The aim of this project is to design a thermosensitive, injectable hydrogel modified with short, electrospun, bioactive nanofibers. An influence of this functionalization will be investigated from the perspective of tissue engineering. Hydrogel matrix loaded with short nanofibers allows to obtain the material with unique fibrous structure and the properties which are attractive for tissue engineering.
Additional goal of this project assumes formation of electrospun bioactive nanofibers and optimization of their fragmentation. This procedure will provide better dispersion of nanofibers in the solution.

Hydrogel system will consist of two components. One of them will be aqueous solution of methylcellulose (MC) which cross-links at higher temperature. The second one will be agarose aqueous solution, which presence influences the cross-linking kinetics and improves the mechanical properties of MC.
Proportions between hydrogel components will be adjusted in order to provide mechanical properties mimicking native neural tissue and adequate time of cross-linking.
Electrospun nanofibers obtained from poly(L-lactic acid) (PLLA) will be loaded into hydrogel. They are biocompatible and present the mechanical properties enabling their fragmentation into short fibers. In this regard ultrasonication will be used. Additionally PLLA nanofibers will be modified with laminin in order to enhance their biological activity. In this form nanofibers will be fragmented using ultrasonication and dispersed in distilled water (the solvent used in hydrogels formation). From the perspective of functionalization, the optimization of proportions between nanofibers and hydrogel will be the most important stage of the project. It allows keep the injectability of the material and will provide a fibrous structure mimicking native ECM.

Obtained in such way hydrogel solutions will be investigated in terms on cross-linking kinetics, mechanical properties and the viscosity.
PLLA and PLLA/laminin nanofibers will be investigated and compared in terms of structure, wettability and biological properties (*in vitro*).
The final part of the research will be focused on optimization the ratio of short fibers to hydrogel. Mechanical properties and biological properties (*in vitro*) will be investigated and will allow to evaluate the usefulness of the material for tissue engineering.
The research proposed in this project will be definitely valuable from the perspective of both fundamental research as well as tissue engineering.

Research hypothesis assumes that optimal content of agarose does not influence the cross-linking kinetics of hydrogel and improves its mechanical properties.
The optimal ratio of short fibers to hydrogel considerably improves biological and mechanical properties of composite, and at the same time keeps its injectability.

Implementation of such research subject is dictated by interest of the proposer concerning designing of modern and functional solutions as thermosensitive hydrogels loaded with short nanofibers. Fabrication of such composites provides many benefits such as injectability, thermal sensitivity, and stable, fibrous structure. These features will provide essential cognitive step toward science development, specifically from the perspective of tissue engineering.