IAP Seminar

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Tuesday, 26th November 2019, 16:00 s.t.
TU Wien, Institut für Angewandte Physik, E134
1040 Wien, Wiedner Hauptstraße 8-10
Yellow Tower „B“, 5th floor, SEM.R. DB gelb 05 B

Macromolecular Gates

There is a steady need for new methods to detect, separate and analyze biomolecules using *in vitro* or “bottom-up” approaches. In this project we combine plasmonic nanopores and polymer brushes with the long-term aim to develop new bioanalytical devices. Meanwhile we also address fundamental questions within the fields of macromolecules and supramolecular chemistry. Examples are interactions (or just repulsion) between different proteins and synthetic polymer chains. The combination of polymer brushes and nanopores offers unique possibilities to study brushes as barriers or selective filters. For one thing, interactions with the surface can be ignored as they do not influence the molecular transport through the brush. To complement the work with nanopores we also perform extensive analysis of the polymer brushes on planar surfaces using various tools, in particular surface plasmon resonance, but also quartz crystal microbalance and electrochemical methods.

I will show recent results of plasmonic nanopores sealed by polymer brushes that either repel or attract proteins. Such pores enable new types of biomolecular filters whose properties are determined solely by the brush. Understanding brushes as barriers can lead to the development of ultrathin filters inspired by the remarkable selectivity of biological systems (Fig. 1).

I will also describe different ways to achieve “gating”, i.e. morphology changes in the brush that make the sealed nanopores permeable to proteins on demand. This could have applications in single molecule analysis by trapping proteins in a non-invasive manner under physiological conditions in volumes as small as one attoliter (a nanopore in a membrane). One can envision nanoscale reaction chambers where individual molecules and their interactions are analyzed by fluorescent techniques (Fig. 2).

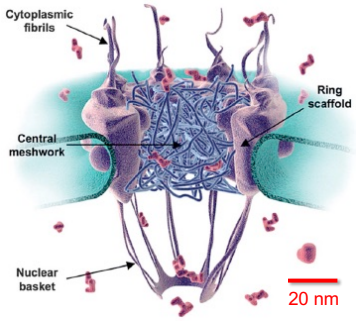

Fig. 1 Schematic representation of the nuclear pore complex. Image from Patel et al. Cell 2007, 129 (1), 83-96.

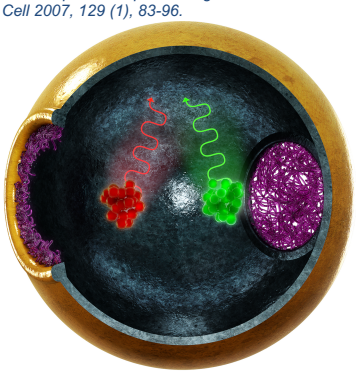

Fig. 2 Artistic description of a nanoscale reaction chamber for single molecule analysis, which is a possible future application of the macromolecular gates.

All interested colleagues are welcome to this seminar lecture (45 min. presentation followed by discussion).

Friedrich Aumayr
(LVA-Leiter)

M. Valtiner
(Seminar Chair)