Recent studies have shown that very small vesicles, called exosomes, are transported in human blood and in cerebrospinal fluid. These vesicles have diameter less than 1 micrometer, and they are secreted by various cell types, including neuronal cells and cancer cells. The extracellular vesicles are enclosed by a membrane, and they transport RNA molecules in order to deliver them to the recipient cells. RNA molecules from these extracellular vesicles are involved in the spread of a cancer within human body, and also in development of neurodegenerative diseases, including Alzheimer, Parkinson and Huntington's diseases. Therefore it is important to investigate the molecular mechanisms regulating selective RNA loading into these vesicles. Proteins which transport RNA inside cells are also involved in the process of selective RNA loading into these vesicles. The purpose of this research is to prove the hypothesis that these mechanisms can be based on the presence of specific membrane regions called membrane rafts within the vesicle membrane and also on the presence of specific RNA fragment called RNA motifs, which can bind membrane rafts or transport proteins.

Both model membranes and live cells will be used in the experiments. The RNA molecules which bind to membrane rafts or to transport proteins will be isolated, and RNA motifs responsible for binding of RNAs to membrane rafts or transport proteins will be determined. These RNA motifs will be compared with RNA motifs most frequently present in the RNA transported inside the extracellular vesicles in order to estimate the percentage of RNAs which loading into exosomes is based on their affinity to the raft-like region and estimate the percentage of RNAs which loading into exosomes is based on their affinity to the transport proteins.

Because the molecular mechanisms of RNAs loading into exosomes remain elusive, therefore the reason for choosing this research topic comes from the willingness to understand the molecular pathways used by the cells for this RNA loading. Research on the mechanisms of miRNA loading into exosomes would have impact both in our understanding of spread of a cancer within human body, neural cell physiology, brain physiology and in development of new therapies and diagnostics for neurodegenerative diseases and cancer.