The development and functioning of organisms are determined by their ability for the short- and long-range transport of molecules that modulate biological processes at the level of single cells, tissues, and whole organs. Regulatory biomolecules can be of endogenous or exogenous origin, for example, dietary dsRNA can induce systemic silencing of gene expression in a process known as environmental RNA interference (eRNAi).

The molecular basis of the effector step of eRNAi has been well understood, which made it possible to develop RNAi technology and widely apply it to study gene functions. Although RNAi technology has been practically used for more than 20 years, the process of dsRNA uptake and transport of signalling molecules between cells is still poorly understood. So far, it has been most extensively studied in *Caenorhabditis elegans*, in which dsRNA transporter (SID-1) and receptor (SID-2) proteins have been identified. However, the data gathered so far suggests that not all animals have the same dsRNA uptake and transport mechanisms as described for nematodes.

The presented PhD thesis aimed to identify and characterise the proteins responsible for the import from the environment and intercellular transport of nucleic acids in the planarian *Schmidtea mediterranea*. It is known as a basic model to study the phenomenon of regeneration and stem cell development and function. This study identified sequences encoding three SID-1 homologues (Smed-SIDT1-3) in the *S. mediterranea* genome. However, no sequences encoding SID-2 were found. *In silico* structural and functional *in vitro* and *in vivo* analyses were performed for all three Smed-SIDT1-3 proteins. The obtained models indicate that Smed-SIDT1-3 possess features characteristic of multi-domain transmembrane proteins capable of binding both nucleic acids and cholesterol. *In vitro* studies in *Drosophila melanogaster* S2 cells confirmed the ability of Smed-SIDT1-3 to transport siRNA across the cell membrane. Further, their involvement of Smed-SIDT1-3 proteins in dsRNA transport during the eRNAi process was demonstrated *in vivo* in *S. mediterranea.*

The results presented in this thesis provide an excellent foundation for further research on the role of the eRNAi phenomenon in animal-environment interactions.