When high dimensional single-cell technologies propel translational research from bench to bedside

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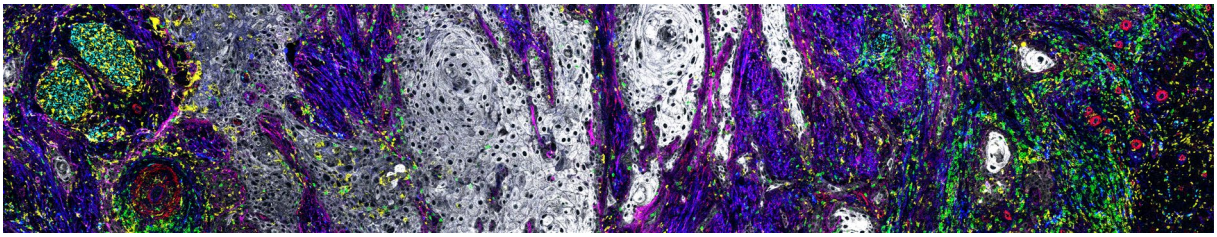
High dimensional imaging mass cytometry for the integrative spatial characterization of the Tumor Immune MicroEnvironment

Cutaneous squamous cell carcinomas (cSCC) are the 2nd deadliest skin cancer. They are currently treated by excisional surgery but can reach, for some patients, a non-operable stage associated with rapid local and nodal relapses and a very poor prognosis. However, no consensus has been reached on the clinical or molecular factors predicting these recurrences. It is therefore crucial to improve the identification of patients that would relapse by the characterization of prognostic biomarkers. An integrative spatial characterization of cSCC immune microenvironment and the interactions of their components are required to identify such biomarkers.
An imaging mass cytometry (IMC) panel of 39 antibodies targeting components of the cSCC TiME (tumor cells, immune subtypes, fibroblasts, blood and lymphatic vessels, extracellular matrix and nerves fibers) was validated to obtain an exhaustive and integrative visualization of the immune microenvironment (TiME) of recurrent and non-recurrent cSCC [(1)]. The analysis of the high-dimensional images of these two groups led to the identification of specific spatial features characterizing the TiME of each group of tumors. The comparison of these specific signatures uncovered a predictive signature associated with relapse risk after surgical excision of cSCC tumors that need to be confirmed in an independent validation cohort

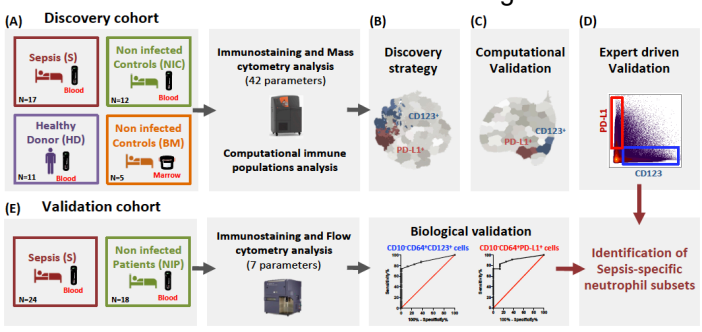
[(1)] Elaldi et al, 2021, Frontiers in immunology



Identification of a discriminating sepsis signature using high dimensional mass cytometry

Sepsis is the leading cause of death in adult intensive care units. At present, sepsis diagnosis relies on non-specific clinical features. It could transform clinical care to have immune cell biomarkers that could predict sepsis diagnosis and guide treatment. There is an urgent need for an early specific immune signature of sepsis severity that does not overlap with other inflammatory biomarkers, and that distinguishes patients with sepsis from those with non- infectious inflammatory syndrome.
Mass cytometry combined with computational high-dimensional data analysis were used to measure 42 markers on whole blood immune cells from sepsis patients and controls, and automatically and comprehensively characterize circulating immune cells, which enables identification of novel, disease-specific cellular signatures. Unsupervised analysis of high-dimensional mass cytometry data characterized previously unappreciated heterogeneity within the CD64+ immature neutrophils and revealed two new subsets distinguished by CD123 and PD-L1 expression.
This study showed that these two new neutrophil subsets were specific to sepsis and detectable by routine flow cytometry. The demonstration here that a simple blood test distinguishes sepsis from other inflammatory conditions represents a key biological milestone that can be immediately translated into improvements in patient care [(2)].

[(2)] Meghraoui-Kheddar et al, 2021, AJRCCM



This presentation will be followed by a brief introduction to AMKbiotech.

AMKbiotech is a high-dimensional tissue imaging and cell phenotyping service laboratory, providing biomedical research actors with a specialized expertise and customizable end-to-end imaging and cytometry services to accelerate the development of their research projects.

Aïda Meghraoui-Kheddar Biography:

Dr Aïda Meghraoui-Kheddar graduated with her ParmD. degree in 2008 from the University of Constantine. She completed her Master of Science degree in Cellular and Molecular Biology at Paris Sorbonne University in 2011 and received her PhD in Immunology from Reims Pharmacy University in 2015 where she trained in inflammatory disease biology and immunology. She completed postdoctoral training in immunology of infectious disease and computational biology at the Institut Pasteur Paris, the Cimi-Paris in C. Combadière lab and Vanderbilt University (Nashville, US) in J. Irish Lab. During this time, she identified an early diagnosis biomarker candidate of sepsis using mass cytometry technology (Meghraoui-Kheddar et al, 2021). These two last years, she was a senior postdoc in Braud and Anjuere Lab at the Institute of Molecular and Cellular Pharmacology in Sophia-Antipolis, France. She used computational analysis and high dimensional technologies including imaging mass cytometry to study immune responses during skin and oral cavity squamous cell carcinomas, focusing on the interactions between immune cells and tumor cell-free components (Elaldi et al, 2021).
She is now the CEO of AMKbiotech, a service laboratory, providing researchers with a specialized expertise in immunology, imaging, mass cytometry and data analysis to accelerate the development of their research projects.