



Seminar

Prof Silvia Giordani

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Carbon nano-onions for targeted drug delivery

Tuesday, 26 February 2025, h. 10.00

Wataghin Room, Physics department, via Pietro Giuria 1, Torino

Abstract:

In this presentation, carbon nano-onions (CNOs) will be discussed as a potential vesicle for nanocarrier-type drug delivery systems.¹ CNOs, or multi-layer fullerenes, consist of multiple concentric layers of sp² hybridized carbon and are emerging as platforms for biomedical applications because of their ability to be internalized by cells and low toxicity.² In my research group we have developed methodology for the synthesis of pure, monodispersed CNOs and various chemical functionalization strategies for the introduction of different functionalities (receptor targeting unit and imaging unit) onto the surface of the CNOs. The modified CNOs display high brightness and photostability in aqueous solutions and are selectively taken up by different cancer cell lines without significant cytotoxicity. Supramolecular functionalization with biocompatible polymers is an effective strategy to develop engineered drug carriers for targeted delivery applications. Non-covalently functionalized CNOs with hyaluronic acid-phospholipid (HA-DMPE) conjugate show excellent in vitro cell viability in human breast carcinoma cells overexpressing CD44 and are uptaken to a greater extent compared to human ovarian carcinoma cells with an undetectable amount of CD44. In addition, they possess high in vivo biocompatibility in zebrafish during the different stages of development.³ We have successfully loaded the CNO-based nanocarrier with chemotherapeutic prodrugs derived from gemcitabine, and showed remarkable efficacy in killing pancreatic ductal adenocarcinoma (PDAC) cells, which are typically resistant to gemcitabine.⁴ These findings highlight the potential of CNOs as a promising scaffold for advanced targeted drug delivery systems and underscore their translational potential in cancer therapy as they have shown capacity in improving PDAC outcomes over conventional therapy.

References

1. Bartkowski M. and Giordani S. Dalton Transactions 2021, 50 (7), 23.
2. Giordani S. et al. Current Medicinal Chemistry 2019, 26 (38), 6915.
3. d'Amora M. et al. Colloids and Surfaces B: Biointerfaces 2020, 110779.
4. Bartkowski M. et al. Journal of Colloid and Interface Science 2024, 659, 339-354



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Biography



Silvia Giordani is full Professor Chair of Nanomaterials at the School of Chemical Sciences at Dublin City University (DCU) since 2018 and she acted as Head of School from 2020 to 2023.

Previously she received a PhD in Chemistry from the University of Miami, USA and carried out postdoctoral research at Trinity College Dublin (TCD), Ireland and at the University of Trieste, Italy. In 2007 she received the prestigious President of Ireland Young Researcher Award and was a Research Assistant Professor at TCD from 2007 to 2013. In September 2013 she founded the new “Nano Carbon Materials” research lab at the Istituto Italiano di Tecnologia (IIT) and in December

2016 she was appointed Associate Professor in Organic Chemistry at the University of Turin, Italy.

Her main research interests are in the design, synthesis, and characterization of a wide range of nanomaterials for applications in smart and responsive bio-related nanotechnologies. She has authored over 160 peer-reviewed publications in International journals from 2001 to date, including Chemical Society Reviews, Nature Nanotechnology, PNAS, Advanced Materials, ACS Nano, Carbon and J. Am. Chem. Soc. that collectively have received over 10,000 citations and her results have been highlighted in journals such as Science, Nature, and New Scientist. Prof. Giordani has also presented her work at numerous conferences around the world e.g. in United States, Canada, Japan, New Zealand, India, Saudi Arabia, Argentina, Brazil, Chile and across most of Europe. She has served as the thesis/dissertation advisor or mentor to over 60 undergraduate, postgraduate and postdoctoral fellows in Ireland and Italy.

In 2012 she was awarded the L’Oréal UK & Ireland Fellowship For Women in Science and in 2014 she has been invited to give a “Women in Science” Masterclass at the Royal Irish Academy. In 2018 she was awarded the William Evans Fellowship from the University of Otago (New Zealand) and was a Visiting Scientist to the Bio-Nano Institute at Toyo University (Japan). In 2024 she was awarded the Montpellier Advanced Knowledge Institute on Transitions (MAK’IT) visiting scientist Fellowship from the University of Montpellier (France).

She is Associate Editor for Beilstein Journal of Nanotechnology.

Prof Giordani’s full profile including publications may be found at:

<https://www.dcu.ie/chemistry/people/silvia-giordani>

and

<https://www.giordanigroup.com/>