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A Study of Bio-Conjugates of Benzothiazole Derivatives for Potential Biomedical Applications

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ABSTRACT

Bio-conjugates of benzothiazole derivatives have emerged as promising candidates for potential biomedical applications due to their unique chemical structure and broad spectrum of biological activities. Benzothiazole is a heterocyclic scaffold known for exhibiting antimicrobial, anticancer, anti-inflammatory, and antioxidant properties. When benzothiazole derivatives are conjugated with biomolecules such as peptides, carbohydrates, nucleic acids, or polymers, their biological efficacy, selectivity, and biocompatibility can be significantly enhanced. These bio-conjugates facilitate targeted drug delivery by improving cellular uptake and reducing off-target toxicity, which is a major challenge in conventional therapeutic systems. In cancer research, benzothiazole-based bio-conjugates have shown notable potential as tumor-selective agents, imaging probes, and diagnostic markers due to their affinity for specific cellular receptors and enzymes. Additionally, conjugation with hydrophilic biomolecules improves solubility and metabolic stability, thereby extending the circulation time of these compounds in biological systems. Benzothiazole bio-conjugates are also being explored in antimicrobial therapies to combat drug-resistant pathogens by enhancing binding interactions with microbial targets.