

Joseena Iype and Tess Brodie: Discover Mass Cytometry with the IMC Platform in Bern

Welcome to the IMC Platform; in this talk we go over the technologies, how to start a project with us and the services we provide.

Hester Koppejan: Mass Cytometry: Because Heavy Metals Rock!

Learn how Fluidigm can support you on starting your own projects. From our ready to use solutions for suspension and imaging mass cytometry to fully customizable projects. We, at Fluidigm, are supporting you at every steps of your projects to maximize your experience.

Florian Ingelfinger: Twin study untangles genetic and environmental immune conversion in multiple sclerosis

Multiple sclerosis (MS) is a chronic inflammatory disorder of the central nervous system underpinned by partially-understood genetic and environmental risk factors, and their undefined interactions. To dissect the influence of genetic predisposition and environmental triggers we defined the peripheral immune signatures from 57 monozygotic twin pairs discordant for MS. Using single cell mass cytometry in conjunction with data-driven computational tools we identified a pro-inflammatory shift in the monocyte compartment of MS-affected twins, coupled with the emergence of an IL-2 hyper-responsive naïve Th cell subset expressing CNS-homing receptors. The naïve Th cell subset, which was also present in non-twin MS patients, exhibited a dysregulated CD25-IL-2 axis, and their proliferative capacity positively correlated with MS severity. By integrating data on the immune profiles of healthy monozygotic and dizygotic twin pairs we estimated that variance in CD25 expression on naïve Th cells was largely driven by genetic and shared early environmental influences. Together, the pair-matched analysis of the extended twin approach allowed us to discern genetically- and environmentally- determined features of an MS-associated immune signature.

Prof Bernd Bodenmiller: Highly multiplexed imaging of tissues with subcellular resolution by imaging mass cytometry.

Cancer is a tissue disease. Heterogeneous cancer cells and normal stromal and immune cells form a dynamic ecosystem that evolves to support tumor expansion and ultimately tumor spread. The complexity of this dynamic system is the main obstacle in our attempts to treat and heal the disease. The study of the tumor ecosystem and its cell-to-cell communications is thus essential to enable an understanding of tumor biology, to define new biomarkers to improve patient care, and ultimately to identify new therapeutic routes and targets.

To study and understand the workings of the tumor ecosystem, highly multiplexed image information of tumor tissues is essential. Such multiplexed images will reveal which cell types are present in a tumor, their functional state, and which cell-cell interactions are present. To enable multiplexed tissue imaging, we developed imaging mass cytometry (IMC). IMC is a novel imaging modality that uses metal isotopes of defined mass as reporters and currently allows to visualize over 50 antibodies and DNA probes simultaneously on tissues with subcellular resolution. In the

near future, we expect that over 100 markers can be visualized. We applied IMC for the analysis of breast cancer samples in a quantitative manner. To extract biological meaningful data and potential biomarkers from this dataset, we developed a novel computational pipeline called histoCAT geared for the interactive and automated analysis of large scale, highly multiplexed tissues image datasets. Our analysis reveals a surprising level of inter and intra-tumor heterogeneity and identify new diversity within known human breast cancer subtypes as well as a variety of stromal cell types that interact with them.

In summary, our results show that IMC provides targeted, high-dimensional analysis of cell type, cell state and cell-to-cell interactions within the TME at subcellular resolution. Spatial relationships of complex cell states of cellular assemblies can be inferred and potentially used as biomarkers. We envision that IMC will enable a systems biology approach to understand and diagnose disease and to guide treatment.