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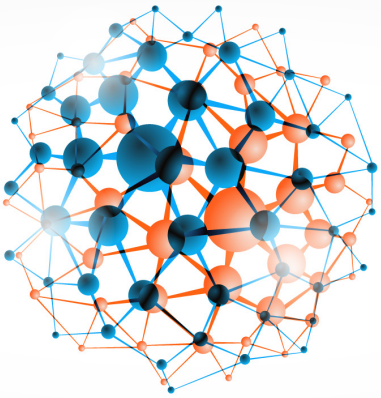
APPLIED NANOTECHNOLOGY AND NANOSCIENCE INTERNATIONAL CONFERENCE

OCT 22-24, 2018
BERLIN



Nanotechnology for improving cancer immunotherapy

Prof. James Moon

University of Michigan, USA

Recent innovations in DNA/RNA sequencing have allowed for the identification of patient-specific tumor neo-antigens, ushering in the new era of personalized cancer vaccines. Peptide vaccines in general may serve as an ideal platform for neo-antigen vaccines, but the therapeutic efficacy of peptide vaccines have been limited in clinical trials. Here we present an alternative strategy where preformed nanocarriers, with an established clinical manufacturing procedure and excellent safety profiles in humans, are readily formulated with adjuvants and antigen peptides, including neo-antigens, to produce personalized cancer vaccines. We show that lipid-based nanodiscs can efficiently co-deliver antigen and immunostimulatory molecules to draining lymph nodes and elicit potent CD8+ cytotoxic T lymphocyte responses directed against tumor antigens, leading to substantially enhanced anti-tumor efficacy in multiple murine tumor models, including colon carcinoma, melanoma, and HPV-induced tumors. In a second research thrust, we have shown that this nano-platform can be engineered to deliver chemotherapeutic agents in a synergistic manner with immune checkpoint blockers. We have also demonstrated their efficacy in murine tumor models, including orthotopic tumors. Owning to the facile production process, robust therapeutic efficacy, and good safety profiles, our nanotechnology offers a powerful and convenient platform for improving cancer immunotherapy.