Bifunctional NanoAlum for Augmenting Cancer Immunotherapy

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Aluminum adjuvants, a cornerstone of vaccine formulation, exhibit limited efficacy in inducing $CD8^+$ T cell immunity and modulating immune cell function within the tumor microenvironment (TME). To overcome these limitations, we have engineered bifunctional layered double hydroxide (LDH) NanoAlum from first-line AlOOH adjuvant and $Mg(OH)_2$ antacid (Figure 1).[1]

LDH NanoAlum well inherits and enhances the function of AlOOH to initiate robust T cell immunity against solid tumors.[2] Moreover, it also uniquely leverages the weakly alkalinity of $Mg(OH)_2$ to neutralize the acidic TME and block tumor cell autophagy, thereby inhibiting tumor progression.[3] Notably, LDH NanoAlum owns remarkable flexibility in metal composition, enabling the incorporation of immunomodulatory metal ions (M) such as Zn, Cu, Mn.[4] This versatility is exemplified by our recent studies on NanoZnAlum, which not only reverses the immunosuppressive TME and induces tumor immunogenic cell death, but also exhibits enhanced adjuvanticity to strengthen dendritic cell antigen presentation, paving the way for personalized antitumor immunity.[5]

In summary, our study presents a novel adjuvant development paradigm and identifies several close-to-clinic NanoAlum formulations with the potential to revolutionize cancer immunotherapy.

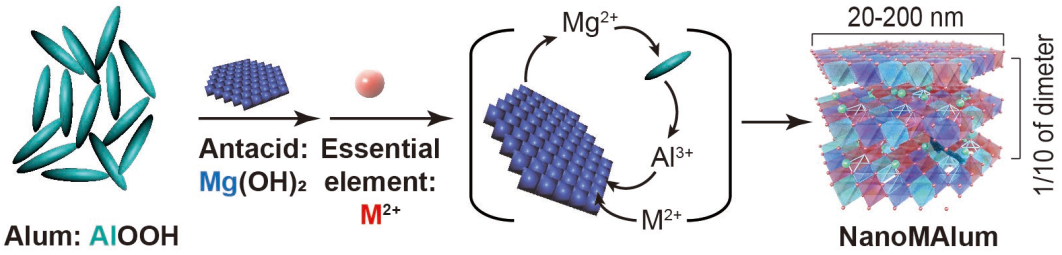

Figure 1. Engineering bifunctional LDH NanoMAlum from first-line drugs

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