These receptors will be applicable for sensing and catalysis in a range of environments, including the most challenging ones.