Doctoral School of Information and Biomedical Technologies
Polish Academy of Sciences (TIB PAN)

SUBJECT: Hybrid Drug Delivery Systems Based on Electrospun Nanofibers (detailed title will be clarified as a result of the PhD student-supervisor interaction)

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DESCRIPTION: The research will focus on the development of innovative drug delivery systems (DDS) based on nanofibers and vesicles containing drugs or drug-like substances. These composite systems will be synthesized and developed using microfluidics combined with the direct electrospinning method. Currently used drug delivery systems, based on micro and nanofibers, have a main drawback - a very low volume available to load the drug. To overcome this problem, the systems containing vesicles filled with a drug will be produced. Using a microfluidic device, a stream of polymer to be electrospun and a stream of a drug solution will be turned into a stream of droplets of water phase suspended in a polymer solution. The stream will then be directly electrospun to form a net of micro- and nanofibers surrounding the vesicles of a drug solution. The use of a microfluidic device allows for the formation of the composite DDS in an easy and highly controllable manner. The vesicles of a water phase can contain a hydrophilic drug, which covers approximately 90% of the registered drugs used. Possible applications of such systems include innovative wound dressings and materials for osteoporosis prevention and treatment. Microfluidic devices of specific configurations will be produced and optimized. Drug-like substances, e.g., Rhodamine B as a model substance for low molecular weight drugs, Rhodamine B – bovine serum albumin conjugate as a model substance for proteinous drugs, or drugs surrounded by selected biodegradable polymers will be tested to find a drug delivery profiles for the selected materials and the synthesis conditions for the composite DDS.

BIBLIOGRAPHY:

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