CRG Core Facilities Technology Symposium: "Innovative approaches for imaging and analysis"

17 November 2011,
Ramón y Cajal meeting room, Barcelona

Stefan JAKOBS
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"Novel reversibly switchable fluorescent proteins for super-resolution microscopy"

Quantitative microscopy relies on imaging of large cell numbers but is often hampered by time-consuming tedious manual selection of specific cells of interest. We have developed a concept to automatically recognize cell morphologies in an unbiased manner after a supervised training step.

This controls fluorescence imaging systems to detect cells and launch immunofluorescence assays, 3D-live cell imaging, fluorescence recovery after photobleaching (FRAP), or fluorescence correlation spectroscopy (FCS). It enables unbiased rapid sampling of cells in specific functional states, allowed detailed statistical analysis of three different biological processes and is thus a powerful tool for systems biology.

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"High Throughput towards Systems Microscopy"

Reversibly switchable fluorescent proteins (RSFPs), or photochromic proteins, which can be revers¬ibly switched between an On- and an Off-state by optical irradiation have opened new opportunities for the imaging of cells. These proteins may be used for innovative microscopy schemes, such as protein tracking, fluorescence resonance energy transfer imaging, and, most notably, sub-diffraction resolution microscopy. However, thus far this class of fluorescent proteins has not displayed its full poten¬tial. By a combination of directed design and intense screening we have generated new RSFPs with favorable properties for super-resolution microscopy and other applications. These proteins can be used for all-optical super-resolution microscopy that records raw data images from living cells and tissues with low levels of light.

Literature:
Grotjohann et al., 2011, Nature, 478, 204-208,
Brakemann et al., 2011, Nature Biotech., 29, 942-947
Andresen et al., 2008, Nature Biotech., 26, 1035-1040

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"Molecular Imaging and Translational Research"

Aspects of medical systems biology become increasingly important within translational and clinical research. The Bioinformatics department provides the techniques, tools, approaches and insights necessary to convert biological information into opportunities for improved patient treatment (genes/proteins causative for diseases) and patient stratification.

Nowadays three dimensional imaging modalities such as CT, MRI and 3D ultrasound play an ever increasing role in research, diagnosis and treatment planning. The Erasmus MC was the first university medical center to install an I-Space fully immersive virtual reality (VR) system which allows very detailed three dimensional volume visualizations of gene and protein expression in small tissue samples, using confocal microscopy (CSLM) or optical projection tomography (OPT), enabling new insights into the developmental processes of both model organisms as well as humans.