Cell Signaling Proteomics

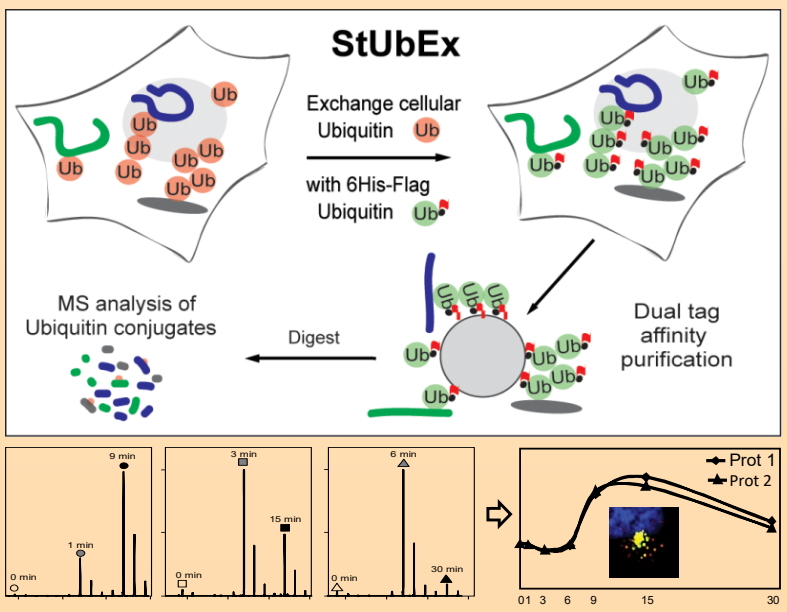
Forskningsleder Blagoy Blagoev

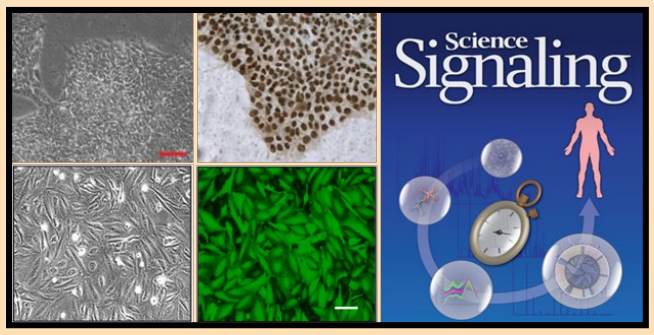
Gruppens kerneforskningsområder

The proper function and survival of every cell in multicellular organisms is dependent on intracellular signaling networks that control cell's growth, differentiation and metabolism. Deregulation of signaling, e.g. loss of growth control, is at the heart of many developmental disorders and severe human diseases including cancer and diabetes.

Our research interest is to explore the mechanisms of cell signaling that control the functions and fate of eukaryotic cells. We utilize modern quantitative proteomics for comprehensive characterization of entire signaling networks with emphasis on their dynamic regulation by posttranslational modifications like phosphorylation and ubiquitination. We investigate the complex and dynamic orchestra of signaling events in human stem cells during cellular development and differentiation. We also conduct proteome-wide comparative studies among different cellular states (e.g. undifferentiated vs differentiated or healthy vs disease) aiming to unveil aberrant factors, which may serve as relevant targets for clinical intervention.

Our major analytical platform is based on high-accuracy mass spectrometry in combination with Stable Isotope Labeling by Amino acids in Cell culture (SILAC), a versatile and accurate method for quantitative proteomics. In addition we employ wide range of classical and modern techniques for proteomics, molecular/cell biology and bioinformatics.





Tidligere studerende

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Projekter	Beskrivelse
Regulation of signaling networks by phosphorylation and ubiquitination	Fundamental cellular processes such as cell growth, motility, proliferation, differentiation and survival are all driven by intracellular signalling networks. The mechanisms for transmitting the proper signal throughout the cell depend entirely on reversible posttranslational modifications such as protein phosphorylation and ubiquitination. In order to obtain a comprehensive picture of the dynamic regulation of signaling networks in mammalian cells, we develop and combine different methods for biochemical enrichment and mass spectrometric characterisation of phosphorylated and ubiquitinated proteins and peptides.
Signaling in stem cells	Stem cells possess the unique abilities to self-renew, i. e. to replicate indefinitely, as well as to differentiate into all types of cells constituting the human body. Therefore the stem cells, both embryonic and adult, hold great promise for advances in developmental biology and regenerative medicine. To obtain deep knowledge on the signaling factors and pathways regulating cellular 'stemness' and differentiation, to understand the mechanisms underlying these central aspects of stem cell biology, we conduct global proteomics and phosphoproteomics studies on stem cells during self-renewal and differentiation stages.
Aberrant signaling in human diseases	Improper regulation of cellular signalling lies at the heart of many human diseases and developmental disorders. Several projects in the lab are focussed on unveiling aberrant signaling processes and individual factors in human diseases using quantitative proteomic screens. We perform subsequent molecular/cell biology studies aiming to understand how these are involved in the pathology of diseases like obesity associated diabetes and cancer.