

SMART MOLECULES

Module name	Smart Molecules: Building on the Nanoscale with Nucleic Acids
Number	2014-T1
Aims	1. Understand the basic principles of DNA based self-assembly nanobiotechnology, 2. Functionalization of biological surfaces, i.e. lipid and biological membranes, 3. Interaction of DNA with metal ions
Basics	DNA molecules represent attractive and versatile building blocks for nanotechnological applications. In the module, the basic principles of DNA-based nanotechnology will be communicated to highlight the important potential of nucleic acids for several applications in bionanotechnology and nanomedicine. The module will cover basic aspects of chemical synthesis, characterization, and application of lipophilic oligonucleotides in modern biophysical and chemical research.
Contents	<ul style="list-style-type: none"> – Chemical synthesis of lipid modified nucleosides and oligonucleotides (Jürgen Liebscher) – Membrane partitioning of lipophilic DNA, oligomer formation, Watson Crick base pairing (Daniel Huster) – Domain specific partitioning of DNA oligonucleotides (Anna Arbusova) – DNA origami (Ralf Seidel) – Interaction of DNA with metal ions (Jens Müller) – Application of DNA constructs in cell therapy (Christoph Schneider)
Methods	Synthesis, Confocal Fluorescence Imaging, Fluorescence Spectroscopy, NMR Spectroscopy (both in solution and in the solid state), differential scanning calorimetry, microscopy
Type	Two-day block course
Date (month/year)	1-2 September 2014
Time	8.25 a.m. (Monday) – 3.30 p.m. (Tuesday)
Work load	15 hours presence / 45 hours self-study
Examination	t.b.a.
Credit points	2
Responsible scientists	Prof. Dr. E. Hey-Hawkins, Prof. Dr. Daniel Huster
Guest lecturers	Prof. Dr. Jürgen Liebscher, Cluj-Napoca (Romania), Prof. Dr. Daniel Huster, Leipzig (Germany), Dr. Anja Arbusova, Berlin (Germany), Prof. Dr. Ralf Seidel, Münster (Germany), Prof. Dr. Jens Müller, Münster (Germany), Jessica Lorenz, Fraunhofer Institute, Leipzig (Germany)
Industrial partners	None
Recommendations for literature	Schade et al., Adv Colloid Interface Sci. 208 (2014) 235-251

Monday, 1 September 2014			
Time	Lecturer	Program	Location
08:25 – 08:30	Prof. Dr. Daniel Huster, Leipzig	Welcoming address	Faculty of Chemistry and Mineralogy, Johannisallee 29
08:30 – 10:00	Prof. Dr. Daniel Huster, Leipzig	Lipophilic DNA Conjugates as Smart Molecular Glue	Seminar Room SR102
10:00 – 10:30	<i>Coffee & Tea, Refreshments</i>		
10:30 – 12:00	Prof. Dr. Jürgen Liebscher, Cluj-Napoca	Design and synthesis of lipophilic nucleosides and oligonucleotides	SR102
12:00 – 13:30	<i>Lunch break</i>		
13:30 – 15:00	Dr. Anna Arbusova, Berlin	Lipid domains - sorting molecules by DNA	SR102
15:00 – 15:30	<i>Coffee & Tea, Refreshments</i>		
15:30 – 17:00	Prof. Dr. Jens Müller, Münster	Metal ions in complex nucleic acid systems	SR102
Tuesday, 2 September 2014			
08:30 – 10:00	Prof. Dr. Ralf Seidel, Münster	DNA nanotechnology: From structures to autonomous machines	SR102
10:00 – 10:30	<i>Coffee & Tea, Refreshments</i>		
10:30 – 12:00	Jessica Lorenz, Fraunhofer Institute Leipzig	Sculpting functional DNA scaffolds for nanoscale molecular templating (preliminary)	SR102
12:00 – 13:30	Transfer to Fraunhofer Institute, Lunch break at Cafeteria		
13:30 – 15:30	Excursion and demonstrations at the Fraunhofer Institute for Cell Therapy and Immunology, Perlickstraße 1, 04103 Leipzig (Jessica Lorenz)		
15:30	Closing Remarks		

Didactic elements: Lecture, discussions, presentations, excursion.
Expected performance: Active participation in discussions