Plastics are indispensable components of our daily lives and are used in almost all areas of life and the economy: in the manufacture of packaging, electronic products, in the construction industry, in the automotive industry, in agriculture, in medicine and in many other areas. Their longevity and resistance to biodegradation cause serious environmental problems, and the search for effective methods of disposing of this waste is becoming an urgent challenge. One of these could be the use of insects that are able to digest plastics thanks to the microorganisms living in their digestive system. The mealworm (*Tenebrio molitor* L.) is a well-known insect that can digest plastics such as polystyrene (PS) and polyethylene (LDPE). Its larvae have been shown to be able to degrade various types of plastics, breaking down almost 50% of the ingested plastic to CO_2 and excreting the rest as feces. However, due to the small body size of mealworm larvae, research is being conducted into the use of larger insects such as the superworm (*Zophobas atratus* F.) to achieve more efficient disposal of plastics. Unfortunately, current research indicates that the larvae of the superworm are less effective at degrading plastics than the larvae of the mealworm, despite their 2-3 times larger body size. Since the microorganisms that form the microbiota of the larvae's digestive system are primarily responsible for the digestion of plastics, it can be assumed that the main reason for the differences between mealworm and superworm is most likely due to differences in the microorganisms that inhabit the digestive system. One solution could be to transfer the mealworm's microbiota to the superworm, which would potentially increase the mealworm's ability to utilize plastic waste.

Research on microbiota transplantation has so far mainly focused on vertebrates. However, microbiota transplantation in invertebrates is rare, and the few cases focus on aspects such as immunity and thermotolerance. Microbiota transplantation has been studied extensively in mosquitoes, where manipulation of the microbiota can control the diseases they transmit. A groundbreaking step could be transferring the microbiota of insects that can digest plastics to their larger relatives, such as superworms. Such a transfer could significantly improve the possibilities of natural disposal of plastics, which are difficult to degrade and pose a serious environmental problem. The main objective of the project is to investigate the possibility of transferring the microbiota of insects between different species in order to improve the ability to digest plastics. The analysis of the results obtained will deepen our knowledge of the interactions between the microflora of the digestive tract and the body of the insect larva.

In order to determine the effects of a diet containing plastic on insect larvae in detail, a series of tests and analyzes must be carried out. First, their condition after eating plastics must be determined. The detrimental effects of the food on the insect larvae can be seen above all in weight loss, inhibition of pupation, reduced fertility and, in extreme cases, death. The project will use modern molecular techniques such as metagenomics. These analyzes will make it possible to identify specific microorganisms and genes involved in the degradation of plastics, to track changes in enzymatic activity in the insect's digestive system and to investigate the relationship between them and the insect's function and development. A detailed understanding of the mechanisms of action of microorganisms inhabiting the digestive system of mealworm and superworm larvae will allow the identification of metabolic pathways involved in the depolymerization of plastics and determine the effectiveness of microbiota transplantation between species. Undigested plastic residues will also be examined to obtain comprehensive data on the ability of insect larvae to digest plastics before and after microbiota transfer. One of the methods used to determine which functional groups are present in the analyzed plastic residues is FTIR spectroscopy or magnetic resonance. An important element of the project will be the isolation of microorganisms from the digestive system of the larvae of both species in order to test whether they can be used to degrade plastics *in vitro*.

Microbiota transfer in insects is an emerging field of research investigating the role of the gut microbiota in insect development, behavior and ecology. Since there is no information that microflora transfer has been used in any insect to improve its digestive capabilities, the approach presented in this proposal is completely novel. The proposed research breaks new ground and will open up the possibility of understanding complex biological processes and ecological interactions between the microbiota and the host. We anticipate that the results of our research will not only help to increase the efficiency of biodegradation of plastics by insects, but will also make an important contribution to the development of microbiome engineering.