Nanomaterials (nanoparticles, fullerenes, nanotubes) are defined by having at least one dimension in the nanometer range, i.e. 10^{-9} of meter. This results in physical characteristics that are distinctly different from those of their bulk counterparts. The magnetite nanoparticles with diameter in the range of 10-20 nm exhibit superparamagnetism, thus they are very strong nanomagnets. It is also worth of underlined that molecules of drugs, enzymes and antibodies can be attached on their surface. These features of magnetite nanoparticles make them excellent candidates for application in medicine. Their surface can be modified in way causing accumulation of nanoparticles only in pathologically changed cells, what can be utilized in magnetic resonance imaging. In turn, the possibility of control of their transport in human organism by magnetic field makes them attractive for application in targeted drug delivery. Additionally, under influence of alternating magnetic field, magnetite nanoparticles generate heat, what can be used for damaging of tumor cells. The medical research revealed that their accumulation occurs in brain cells of persons with Alzheimer's disease. However, it is not known whether observed phenomena is a reason or an effect of this illness.

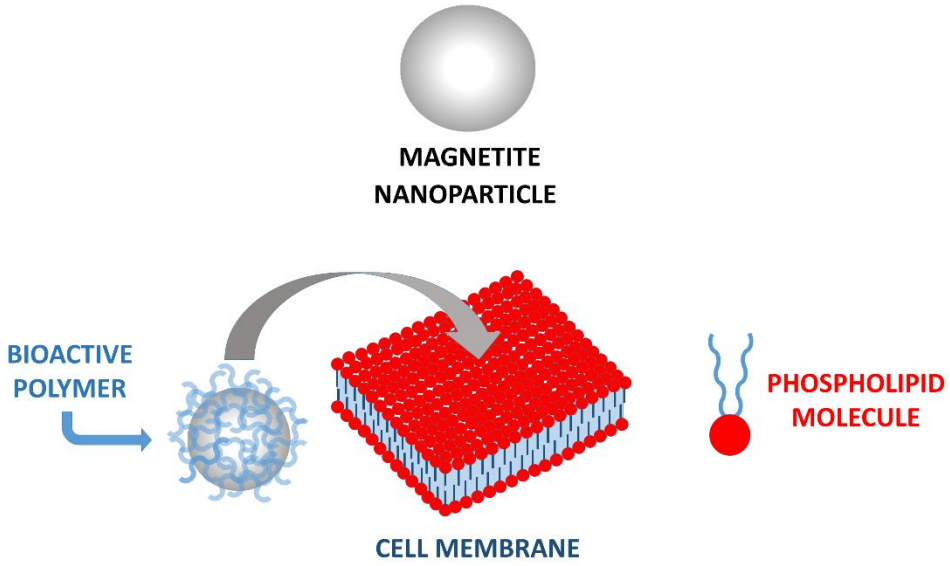

Figure 1. Graphic illustration of project aim

Due to application potential of magnetite nanoparticles in medicine, it is necessary to expand knowledge of their influence on human organism and mechanism of interaction with cell membranes. The cell membrane is a phospholipid bilayer, in which peptides, cholesterol and sugars are embedded. Such a complex structure makes difficult investigation of biological processes taking place in cells. Therefore, the simplified model of membrane constituted by a phospholipid monolayer formed on water surface will be applied during research on a nanoparticles role. This monolayer can be easily transferred from water surface onto solid substrates to provide its full characterization. The proposed research will be focused on organization of magnetite nanoparticles functionalized with bioactive polymers in monolayers of phospholipids being the most often components of natural cell membranes. It is worth of noticed that in human organisms cells are exposed to extremely diverse environmental conditions due to variety of their functions. The lipid membrane, constituting border between cell interior and external environment, separates two liquid areas with a different pH and ion concentration. Thus, the important part of project will be evaluation of these conditions on interactions of magnetite nanoparticles and model cell membranes. By applying of sensitive methods of materials characterization from field of nanotechnology, it will be possible to obtain information about structure and magnetic properties of formed monolayers.