Bar-Ilan University
אוניברסיטת בר-אילן

Faculty of Exact Sciences
Department of Chemistry

הפקולטה למדעים מדויקים
המחלקה לכימיה

S E M I N A R

Monday 23/12/19, 12:00 pm

Building 211, seminar room

SPEAKER:

Prof. Itamar Willner

Institute of Chemistry,
The Hebrew University of Jerusalem

TOPIC:

Supramolecular Nanostructures for Catalysis, Photocatalysis and Nanomedicine Applications

Abstract:

Substantial information is encoded in the base sequence of nucleic acids, reflected by guided duplex formation, switchable reconfiguration into supramolecular structures and sequence-specific recognition or catalytic functions. These unique properties are used to develop nucleic acid-based supramolecular structures of enhanced hierarchical structural and functional complexities. This will be exemplified with: (i) The synthesis of catalyst- and photocatalyst-modified aptamers, acting as enzyme-mimicking[1] and artificial photosynthetic systems[2]. (ii) Assembly of nucleic acid-based supramolecular constitutional dynamic networks (CDNs)[3]. *In vitro* adaptive and hierarchical functions of CDNs[4], intercommunication of CDNs[5] and feedback-driven CDNs[6] will be mentioned, and possible applications, such as, CDN-guided transcription processes will be discussed. The incorporation of CDNs into cell-like containments, Networksomes, will be introduced, and adaptive dynamic operation of the networks, including inter-communication between networksomes will be addressed. (iii) Supramolecular nucleic acid-based stimuli-responsive hydrogel materials will be introduced, and their application as shape-memory, self-healing and controlled drug-release materials[7]. Specifically, the development of a hydrogel acting as an artificial pancreas will be demonstrated. (iv) Origami tiles represent one of the highlights of supramolecular DNA nanotechnology. The assembly of origami-nanostructures that include mechanically driven parts will be introduced, and the application of mechanically generated "nanoholes" as confined volumes for catalytic transformations will be presented[8].

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(2) G.-F. Luo, Y. Biniuri, W.-H. Chen, E. Neumann, M. Fadeev, H.B. Marjault, A. Bedi, O. Gidron, R. Nechushatai, D. Stone, T. Happe, I. Willner, *Nano Lett.*, 19, 6621-6628 (2019).
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(4) Z. Zhou. L. Yue, S. Wang, J.-M. Lehn, I. Willner, *J. Am. Chem. Soc.*, 140, 12077-12089 (2018).
(5) L. Yue, S. Wang, S. Lilienthal, V. Wulf, F. Remacle, R.D. Levine, I. Willner, *J. Am. Chem. Soc.*, 140, 8721-8731 (2018).
(6) L. Yue, S. Wang, V. Wulf, S. Lilienthal, F. Remacle, R.D. Levine, I. Willner, *Proc. Natl. Acad. Science U.S.A.*, 116, 2843-2848 (2019).
(7) J.S. Kahn, Y. Hu, I. Willner, *Acc. Chem. Res.*, 50, 680-690 (2017).

(8) J.-B. Wang, L. Yue, Z. Li, J. Zhang, H. Tian , I. Willner , *Nat. Commun.*, in press.