Spintronic devices for biomedical applications

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Spintronic devices have been proposed over the past decade for various biomedical applications. These include static or dynamic biomolecular recognition platforms (DNA-cDNA, antibody-antigen, phage-bacteria, …), cytometer and cell separation devices and lateral bio assay platforms , microelectrode based devices for neuroelectronic applications, and hybrid sensor arrays for imaging applications [1]. The biomolecular recognition platforms include a magnetoresistive sensor array, a set of biomolecular probes (surface immobilized or in solution) , biological targets labeled with particular magnetic micro beads or magnetic nanoparticles, and arraying architectures and microfluidics used to increase sensitivity and favour probe-target interaction. The platforms also incorporate the proper signal conditioning and processing electronics. Results will be shown for cell free DNA detection as a cancer marker indicator, and for cell detection using phage markers. For neuroelectronic applications, magnetoresistive sensors were fabricated onto Si microelectrode arrays. Experiments probe either extra cellular currents measured in mouse hypocampus slices, or spinal medulla signals probed directly with implanted magnetoresistive electrodes. For deep brain simulation and detection, sensors and electrodes are being fabricated into flexible polyimide probes. Separation between straight electrical contributions and magnetic signals is discussed. For imaging applications (magneto cardiography) efforts continue to reach pT level detectivity at 1Hz, using hybrid MEMS/magnetoresistive sensor devices. Two architectures will be presented leading to larger DC field mechanical modulation, and therefore increased sensitivity.

[1]-“Spintronic platforms for biomedical applications”, P.P.Freitas, F.a.Cardoso, V.C.Martins, S.A.Martins, J.Loureiro, J.Amaral, R.C.Chavres, S.Cardoso, J.Germano, m.S.Piedade, A.M.Sebastiao, L.F.Fonseca, M.Pannetier-Lecoeur, C.Fermon, Lab Chip,vol. 12(3), pp.546-557, 2012