Optical and electrochemical sensors, optodes and ion-selective electrodes are intended to determine ions contents in biomedical or environmental samples. They offer high selectivity and allow application of relatively simple and easy to miniaturize experimental set up. These sensors take advantage of lipophilic polymeric receptors containing highly selective ionophores with additives. Sensor operation requires transfer of analyte ion through the interface from the sample to the receptor, thus application of nanostructural receptor format is beneficial – typically, especially in optical sensors, nanoparticles are used. Nanoparticles due to advantageous surface area to volume ratio yield sensors of improved sensitivity, response time or linear dependence range. Majority of studies in the field look at the relatively narrow group of well proven, classical combinations of polymers and ionophores, which is a constraint.

One of the possible approaches to improve existing sensors and develop new ones – for examples allowing quantification of analytes difficult to access using conventional optodes or ion-selective electrodes is to use novel, with respect to both nanostructure format and composition, electrospun nanofibers receptor layers.

The aim of the project is to prepare ion-selective nanofibers – directly by electrospinning of commercially available polymers or their mixtures, or by modification of obtained nanofibers mats, including mats obtained by composing nanofibers of different polymers or containing various constituents aligned in defined order. The aim of the project is to study and describe properties of such systems as well as to develop improved optical and electrochemical sensors using receptors in the format of nanofibers, or their alignments that additionally include also nanofibers pretreating or conditioning locally the sample before / during analysis using optical (fluorometric/ colorimetric) or electrochemical (potentiometric/ amperometric) approach. Such system - “lab on a mat” can include e.g. nanofibers locally buffering pH close to sensing nanofiber or alternatively can mask / bind interfering ions, contributing to improved analytical parameters, enhanced selectivity of the system, extended addressable analytes to include new ones, simplified determination procedures.

“Lab on a mat” systems can be useful to monitor e.g. physical activity during exercise looking at sweat composition changes.