ChiralCat-"Transferring Chirality to Polycatechol-Based Materials – Implication for Materials Science and Nanomedicine”

Chirality plays an extremely important role in biology and chemistry, especially in the context of interactions with living organisms. A prime example is drugs, which, depending on their chirality (whether they are left-handed or right-handed), can have different therapeutic effects. For this reason, research on the chirality of materials holds enormous potential, particularly in medicine, where precise control of such properties can significantly improve the effectiveness of therapies.

As part of the ChiralCat project, we plan to introduce chiral molecules—molecules that are non-superimposable on their mirror image—into the structure of poly(catecholamines), which will allow for the creation of new materials with unique properties both on the nano and macro scale. These materials will then be subjected to detailed studies to examine their structure, chemical and physical properties, and how the synthesized chiral materials interact with cells. A key element of this research will also involve evaluating the safety of these materials and their potential applications in nanomedicine, particularly in the context of cancer treatment using photothermal therapy and tissue regeneration through coatings that promote cell growth.

Although chirality is a well-known phenomenon in biology, its application in nanotechnology and medicine remains an area of vast, untapped potential. Previous research on this topic has mainly focused on the chemical aspects of chirality, but this project aims to explore chiral materials from the perspective of their interactions with living organisms, opening up entirely new possibilities in medicine. Through our research, we will develop and analyze materials that could offer new solutions for treating hard-to-cure diseases, such as cancer.

ChiralCat is an interdisciplinary project, combining knowledge from chemistry, biology, materials engineering, and nanomedicine. Its implementation will contribute significantly to advances in these fields, leading to the development of innovative therapies and materials that will transform modern medicine and materials based on poly(catecholamines).