Acute phase protein that is a group of serum proteins, the concentration of which determines the response of organism to inflammation. They are therefore very important diagnostic indicators both in the course of a number of infections, inflammation, neoplastic disease, transplant, as well as in other states homeostasis disorders. The main task of acute phase proteins is to restore homeostasis (maintaining the stability of the internal environment of the organism). Determination of the acute phase proteins enables rapid diagnosis and assessment of severity of the disease, its extent and dynamics of change, is also used to confirm genetic diseases. There is therefore a strong need for a reliable method for the determination of these substances in the blood.

Acute phase proteins include inter alia transferrin or ferritin. Both of these proteins are able to form stable complexes with iron ions in the third oxidation state. The transferrin transports iron in the body, while ferritin is responsible for storing iron that are used by the body as it is needed. Ferritin is the only known protein that is able to accumulate up to 10^{-2} M of iron, which is a very high value considering the fact that the solubility of iron (III) under physiological conditions, e.g.: the pH, the temperature is just 10^{-18} M. The role of ferritin thus focuses on delivering iron to the cells at a concentration enabling their proper functioning in the range ($10^{-3} \div 10^{-5}$ M) [E.C. Theil; „Handbook of Metaloproteins", Eds. A. Messeschmidt, R. Huber, T. Poilos, K. Wieghardt; John Wiley and Sons, Chichester, 2000, pp. 771-781; X. Liu, E.C. Theil; Accounts Chem. Res., 38, 2005, 167]. In turn, the transferrin is responsible for regulating the concentration of iron ions in the plasma and their transport to the place of their absorption (cells of the intestine) and storage (mononuclear cells) to the tissues [I. Pietrzak, D. Formanowicz; J. Am. Soc. Nephrol. 15, 2004, 179A]. One molecule of transferrin is able to bind simultaneously two iron atoms. Due to the high molecular weight of transferrin is not removed by the glomerular filtration of blood, which protects the body against loss of iron. When the transferrin molecules are saturated with iron, there is then to be joined and the transferrin receptor by endocytosis (method of transporting large molecules into the cell), the complex is introduced into the cell, where the iron released, whereupon the complex back to the cell membrane and apotransferrin (i.e. transferrin without iron) back into the bloodstream.

The presence of Fe(III) transferrin and ferritin structure allows the use of electrochemical methods for the determination of these proteins in body fluids. Unfortunately, the locations of these ions in the protein structure, as well as their proximity to chemical definitely slow electron transfer between Fe(III) and the surface of the electrode. In order to enhance the transport of electrons is modified electrode surface with a thin layer of a ferromagnetic – carbon nanocapsules containing iron. Ferromagnetic, as a substance having strong magnetic properties, comprising areas of constant magnetization which produces a magnetic field around itself must interact strongly with paramagnetic molecules. The interaction between paramagnetic and magnetic field of transport is to reinforce the paramagnetic toward the source of the magnetic field. Due to the fact that the present structure of transferrinand ferritin Fe(III) containing unpaired electrons, these molecules exhibit paramagnetic properties. In such a situation, the presence on the surface of the electrode areas fixed magnetization enhance the transport of electroactive (dispersible substance of reduction or oxidation at the electrode surface), and provide appropriate positioning of the molecule reaches the surface of the electrode. In other words, the molecule adopts such an orientation, the distance between the active site (ion Fe(III)) and the electrode surface as small as possible. Introduction to the vicinity of the electrode external magnetic field should further enhance this effect.

The aim of this research project is to develop electrochemical sensors for the direct detection of metalloproteins such as: transferrin (Tf) or ferritin (Ft) from body fluids. I plan to apply in the studies electrogravimmetry for transferrin and ferritin detection. Additionally I want to use the proteins with varying degrees of saturation with iron ions. Their level of content in the structure of metalloproteins usefulness of guarantees electrochemical techniques. I would like to determine the limit content of Fe(III) conditioning the electroactivity these compounds. Reports in the literature on the electrochemistry Tf and Ft are negligible, therefore undertaken research tasks in the project can be considered innovative.