Protein cages are extremely interesting structures abundant both in nature and created artificially by scientists. They take the form of three-dimensional structures, most often similar in shape to a polyhedron or a sphere and built of protein subunits. Proteins, as the most important and main building and regulating subunits of living organisms, are intensively studied by scientists in order to better understand them and use them for various purposes. This knowledge also allows the use of these subunits to create more complex objects, such as protein cages which are hollow protein structures able to carry cargoes. Although apparently simple and symmetrical, these structures are usually extremely complex and difficult to obtain, and their potential in medicine and biotechnology cannot be overstated. Due to the great interest in proteins, we now know of many possible modifications of protein cages that could make them suitable for medical purposes. Of course, first we have to start with the protein cage itself - and TRAP-cage is an example of this.

TRAP-cage is a protein cage made up of 24 rings, each of which consists of 11 subunits. This gives a total of 264 protein cage subunits, each of which can be modified. These modifications may affect the functionality of the cage itself and its potential use. The most popular envisaged uses for any protein cage are to deliver drugs to specific tissues and cells or use them as modern vaccines.

In both cases, we want to obtain the appropriate cargo (drug or pathogen fragment for which we want to develop immunity) in combination with external decorations that will allow the cargo to be delivered to the desired cells or tissues - the immune system in the case of a vaccine or, for example, a cancerous tumor in the case of chemotherapy .

In this project, we provide research on the use of the TRAP-cage in both of these situations. We plan to load cargo (bromelain, an interesting enzyme widely used in folk medicine and obtained in a base form from pineapple, having a number of anti-inflammatory and anti-cancer effects) along with external decorations (Nanobodies and ODNs, i.e. nanobodies and oligonucleotides, which, with appropriate therapy or experiment planning, will allow target specific cells or tissues) allowing its delivery to specific tissues or cells.

In the future, TRAP cages based on the research results obtained from this project may be used as modern vaccines or anti-cancer therapies, which may prove to be more effective than currently used therapies.