110-LIPS

Title: Interactions between Cell Penetrating Peptide (CPP) Pep-1 and Breast Cancer Cell Membrane

Abstract

Breast cancer is the most commonly diagnosed cancer worldwide. Although chemotherapy remains the standard treatment, its effectiveness is often compromised by poor drug accumulation at tumor sites and severe side effects. Modern drug delivery methods, particularly those that use nanoparticles, seek to address these challenges by enabling targeted drug delivery; however, their toxicity remains a concern. Therefore, nanotechnology-driven drug delivery systems (NDDS) have increasingly focused on bioactive peptides, offering innovative platforms to enhance the therapeutic efficacy of chemotherapeutic drugs while minimizing the adverse effects. Among these, cell-penetrating peptides have emerged as promising drug delivery vehicles. The purpose of this research is to investigate the potential of Pep-1 in facilitating the transport of anticancer drugs across model membranes in breast cancer treatment.

This study examines the interactions between Pep-1 and breast cancer model membranes using biophysical techniques, including UV-visible and infrared (IR) spectroscopes. UV-Visible spectroscopy measures Pep-1 absorbance to assess solution concentration, and Pep-1 binding to membranes can be detected by absorbance changes. IR spectroscopy analyzes membrane lipid and peptide structural changes during Pep-1 interaction. It can also reveal Pep-1 secondary structures (alpha helices, beta sheets) when they interact with cell membranes. From UV-Visible data, Pep-1 was shown to translocate into the model membrane at very low concentration as evidenced by the blue shift. Similarly, infrared data shows that Pep-1 interacted with the model membrane at a very low concentration through a conformational change. The results of this study contribute to the expanding body of knowledge about the use of CPPs like Pep-1 in tackling major healthcare concerns, such as targeted breast cancer treatment.