Chemical & Physical Sciences
UNIVERSITY OF TORONTO
MISSISSAUGA

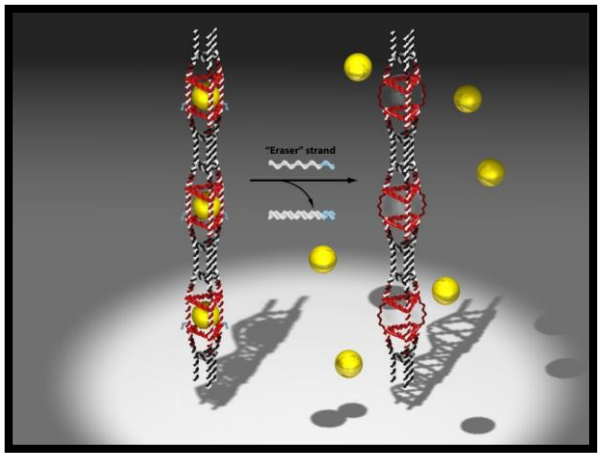
COLLOQUIUM

TUESDAY NOVEMBER 8TH, 2011
12:00 P.M. (SHARP) – 1:00 P.M.
INSTRUCTIONAL BUILDING 240

Hanadi Sleiman

McGill University, Chemistry

"Supramolecular Chemistry with DNA: Towards Biological and Materials Applications"



A central challenge in supramolecular chemistry is the organization of functional components into deliberately designed patterns, and the ability to modify these patterns at will. Because of its molecular recognition specificity and structural features, DNA presents a unique opportunity to address this problem. A number of strategies for DNA construction have been developed, such as weaving together DNA strands into 'tiles', or stapling a viral DNA strand into 'origami' structures. These approaches use DNA as the only information source to guide the assembly, resulting in DNA-dense structures that are large and rigid.

Our group has been examining a new approach to build DNA nanostructures, in which synthetic molecules are used to control and modify DNA self-assembly. This results in combining the diverse structural features and functionalities of inorganic and organic molecules, with the programmable nature of DNA, and obviates the need for interweaving DNA strands for structure definition. Thus, 'DNA-economic' structures with smaller sizes, increased dynamic character and intrinsic functionalities are formed. Specifically, we will describe (a) the synthesis of 3D-DNA structures, such as DNA cages and nanotubes, with deliberate variation of geometry, size, single- and double-stranded forms, permeability and persistence lengths, (b) the encapsulation of guest materials within these 3D-hosts and their selective release with externally added molecules, (c) the site-specific incorporation of transition metals and synthetic polymers in these structures, with significant stability enhancement, redox, photophysical and magnetic properties, (d) the use of small molecules to effect profound changes in both DNA nanostructure preparation and the fundamental self-assembly properties of DNA itself. Finally, we will describe the selective delivery of these responsive DNA cages and nanotubes into mammalian cells.