Self-assembly of DNA / π-conjugated structures: a supramolecular approach

Dr. **Mathieu SURIN**

Laboratory for Chemistry of Novel Materials, Université de Mons, Belgique

Hybrid self-assembled structures combining biomolecules and synthetic π-conjugated polymers constitute a promising new class of (nano)materials, by the combination of the exceptional optical properties of these polymers and the recognition properties of the biomolecular structures, for which prospective applications are envisioned in biosensing, diagnosis, and therapeutic (nano)systems.[1] For instance, fluorescence properties of π-conjugated polyelectrolytes have been exploited to selectively detect complementary single-stranded DNA, to probe conformational changes of an aptamer when binding to human α-thrombin, and to monitor anti-cancer drug release in DNA-polymer hydrogels.[2]

In this frame, we focus our research efforts on the self-assembly of π-conjugated oligomers or polymers with specific DNA structures (oligonucleotides), in order to elaborate novel hybrid materials possessing specific optical and/or (bio)recognition properties. With this aim, we develop a supramolecular approach, which combine molecular modelling, (chir)optical spectroscopy, and scanning probe microscopy to develop models of self-assembly and establish a deep understanding of the structure-properties relationships. In this seminar, we will particularly highlight two approaches:

(i) the DNA template approach, which deals with the base recognition properties to scaffold assemblies of π-conjugated oligomers with specific 2D or 3D supramolecular organization, which is exploited to develop supramolecular wires on surfaces, to direct energy-transfer processes along DNA templates, or to template dynamic polymerization ;

(ii) the DNA-polyelectrolyte approach, which deals with the binding of cationic of π-conjugated polymers and specific nucleic acids, with the intention to further understand the self-assembly to construct highly selective chemo- and bio-sensors.

References

1. C. Zhu et al., Chem. Rev. 2012, 112, 4687.

2. (a) Q.H. Xu et al., *Proc. Nat. Ac. Sci. USA* **2004**, *101*, 11634 ; (b) H.-A. Ho, M. Leclerc, *J. Am. Chem. Soc.* **2004**, *126*, 1384 ; (c) H. Tang et al., *Chem. Comm.* **2009**, 641.