Abstract

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Discrimination of red blood cells of different pathological states by statistical analysis of physical parameters, obtained with biosensing technology during microcirculatory

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Abstract

Red blood cell (RBC) genetic disorders affect millions of peoples in the world. Abnormal hemoglobin (HbS) is produced and fills the denuclearized RBC. Under hypoxic condition, HbS polymerizes and RBC with a diameter of 8µm loses its elasticity and deformability to pass through the blood microcapillaries network. Such disorder can be found for example in Sickle Cell Disease (SCD), and might induce vaso-occlusive and organs dysfunction. For the abnormal RBCs detection, bioimpedance measurement of cells injected into a microfluidic device is proposed. Electrically monitoring the transit of RBC in the microfluidic network, comprising fluidic restrictions, the RBCs of different pathological states can be discriminated. The device was made in Polydimethylsiloxane (PDMS) casted thanks to soft lithography technology. Physical parameters like RBC transit time, blockade amplitude and phase shift were electrically recorded and analysed. The distribution of those electrical characteristics was analysed for different RBCs populations (healthy RBCs, heated RBCs, RBCs of spherocytosis, sickle cell classified into multi-subpopulations). The scatter plot according to the blockade amplitude and the transit time is also informative. RBCs of different pathological states were discriminated. The cell bioimpedance monitoring in the biomimetic microcapillary network provides a new possibility for the statistical analysis of red blood cell distribution and a new method for patient management. This method is very promising for future microfluidic systems for the follow-up of red blood cell patients over time and during treatment. Characterizing cell abnormalities based on bioimpedance may be useful for future biomedical applications.

Biography

Tieying XU, PhD from University Paris XI, is Professor at ENS Paris-Saclay, within the University Paris-Saclay. He is the Director of Institut d'Alembert. He is author of more than 70 papers in scientific journals.