A wound is an interruption of the anatomical continuity of the skin and mucous membranes with the presence of damaged cells and damaged/diseased tissue. Superficial wounds do not exceed the subcutaneous layer of tissue, deep wounds extend beyond the subcutaneous tissue, and penetrating wounds penetrate deeply located organs or body cavities. On the other hand, chronic wounds (extensive burn wounds, diabetic foot syndrome, arterial or venous ulcers of the shin, decubitus ulcers) develop as a result of disease or co-morbidities, resulting from disorders of the immune system, abnormalities in the course of the various stages of healing or failure of the circulatory system. These types of wounds succumb to frequent bacterial infections are difficult to treat due to multi-bacterial infections and the presence of biofilm. Conventional therapies are mainly based on systemic or topical antibiotic therapy. The former disrupts the patient's normal microflora and shows poor tissue penetration, leading to delayed healing. On the other hand, the second (gels or ointments with antibiotic) requires multiple applications, and is not suitable for complex injuries (bedsores, diabetic foot syndrome). Currently, in the topical treatment of chronic wounds, antibiotics are not recommended due to the ineffectiveness of therapy and the selection of resistant strains. The exception is gentamicin in sponge form at relatively high concentrations. However, no such solution has yet been developed that is more effective and selective than antibiotics and chemotherapeutics, so it is worthwhile to focus research on solving the problem of bacterial resistance, and nanotechnology offers such opportunities.
Therefore, the aim of this project is to produce a hydrogel biomaterial based on a sugar curdlan polymer, containing nanobiotics made with non-toxic carbon nanoparticles, i.e. fullerenols - hydrophilic fullerene derivatives of C_{60}, containing drugs that exhibit a broad spectrum of antibacterial activity - an aminoglycoside antibiotic (gentamicin) or fluoroquinolones: 2nd generation (ciprofloxacin) and 4th generation (moxifloxacin). The advantage of the project is a novel way of combining the drug (antibiotic, fluoroquinolones) to fullerenols and forming nanostructure, incorporated into the curdlan hydrogel. We assume that the incorporation of the nanostructure into the curdlan hydrogel matrix will make it possible, on the one hand, to exhibit antimicrobial properties (through the gradual release of the drug-containing nanostructure) and, on the other hand, to exhibit - thanks to the free hydroxyl groups of the fullerenol - antioxidant and anti-inflammatory properties. In turn, the curdlan hydrogel will promote skin cell viability and proliferation. The above hypothesis will be confirmed experimentally by determining the release profile of nanostructure from the hydrogel matrix, evaluating the ability of the nanostructure to pass through the model cellulose membrane. The antioxidant, anti-inflammatory and antimicrobial properties of the fabricated biocarrier, its cytocompatibility against human skin fibroblasts and keratinocytes will be tested. In addition, *in vivo* experiments will be carried out on the effects of toxicity, antimicrobial activity, and antioxidant and anti-inflammatory properties of selected bionecarriers on a zebrafish larvae model.

In summary, the advantage of the project is the novel way of combining the drug (antibiotic, fluoroquinolones) to fullerenols and forming nanostructure, incorporated into curdlan hydrogel, creating an active system (gradually releasing nanostructure) with therapeutic potential for skin and deep tissue wounds, especially infected wounds. It is worth noting, the use of a combination of nanostructure (carrier-antibiotic or carrier-chemotherapeutic) can affect its effective antimicrobial activity, as bacteria are not prepared to recognize such a complex. A manufactured biocarrier characterized by the ability to gradually release the nanostructure into the external environment (e.g. into a wound) can also have an antimicrobial effect over a longer period of time - and what is extremely important - so it does not need to be changed frequently. This is in line with the principle in dermatology - "dressings are changed as often as necessary and as rarely as possible." So, in the future, the bionocarrier designed and tested in the project can be used as a novel method of treating pharmacologically difficult dermatological wounds.