Symbiosis is a phenomenon of close and often long-term interactions between two or more organisms of different species, often completely unrelated. Symbioses of macroscopic organisms have fascinated scientists for centuries. Perhaps, the most spectacular examples of symbiosis are those between reef-building corals and single-cell algae or between fungi and algae (known as lichens). Symbioses have played an essential role in the evolution, diversity, and success of all eukaryotes, exemplified by their mitochondria and chloroplasts having descended from once free-living bacteria. However, such symbiotic events did not happen only twice in the history of life. Numerous more recent symbionts continue to play a significant role in the evolution of eukaryotes, expanding their metabolic potential and diversifying ecological niches by providing various nutrients, removing toxic host waste, digesting complex nutrient substrates, and defending against bacterial infections and predation. Symbioses involving prokaryotes (bacteria and archaea) are especially common among microscopic, single-celled eukaryotes (also known as protists, such as amoebae and paramecia), which account for most eukaryotic diversity. But surprisingly, only a small number of symbioses have been documented for many protist groups.

One of the least studied groups are euglenozoan protists, which contain many thousands of different species. Euglenozoans are split into three major subgroups – kinetoplastids, euglenids and diplonemids. Kinetoplastids, which mostly feed on bacteria, thrive in marine and freshwater environments, while photosynthetic euglenids are common algae in small freshwater ponds. Diplonemids have been recently shown to be one of the most species-rich groups of protists in the world ocean. Our hypothesis is that symbiotic relationships with prokaryotes have contributed to the ecological success of euglenozoans. Therefore, the project's primary goal is to expand our understanding of symbiosis among euglenozoan protists. I will study cultures and single cells of these protists with the purpose of identifying their symbionts and revealing their functions. I will use microscopic techniques and high-throughput DNA sequencing to identify and validate the presence of prokaryotic symbionts and to understand their possible role.

Completing this project will allow us to close this notable gap in our knowledge of euglenozoan symbionts. I will also develop a new approach for the effective screening of symbionts in protists, which can be applied to other groups of microbial eukaryotes. Finally, an in-depth study of the euglenozoan protists' interactions with their symbionts is crucial for understanding their evolution and ecological success.