High-dimensional approaches for immune characterization of 2D materials

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Abstract

Thanks to their unique physicochemical properties, two-dimensional (2D) nanomaterials have attracted increasing interest for a wide variety of applications in several fields, including nanotechnology, energy technology, and biomedicine. We recently depicted the "*NanoImmunity-by-Design*" concept, where the characterization of two-dimensional (2D) materials is not solely based on their physical-chemical parameters but also on their immune profiling. [1] The immune profiling can only be revealed in its complexity by applying unique and informative high-dimensional approaches. [2,3] Therefore, we exploited high-dimensional approaches, such as single-cell mass cytometry (CyTOF) and imaging mass cytometry on graphene and other novel 2D materials, such as transition metal carbides/carbonitrides (MXenes). [4-6] We revealed that the amino-functionalization of graphene oxide increased its immunocompatibility. [4] Moreover, we combined graphene with $AgInS_2$ nanocrystals, enabling its detection by CyTOF on a large variety of primary immune cells. [5] Recently, we reported the immune modulation of specific MXenes, and their label-free detection by CyTOF and high-dimensional imaging approaches by our LINKED approach. [6-7]. We translated our LINKED approach in the context of environmental nanopollutants, nanoplastics [8]. Together with our more recently published works, [9-10] unpublished results will be presented on a wider variety of novel 2D materials, including MXenes, transition metal dichalcogenides (MoS_2 and WS_2), and bismuthene. Our results conceptualize that the chemical and immunological design of 2D materials offers new strategies for their safe exploitation in biomedicine.

References

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