The scientific objective of the project is to impart antibacterial properties to the titanium alloys Ti-13Nb-13Zr and Ti-6Al-4V through: i) performing preliminary surface treatments and ii) producing coatings containing chitosan, bioactive glass, and antibacterial particles. This will result in new functional properties of titanium substrates, such as bioactivity and bactericidal properties, which enable implants to promote faster bone tissue growth without postoperative complications and rejections. According to the literature, composite coatings of chitosan/bioglass have been confirmed to enhance the bioactivity of titanium alloys. Current research is focused on improving the adhesion of these coatings and obtaining bactericidal properties. The implementation of hybrid surface treatments will enable both of these problems to be solved, thus constituting the innovative aspect of the project.

The materials studied were selected for their application potential. Ti-6Al-4V alloy is already widely used in biomedicine due to its good mechanical properties and very favorable strength-to-weight ratio. However, aluminum and vanadium in its composition constitute a potential threat to the human body, as they can lead to neurological diseases or the phenomenon of metallosis. Attempts to replace harmful elements involve the application of titanium alloys from the β and pseudo-β groups, which include the Ti-13Nb-13Zr alloy. It is characterized by high biocompatibility, relatively low Young's modulus (more similar to the Young's modulus of human bone), and high corrosion resistance in the environment of the human body.

The requirements imposed on biomaterials do not only concern their volumetric properties. The point of initial contact between the implant and the human body is its surface, and it is the conditions on that surface that determine interactions with bacteria - their adhesion and viability. Two paths for imparting bactericidal properties to the surface area can be distinguished: modification of the surface's topography and wettability, or introduction of antibacterial particles through layer or coating formation.

In the presented project, four different surface states will be prepared by combining various types of surface treatments, including mechanical, chemical, electrochemical, and laser treatments. Subsequently, two types of coatings will be produced on the pre-modified surfaces using the alternating current electrophoretic deposition (AC-EPD) method: chitosan with bioglass and antibacterial particles, either silver or copper. Implemented solutions will be verified by characterizing the topography, morphology, and wettability of the surfaces, adhesion of the coatings, and, above all, by conducting bactericidal tests for two different bacterial strains: *Staphylococcus aureus* and *Escherichia coli.*

The project involves innovative solutions for improving antibacterial properties and novel research on the impact of preliminary surface modifications on the topography and structure of the produced coatings. The development of a methodology for the electrophoretic deposition of bioactive coatings using alternating current will enable the extension of the scope of application of the economically advantageous EPD method by achieving precise control over the uniformity and quality of the coatings produced. The project will also contribute to characterizing the effect of surface conditions on the antibacterial properties of titanium alloys, enabling the reduction of infections and inflammation caused by bacterial contamination of implanted devices.