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ABSTRACT BOOK

Number: 104.
Principal investigator: Izabela Piechocka
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FNP programme: HOMING
Authors: I. K. Piechocka, N. Wolska, B. Luzak
Title: The role of shear flow in glycosylated fibrin clot response

Glycation of fibrinogen, and subsequently fibrin is a natural process taking place under normal physiological conditions and giving rise to fibrin networks with characteristic structural and mechanical properties. However, excess glycation and the accompanied elevated levels of fibrinogen, as observed in diabetes states, yield formation of modified fibrin clots with more compact and difficult to lyse structure. As in vivo fibrin clots form in the presence of flowing blood that exerts a continuous shear force on the whole structure, it is important to understand the contribution of shear flow to fibrin clot resistance. Therefore in our work, we use combined mechanical (parallel-plate flow chamber) and optical (confocal microscopy) tools to follow in situ changes in the spatial organization of individual glycosylated fibrin filaments, as a model system that mimics blood clotting in vivo. Additionally, we use biochemical tools to investigate the effect of glycation on FXIII-induced crosslinking in fibrin networks. Our data highlight directly the role of FXIII in the structure of glycosylated fibrin filaments which in turn may help to explain the differences in the overall response of glycosylated fibrin networks to applied shear flow. This project is important not only in light of the biological function of blood clots but also for the development of FXIII inhibitors that can be used for the treatment and prevention of thrombosis in diabetes conditions.

Number: 105.
Principal investigator: Filippo Pierini
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FNP programme: FIRST TEAM
Author: Filippo Pierini
Title: Electrospun conducting hydrogel nanomaterials for neural tissue engineering

The medical treatment of neural system diseases and injuries with the use of implanted probes can be applied over a wide range of illnesses and has great potential. However, the effectiveness of implantable neural probe medical treatments is affected by a lack of implant biocompatibility and the mismatch of physical properties between the electrodes and the biological tissue. These issues can be resolved by covering the electrodes with bioactive, soft and electrically conductive polymer nanostructured materials.
The aim of this research project is to develop electrospun conducting polymer hydrogel based materials which could be used as coating to improve the implantable neural electrode effectiveness and avoid the decline of the implant performance caused by the biological tissue reaction to the probe. The overcoming of this critical limitation will be achieved by developing a biocompatible material that will reduce the body response avoiding the contact between the stiff and metallic probe surface and the soft biological tissues.
The realization of the proposed biocompatible and electrically conductive coating for implantable electrodes will make the neural probe-based treatments available for the general public, removing their main disadvantages. In addition, the obtained materials will be useful for other advanced applications in the field of medical bionics (e.g. bionic eye and brain–computer interface). It is also expected that it will be possible to use the produced materials in a broad range of other fields, including nanoelectronic and energy storage devices, tissue engineering and drug delivery systems.

Number: 106.
Principal investigator: Zbigniew Piotrowski
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FNP programme: FIRST TEAM
Authors: Zbigniew Piotrowski, Marcin Polkowski, Adam Ryczkowski
Title: Green computing in the service of numerical weather prediction

In the context of the climate change and limited natural resources, energy-efficient technologies play a key role in adaptation of modern civilisation towards sustainable future. While efficiency constitutes success of business activities, it is not always taken into account in the context of research and public services. The FIRST TEAM project "Numerical weather prediction for sustainable future" leads to improve the efficiency of weather prediction, traditionally employing world's-fastests supercomputers. The improvement is sought in several areas, from the use of novel algorithmic approaches to adaptation of weather prediction software to energy-efficient computing platforms based on Graphical Processing Units (GPUs). While the former leads to the improvement of effective resolution of weather information, the latter takes advantage of the commodity hardware designed primarily for the entertainment purposes e.g. video games. The poster presented here summarizes the process of refactoring of legacy computer codes and elevating them to commercial quality of software-engineering. It also provides insights on the performance of the developed software in real pre-operational weather forecasting application, as well as discusses the benefits of investment in the human capital (i.e. salaries of programmers and development of domain scientists) rather than raising CO2 emissions via increased energy consumption.