# Dual-Functional Vaccine Adjuvant for Amplifying Immunity

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With the advancement of vaccine technology, the need for safe and effective adjuvants has become increasingly important. While QS-21 is a clinically established adjuvant, it alone cannot fully optimize the immune response toward a Th1-skewing profile, which is essential for protection against pathogens and cancer. Additionally, its application is further limited by the scarcity of its natural source. Phytosphingosine, a naturally occurring sphingoid base, promotes a pro-Th1 environment through innate immune signaling. In this study, we designed and synthesized a novel dual-mechanism adjuvant, MH-b, by chemically linking a QS-21 analogue with phytosphingosine to simultaneously enhance antigen presentation and promote Th1 immunity. MH-b was synthesized via a 10-step process, with its structure confirmed by NMR and HRMS. In immunological evaluations using C57BL/6 mice and an OVA antigen platform, MH-b demonstrated an excellent safety profile with no significant toxicity. ELISA results revealed that MH-b significantly enhanced OVA-specific IgG antibody production. Notably, the evaluation of cytokine levels (IFN-? and IL-4) confirmed that MH-b successfully induces a strong Th1-skewed immune response. Overall, MH-b represents a promising, controllable candidate for next-generation vaccine adjuvants, effectively inducing enhanced cellular immunity and addressing potential supply challenges.

**Awards Won:**
American Chemical Society: First Award of $4,000