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THE IBY AND ALADAR FLEISCHMAN FACULTY OF ENGINEERING
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

הפקולטה להנדסה ע"ש איבי ואלדר פליישמן
המחלקה למדע והנדסה של חומרים

The DMSE Lectureships on the occasion of the founding of the Department of Materials Science and Engineering

You are cordially invited to attend this special seminar to be held
Tuesday, April 22, 2014
14:00-15:00
Room 011, Engineering Classes Building

Biomimetic Polypeptide and Polysaccharide Based Polymersomes for Therapy and Diagnosis

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Polymer vesicles (polymersomes) are among the most attractive systems for drug delivery applications. Actually, vesicles obtained by self-assembly of block copolymers are expected to overcome some of the current limitations in drug delivery, allowing the development of robust nanocontainers of either hydrophilic or hydrophobic species. In addition, the development of macromolecular nanodevices that can be used within the living body implies that sensors detecting chemical signals -such as ions, enzymes or pH changes- and generating internal signals or appropriate responses be integrated in the macromolecular system [1]. The use of peptide and saccharide building blocks in the copolymer structure would allow both controlling the self-assembled structure and the resultant biofunctionality.

We report an overview on the self-assembly in water of amphiphilic block copolymers into polymersomes, and their applications in loading and controlled release of both hydrophilic and hydrophobic molecules and biomolecules. We pay special attention to polysaccharide and polypeptide-based block copolymer vesicles that we have studied these recent years in our group [2,3]. These newly developed copolymers that mimic the structure and function of glycoproteins represent an example of the effectiveness of a biomimetic strategy in implementing materials design [4]. In addition, magnetic polymersomes, including iron oxide γ-Fe_2O_3 nanoparticles are currently investigated, together with their potential applications as contrast agent for imaging and as therapeutic nanoparticles using hyperthermia [5]. Exciting and very promising results about their therapeutic evaluation for tumor targeting and in vivo tumor regression studies will be presented [6].

Finally our recent advances in using “biomimicry approaches” to design complex, compartmentalized materials will be proposed. We demonstrate the formation of compartmentalized polymersomes with an internal « gelly » cavity using an original and versatile emulsion-centrifugation process. Such a system constitutes a first step towards the challenge of structural cell mimicry with both “organelles” and “cytoplasm mimics”. This study constitutes major progress in the field of structural biomimicry and will certainly enable the rise of new, highly interesting properties in the field of high-added value soft matter, especially in controlled cascade (bio)reactions [7].

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Biography of lecturer

Sébastien Lecommandoux received his PhD degree in Chemistry and Physics in 1996 at the University of Bordeaux, supervised by Prof. F. Hardouin (CRPP). Then, he went to the Materials Research Laboratory and the Beckman Institute (University of Illinois at Urbana-Champaign, USA) and worked as a Post-Doc in the group of Prof. S. I. Stupp. There, he learned the art of self-assembly and supramolecular chemistry. Subsequently, he joined the Laboratoire de Chimie des Polymères Organiques (Bordeaux, France) as Associate Professor in 1998, and became Professor in 2005 and Full Professor in 2009.

He is currently leading the group "Polymer Self-Assembly and Life Sciences" at the LCPO. His research interests include polypeptide and polysaccharide based block copolymers self-assembly, biomimetic approaches toward design of synthetic viruses and cells as well as the design of polymersomes for drug-delivery and theranostic in cancer therapy. He is deputy director of the LCPO and director of the research at the ENSCBP. He is also currently chairing the ESF Research Network Programme on "Precision Polymer materials" P2M.

Prof Lecommandoux is recipient of the CNRS bronze medal award (2004) and is honorary junior member of the Institut Universitaire de France (promotion IUF 2007). He is Associate Editor for Biomacromolecules (ACS) and in the Editorial Advisory Board of several international journals, including Bioconjugate Chemistry (ACS), Polymer Chemistry and Biomaterials Science (RSC).

Prof. Lecommandoux has supervised about 20 PhD students and published more than 130 publications in international journals, 6 book chapters and 3 patents (2 being licenced), with over 4000 citations (h-factor 34). He has presented more than 150 communications, including about 120 on invitation.