Bloodsurf2017

Blood-biomaterial interface: where medicine and biology meet physical sciences and engineering.

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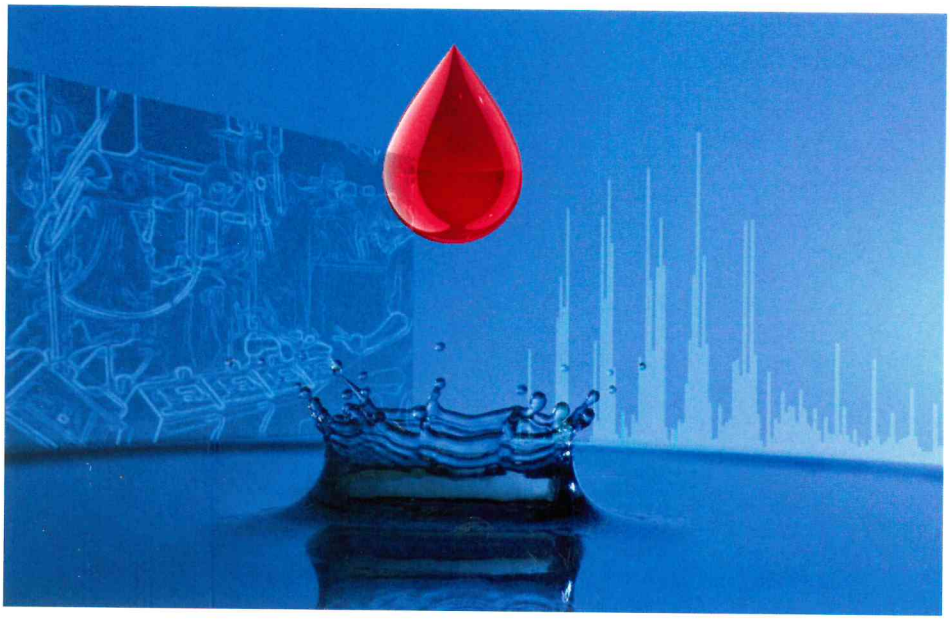
Program and Abstracts



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Blood clotting activation through contact with polymer nanofibers

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Electrospun nanofibers are increasingly studied thanks to their potential applications in biomedical devices that include drug delivery systems and tissue engineering scaffolds [1]. Numerous synthetic and natural polymers were used to develop nanofibrous materials. Nanostructured materials high porosity, surface-to-volume ratio together with the ease in surface functionalization and drug incorporation, make them perfect candidates for the development of hemostats.

Immediate hemorrhage management becomes crucial to preventing death and serious injury in emergency situations. Severe injuries caused by e.g. traffic accidents are the third leading cause of death worldwide [2]. Research on medical incidents of soldiers stationed in Iraq in 2003-2004 showed that the main cause of death was massive hemorrhage that led to death in about 51% of the rescued soldiers [3]. There is no universal dressing and despite the development of new hemostats, they fail in many preclinical studies. Therefore, there is a need to define most important nanofibrous material characteristics that are responsible for rapid and effective bleeding arrest.

There is little research on nanostructured hemostats, regarding the impact of nanofibrous surface on blood and its components. Nonetheless, because of the wide use of nanofibres in wound dressings, artificial blood vessels as well as heart valves, there is knowledge helpful in determining material surface chemistry, wettability and other, which can affect blood coagulation. The very first findings appeared in the research where it was found that even polymers having excellent antiplatelet adhesion abilities, triggered increased platelet adhesion and activation when they were in the form of nanofibers. In several other studies, scaffold morphology, was found to have larger impact on platelet adhesion and activation than differences in the chemistry of the polymers used [4]. More specifically, it was found that materials with fiber diameter higher than 1 μm triggered higher platelet adhesion and aggregation than smaller fibers. In other research, nanofiber stiffness was assessed as more dominating than biological moieties and surface roughness of the nanofiber [5]. In spite of all, analyzed literature presents many contradictory results or findings that had low or no impact on blood clotting in research results of other groups. Hence, additional research and novel experimental methods are needed to find nano features that impact hemostat efficiency.

Acknowledgements

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