Recognition of Graphene Biomolecular corona by Scavenger Receptor B1

Fatima Alnasser[a]
Valentina Castagnola[a], Esen Efeoglu[b], Jennifer McIntyre[b], Luca Boselli[a], Hugh J. Byrne[b] and Kenneth A. Dawson[a]

a. Centre for BioNano Interactions, School of Chemistry, University College Dublin, Belfield, Dublin 4, Ireland.
b. FOCAS Research Institute, Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland

Contact@ Fatima.al-nasser@cbni.ucd.ie

Graphene is one of the most promising nanomaterials that has attracted tremendous attention in a wide range of applications such as optical electronics, energy storage, photonics sensors, environmental application, biological engineering and biomedical application [1],[2]. However, the great promise held by graphene in the biological field requires a fundamental understanding of its interaction with cells and the biological mechanism of clearance. Graphene, as well as the other nanomaterials, absorbs biomolecules on its surface when in contact with biological fluids leading to the formation of a biomolecular corona. The corona composition and orientation, therefore the motifs presented on this surface might determine the biological behaviour and the final fate of graphene[3]. The aim of our study is to link the molecular details of the biomolecular corona of graphene to the role of specific cell receptor, such as scavenger receptors, mostly expressed by liver cells. Scavenger receptor B1 (S-RB1), is known to bind to high-density lipoprotein (HDL) and to play an important role in the HDL transport into the liver [4]. Given the large abundance of Apo lipoprotein AI (the major protein component of HDL), found in the graphene protein corona, Human embryonic kidney 293T cells (HEK-293T) were transfected with S-RB1 vector to induce an over expression of the S-RB1 receptor (Figure 1a-b) and an uptake study of graphene on this system have been performed. The results showed a significant increase of the uptake in the cells with elevated expression of S-RB1 suggesting that a recognition of specific exposed epitopes in the protein corona is occurring (Figure 1c-d). This knowledge obtained from this study will help to understand basic principles of the uptake mechanism and allow to better predict and control the biodistribution of graphene which could lead to precisely engineer such nanomaterials for future specific targeting of organs of interest.

References

[1] Soldano et al., Carbon, 48 (2010) 2127-2150.
[2] Chung et al., Accounts of Chemical Research, 46 (2013) 2211-2224.
[3] Chong et al., ACS Nano, 9 (2015) 5713-5724.
[4] Valacchi et al., Annals of the New York Academy of Sciences, 1229 (2011) E1-E7.

Figure

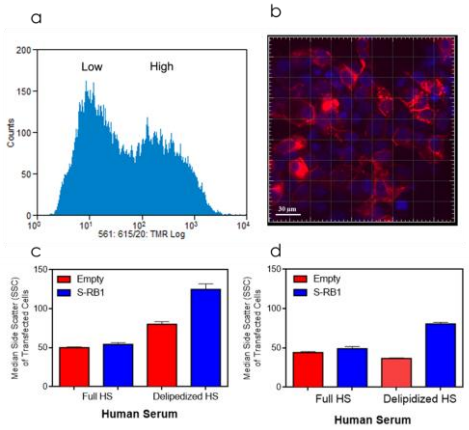

Figure 1: a) Expression of SR-B1- HaloTag® fusion protein in cells transfected with the SR-B1vector as measured by flow cytometry. c) Confocal

image of S-RB1 transfected HEK-293T cells stained with TMR (receptor) in Red and Hoechst (nucleus) in blue. c-d) Side scatter intensity as measured by flow cytometry for cells transfected with either SR-B1 or Empty vector (control cells) and exposed for 7 h to graphene flakes at different concentrations 100µg mL^{-1} (c) and 50µg mL^{-1} (d) in two different medium (full Human Serum and delipidised Human serum).