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Vaccine development against the Plague

■ Researcher Info

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- Collaboration： None

■ Research Ideas & Technology Seeds

■ Originality & Superiority

A novel vaccine using membrane vesicles derived from plague bacteria. No vaccine products based on this research technology have yet been commercialized anywhere in the world.

■ Vaccine Modality & Animal Model

Technology for producingmembrane vesicles from plague bacteria, along with a mouse evaluation model.

■ Key findings

Pre-immunization with plague bacterial membrane vesicles achieves protective efficacy against infection up to 1000 LD_{50}. In mouse models, it also shows extremely high preventive efficacy against pneumonic plague caused by airborne infection.

■ Background & Challenges

- Plague has an extremely high mortality rate if left untreated. The "Black Death" caused by plague bacteria in medieval Europe is historically famous, but outbreaks are still reported in Africa, Asia, and other regions. In particular, pneumonic plague poses a risk of explosive epidemics through human-to-human droplet transmission. Therefore, there is an urgent need to develop a plague vaccine that can induce mucosal immunity and prevent respiratory infections.

■ Schematic Overview

- Immunization with an outer membrane vesicle (OMV) type vaccine against plague resulted in significant antibody production in BALB/c mice. However, the antibody increase from OMV alone was not non-inferior to that from the addition of an immuno-adjuvant. Both IgG1 and IgG2a were observed in OMV-immunized mice, indicating that immunization was induced from both Th1 and Th2 cells. In both intraperitoneal administration (septicemic plague model) and intratracheal administration (pneumonic plague model), mice pre-immunized with OMV survived even when inoculated with a highly virulent strain of *Yersinia pestis*, even at 1000-LD_{50} doses, demonstrating a high level of disease prevention.

■ Future Direction, *etc.*

- Currently at the preclinical stage.
- Free-form text section: Details can be shared if requested by co-development partners, etc.
- Intellectual property status: Not acquired