Efficient and Discriminant Exosome Isolation from Blood and Plasma

Summary:
A microfluidic device capable of efficiently isolating exosomes from blood and plasma.

Overview:
Exosomes are vesicles secreted from cells that function as key mediators of many cellular processes including cell-to-cell communication, immune responses and many others. In addition, exosomes are actively secreted in cancer indicating that they play a role in the progression of tumors. Thus, studying exosomes could provide key insights into the mechanisms that drive both physiological and pathological processes. However, studying exosomes is severely limited by the technical challenges of isolating and analyzing exosomes. Standard ultracentrifugation techniques are time-consuming and they provide low yields as well as impure samples. Western Blot and ELISA are limited by their low sensitivity. This novel microfluidic device solves these problems because it is able to efficiently and discriminately isolate exosomes from blood and plasma.

Application:
This technology could be used in cancer research and clinical diagnosis of cancer. Also, this technology could be used to isolate pure populations of exosomes, which could facilitate investigation into exosome biology.

How It Works:
This microfluidic device is modified by a layer of graphene oxide and a layer of poly-dopamine, creating a unique nanostructured reactive surface coating. This microfluidic device can be readily modified through immobilizing protein G on the nano-bio interface. Protein G can be linked to monoclonal antibodies, thus allowing for specific capture of exosomes directly from plasma. This nano-bio interface is capable of greatly enhancing efficient and discriminative isolation of exosomes directly from clinical patient samples of microliter volumes. A microfluidic exosome ELISA assay have been developed to afford sensitive, specific and fast detection of captured exosomes.

Benefits:
By isolating pure populations of exosomes, this technology could play a critical role in facilitating investigations into exosomes. Thus, this technology could be a key tool in elucidating the molecular mechanisms involved in exosome secretion and function.

Why It Is Better:
This device significantly improves exosome capture relative to currently available technologies. Specifically it provides a low detection limit that is order of magnitudes better than existing methods while requiring minimally invasive sample volumes. Also, this device suppresses non-specific interactions, which results in isolation of pure populations of exosomes with specific molecular properties.

Other Applications:
This microfluidic device could be a tool to facilitate the study of any disease in which exosomes play a role.

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