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PPE Protein Epitope Platform for Next-Generation Tuberculosis Vaccines

Researchers at Stanford have pioneered a novel approach to tuberculosis (TB) vaccine development by pinpointing a novel T-cell target, a PPE protein epitope, *via* leading edge T-cell reporter assays and comprehensive peptide library screening. This technology addresses a far-reaching global health problem and holds promise in fulfilling the unmet medical needs of populations at high risk of TB.

Existing TB vaccines, such as the widely administered BCG vaccine, offer only incomplete disease protection and do not reliably prevent latent infection or disease reactivation in adults. Leveraging a highly optimized artificial antigen-presenting system with engineered Jurkat T-cell reporters, the inventors systematically identified a peptide epitope from a *Mycobacterium tuberculosis* PPE protein that is uniquely recognized by T-cells associated with natural control of TB infection in high-exposure individuals. The protein antigen and its immunodominant epitope enable the design of next-generation TB vaccines—potentially as mRNA- or peptide-based formulations—targeting robust and protective cellular immune responses overlooked by current strategies.

The inventors' technology aligns with standard vaccine development platforms, is compatible with modern delivery systems such as lipid nanoparticles, and addresses the unmet need for durable efficacy against latent and active TB in diverse populations. Vaccines based on the researchers' discovery could significantly enhance public health by effectively reducing TB transmission, morbidity, and mortality.

Stage of Development
Proof of concept – in vitro and (work in progress) in vivo data

Applications

- Development of vaccines with broad, protective efficacy against TB
- Advanced tools for quantifying T-cell responses and guiding vaccine optimization
- Immunological research and diagnostic assay development

Advantages

- Identifies a previously overlooked, naturally protective T-cell epitope associated with durable TB resistance
- Supports rational design of next-generation vaccines beyond BCG or classic subunit vaccine limitations
- Designed for flexibility with mRNA, peptide, and subunit vaccine technologies, facilitating global deployment and study

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