

Annotation:

Mariam Tsindelian, a master's student in Biophysics at Ivane Javakhishvili Tbilisi State University, explores the biophysical effects of the antibiotic **Ampiox** on bacterial growth dynamics in her research thesis. The study focuses on a comparative analysis of the antibiotic's efficacy in two forms: **its conventional free form** and its **nano-encapsulated form within DPPC (Dipalmitoylphosphatidylcholine) liposomes**.

The research aims to evaluate the potential of liposomal drug delivery systems in enhancing antibacterial activity, particularly against **intracellular pathogenic bacteria**. Liposomes, due to their structural and physicochemical similarity to biological membranes, offer a promising platform for targeted and biocompatible delivery of antibiotics. Their capacity to penetrate cellular barriers and release therapeutic agents directly within infected cells is a central advantage in addressing infections that are otherwise difficult to treat with conventional methods.

The experimental phase is preceded by **computational modeling and theoretical simulations**, which predict an improved antibacterial response when Ampiox is delivered via liposomal carriers. The subsequent in vitro studies confirm these findings, demonstrating that nano-structured Ampiox exhibits **enhanced inhibitory effects on bacterial proliferation** compared to its unencapsulated counterpart.

This thesis underscores the growing significance of biophysical methodologies in **medical microbiology** and **antimicrobial research**. It highlights how nanotechnology-based delivery systems can optimize antibiotic effectiveness and provides insight into the mechanistic understanding of antibiotic action at the cellular and molecular levels. The study contributes to the broader field of drug delivery and offers promising perspectives for future applications in the treatment of resistant and intracellular bacterial infections.