Biology and Pathology

Biology and Pathology – Systems Biology and its Link to Molecular Imaging

Systems Biology of Single Cells
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Learning Objectives:

- Understanding the background and motifs for the establishment of systems biology as a new research field in life sciences
- Getting familiar with specific methods and approaches used in cellular systems biology
- Conceiving the enormous potential of cellular SB for biotechnological purposes and the prevention, diagnosis and treatment of diseases

This talk introduces systems biology (SB) as a new fascinating research field in life sciences. SB aims at integrating observations and measurements gathered at various levels of cellular and organismic organization into holistic paradigms. The final goal of SB of humans is to decipher the complete causal chain of molecular events by which genomic information and environmental conditions of an individual translate into features on the phenotype level such as, for example, aging, susceptibility to certain diseases or the efficacy and side effects of special medications. In this first lecture of a planned series of lectures on SB, I will focus on SB at cellular level thereby outlining novel techniques and approaches that have evolved during the past 15 years to monitor cellular processes and structures simultaneously at all hierarchical levels of organization and to consistently lump together this wealth of information by the use of complex mathematical models I will demonstrate how the enormous progress in the development and improvements in the spatial resolution and acquisition frequency of imaging techniques like confocal microscopy have paved the way for studying the dynamics an d structural endowment of single cells.