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Development and bioapplications of nontoxic carbon dots

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Carbon dots (C-Dots) with diameter smaller than 10 nm have recently attracted enormous attention in various fields due to their unique properties. In this talk, the synthesis, characterization and bioapplications of a new type of nontoxic, water-soluble C-Dots will be presented. A major medical challenge one faces to treat Central Nervous System (CNS) related diseases is to cross the tight junctions between endothelial cells, which are known as blood-brain barrier (BBB). Recently, our *in vivo* experimental observations suggested that the transferrin conjugated C-Dots could enter the CNS of Zebrafish while C-Dots alone could not. Thanks to the abundant presence of carboxylic acids on the surface, C Dots are easily conjugated with transferrin and anticancer drug doxorubicin. The system was then applied as a drug delivery system for the delivery of doxorubicin into cancerous cells. Our *in vitro* study showed greater uptake of the conjugates compared to free doxorubicin, the conjugates at 10 nM was significantly more cytotoxic than doxorubicin alone, reducing viability by 14-45 %, across multiple pediatric brain tumor cell lines. Accidents, disease and aging compromise the structural and physiological functions of bones, and *in vivo* bone imaging test is critical to identify, detect and diagnose bone related development and dysfunctions. Here we show that C-Dots with low quantum yield ("dark") bind to calcified bone structures of live Zebrafish larvae with high affinity and selectivity. Binding resulted in a strong enhancement of luminescence that was not observed in other tissues, including non-calcified endochondral elements. Retention of C dots by bones was very stable, long lasting, and with no detectable toxicity. These observations support a novel and revolutionary use of C-Dots as highly specific bioagents for bone imaging and diagnosis, and as a potential bone-specific drug delivery carrier.

Biography

Roger M Leblanc received his BS in Chemistry in 1964 from Universite Laval, Canada, and PhD in Physical Chemistry in l968 from the same university. From 1968 to 1970, he was a Postdoctoral Fellow in the Laboratory of Prof. George Porter, FRS, in Davy Faraday Research Lab, the Royal Institution of Great Britain. He was a Professor from 1970 to 1993 at Department of Chemistry and Biology in Universite du Quebec a Trois Rivieres, Canada. During this period, he was Chair from 1971 to 1975 at the same department, and Director from 1981 to 1991 at Photobiophysics Research Center. In 1994, he moved to University of Miami, where he has been a Professor at Department of Chemistry since then to present. At University of Miami, he was Chair of Department of Chemistry from 1994 to 2002, and he is appointed as Chair from 2013 to present. He was also one of the three editors of *Colloids and Surfaces B: Biointerfaces* from 1998 to 2017. During his early career as a Scientist, his research interest was on the photosynthesis and photoconductivity using surface chemistry and spectroscopy. His current research interest is to apply 2-dimensional (2-D) surface chemistry combined with spectroscopy and microscopy to investigate the properties of nanomaterials (carbon dots, graphene oxide and quantum dots) and the fibrillation process of amyloidogenic proteins (insulin, amyloid-beta peptide and islet amyloid polypeptide). He is also interested to design and develop biosensors with high sensitivity and selectivity for diseases diagnosis. He has published 512 scientific articles in peer-reviewed journals. As a Professor, he has supervised more than 100 Master's and PhD students.

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