Bacteriophage Qβ As Promising Platform for Anti-Carbohydrate Cancer Vaccine

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Abstract:
Vaccines that aim to stimulate the immune system to eradicate tumor cells are very attractive method for cancer therapy. One such strategy, active vaccination against tumor associated carbohydrate antigens (TACAs), which are overexpressed on malignant cells and strongly correlated with tumor progression and metastasis, has shown high potential in clinical studies. However, two major challenges need be circumvented to develop effective TACA anticancer vaccines. First, TACAs are self-antigens and tolerated by the immune system; Second, TACAs are weak T cell independent antigens and cannot generate long lasting immune responses when administered alone.

We are interested in exploration of virus like particles (VLPs) as versatile platforms for the development of carbohydrate based cancer vaccine. The highly repetitive array of subunit in VLPs permits the organized display of antigens on the surface of the particle. The VLPs also contain natural T-helper epitopes and pathogen associated molecular patterns, which can engage innate immunity and activate the immune system. Herein, we present the vaccination studies with Tn antigen conjugated to bacteriophage Qβ. All sera from vaccination group showed high titer of anti-Tn IgG antibodies, which could strongly bind with Tn positive tumor cell lines. The vaccine also demonstrated very promising preventive and therapeutic effects on highly aggressive TA3Ha tumor model. The anti-sera after vaccinations or tumor challenges were analyzed by using microarray for the high-throughput screening of a large number of tumor associated carbohydrate antigens, or physiological related carbohydrate structures, which provide the deep insight into the mechanism and rational design of current vaccines.