EU-FP7 Systems Microscopy Network of Excellence

Imreh[1], G. and Strömblad S.[1]*

[1]Karolinska Institutet, Department of Biosciences and Nutrition, 141 83 Huddinge, Sweden
gabriela.imreh@ki.se

* Corresponding Author: Staffan Strömblad, Staffan.stromblad@ki.se

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Abstract

Novel research approaches have emerged that use powerful experimental and computational tools, with the aim of achieving a quantitative systems-level understanding of life. However, the current experimental methods commonly employed in systems biology research are limited in resolution and failed to capture the true spatiotemporal complexity of life. Next-generation systems biology therefore requires new, more powerful methods that capture data and can be used to create models in three-dimensional space and time, allow measurements with single-cell sensitivity, and at the same time can be performed in sufficiently high throughput to address the molecular diversity and complexity of life. Recent advances in automated fluorescence microscopy, including cell microarray platforms, highly specific molecular probes, quantitative image analysis, and data mining provide powerful tools that push high-content microscopy towards the realm of high-throughput, for the first time enabling systems biology of the living cell.

The Systems Microscopy Network of Excellence (NoE) is developing a technological platform making microscopy based technology a powerful tool in systems biology by combining the strengths of modern microscopy with the experimental throughput needed for systems level analysis of the living cell. This NoE constitutes a highly coordinated multidisciplinary effort including technology development, front line cell biology, bioinformatics, biostatistics and mathematical modeling.

The studies of two complex biological processes highly relevant to human cancer progression, cell division and cell migration, form the paradigm for the systems microscopy methodology. Events promoting cancer progression are believed to most commonly occur at the single cell level, making the single cell resolution offered by microscopy a requirement for the successful translation of basic research into tools for human health.