Elitenetzwerk Bayern

UNIVERSITÄT BAYREUTH

Elite Study Programme in Macromolecular Science

Module

Advanced Interdisciplinary Lab Course

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Winter Term 2007/08

This teaching module in the winter term 2007/08 within the Elite Study Programme “Macromolecular Science” consists of an “Advanced Interdisciplinary Lab Course”. This lab course comprises an actual interdisciplinary practical course conducted in a team. Its aim is to gain practical knowledge about a model drug delivery system based on amphiphilic diblock copolymers, which form micelles. The students learn how to characterize diblock copolymers and aggregates of these diblock copolymers, which are loaded with an organic fluorophore as a model for a drug. Then the students study the uptake of these micelles or vesicles into mammalian cells. Each group uses a diblock copolymer of different composition and the influence of these compositions on the properties of the aggregates is investigated.

Series of consecutive experiments on the characterization of model diblock copolymer aggregates and their application in drug delivery:

Finishing the dialysis of the micelles, preparation of the solutions for the characterizations, Size Exclusion Chromatography (SEC) and Nuclear Magnetic Resonance (NMR)

The students finish the dialysis of the micelles and prepare the different solutions needed for the characterizations. The characterization of diblock copolymers with respect to molecular weight, polydispersity and composition is carried out. SEC or Gel Permeation Chromatography (GPC) are used in order to determine the molecular weight and the polydispersity. The students determine the composition of the diblock copolymers by H-NMR. (Prof. Dr. H.-W. Schmidt)

Fluorescence Correlation Spectroscopy (FCS)

The students use FCS in order to selectively determine the diffusion constants of those particles, which are loaded with an organic fluorophore. The fluorophore is used as a model for a drug. The FCS are an important part of the training to understand the physical principles. By analyzing the FCS data a loading efficiency can be determined.
(Prof. Dr. A. Fery)

Atomic Force Microscopy (AFM)

The students will prepare thin films of the diblock copolymers and determine the topography of these films. Also the different nature of the two blocks of the diblock copolymers is visualized by phase contrast. Thereafter the micelles are imaged and a rough estimate about their size distribution can be given. (Prof. Dr. A. Fery)

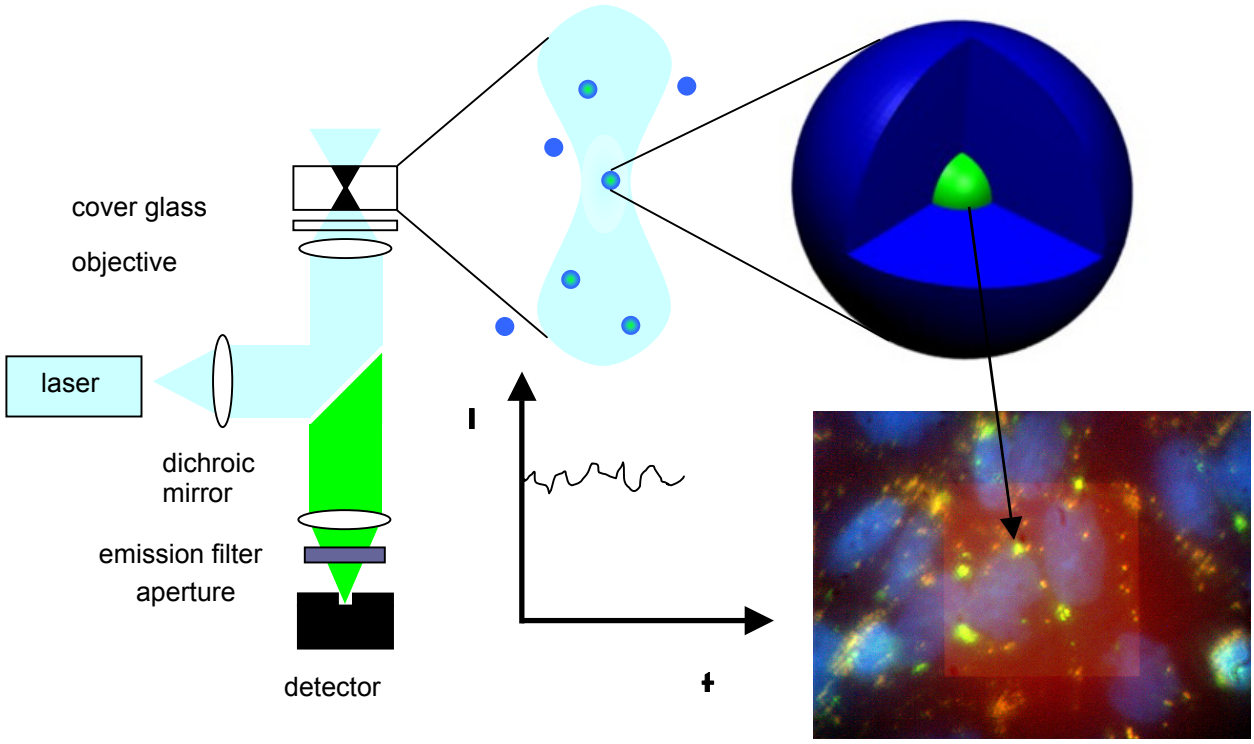

Figure 1. An FCS set-up used to characterize micelles, whose hydrophobic core is labeled by an organic fluorophore and a fluorescence microscopy image of mammalian cells, which have been exposed to an aqueous solution of these micelles.

Nano-containers Uptake in Mammalian Cells

This practical course covers some basic manipulations typical for mammalian cell culture: work under sterile conditions in a laminar flow hood and enzymatic detachment of cells from substrates. Further on, the flow cytometry method is used to perform a quantitative analysis of nano-containers uptake, making use of the incorporated fluorescent dyes. Fluorescence Microscopy finally gives images of the cells and the distribution of the fluorescent drug model in them. (Prof. Dr. R. Freitag)