Universität Basel

Research Project

Interactions, dynamics and functionality at nanoscale characterized by confocal laser scanning microscopy and fluorescence correlation spectroscopy

Third-party funded project

Project title Interactions, dynamics and functionality at nanoscale characterized by confocal laser scanning microscopy and fluorescence correlation spectroscopy
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Fluorescence correlation spectroscopy (FCS), fluorescence cross-correlation spectroscopy (FCCS), and Förster resonance energy transfer (FRET) play an irreplaceable role to determine the number and movement of molecules, biological entities, and nanoparticles in biological or synthetic systems. These methods can analyze particles, not only in solution, but also attached to surfaces, inside cells, or nanoparticles. From these measurements, the number of particles, binding strength (KD), distance, surface modifications, and the speed of particles can be determined. When coupled with confocal laser scanning microscopy (CLSM), the particles can be visualized in various environments as well. We require financial support for a new state of the art CLSM/FCS/FCCS instrument in the Department of Chemistry at the University of Basel that will include all three spectroscopy modes (FCS, FCCS and FRET) as well as a high resolution confocal microscope and cell incubation platform. We strongly depend on these techniques in our on-going and future projects. This instrument will allow for resolving images of fluorescently labeled particles from the nano to micrometer size (140 nm- 2 ţm), as well as enable the long term study of particles inside growing cells. FCS and FCCS will allow for measurements of product formation and molecule localization at the site of interest, as well as allow for the determination of binding, release, and movement of particles. It will also expand our capabilities by giving us the ability to detect samples inside growing cells for extended periods of time, which was previously not possible. The new software will make data analysis and interpretation much simpler, and with models adapted for complex systems. Finally, the system is designed in a modular fashion allowing for the future upgrade with more diverse laser arrays as well as the addition of enhanced fluorescence lifetime imaging microscopy. This new state of the art CLSM/FCS/FCCS instrument will support research emphasized by the University of Basel, within the scope of “life- and nanoscience. It will ensure the international competitiveness of the research groups involved in the proposal (groups from the Department of Chemistry, Biozentrum, and the Swiss Tropical and Public Health Institute), and their collaborations within the NCCR Molecular Systems Engineering, the Swiss Nanoscience Institute, and industrial partners. Moreover, other groups from adjacent departments of the University of Basel and various industrial partners can have access based on joint projects.

Keywords polymer membranes, fluorescence correlation spectroscopy, nanoreactors, fluorescence cross correlation spectroscopy, supramolecular hybrid materials, confocal laser scanning microscopy, artificial mettaloenzymes, nuclear pore complex, exported proteins
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