Nanoparticles and microfluidics for future tuberculosis vaccines

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Stellingen
Behorende bij het proefschrift

NANOPARTICLES AND MICROFLUIDICS FOR FUTURE TUBERCULOSIS VACCINES

1. The only tuberculosis vaccine currently registered, *Mycobacterium bovis* Bacille Calmette-Guérin, is inadequate. Besides having a highly variable efficacy, it fails to prevent active pulmonary tuberculosis in adults and can cause severe side effects in immunocompromised individuals. A new and better vaccine is therefore urgently needed.

   Adapted from Chapter 2, this thesis

2. "To date, no clear immune correlates of protection against tuberculosis have been established."

   Chapter 4, this thesis

3. Nanoparticle subunit vaccine formulations offer several advantages in vaccine efficacy, but the immunogenicity is highly dependent on the physicochemical characteristics, such as size, charge, and rigidity, which are difficult to control by classical preparation methods.

   Adapted from Chapter 4, this thesis

4. Microfluidics has emerged as a promising technique to prepare nanoparticles. However, the current microfluidic devices are mainly chip-based and are often integrated into expensive systems, such as the Nanoassemblr®, that lack on-the-spot versatility. To make microfluidic systems more applicable, there is a need for a versatile, low-cost modular microfluidic system.

   Adapted from Chapter 3, this thesis

5. Upon intradermal injection of aqueous formulations, the PLGA nanoparticles induced high T-helper cell and superior cytotoxic T-cell responses in the blood and spleen, demonstrating their potential as a powerful vaccine platform.

   Adapted from Chapter 5, this thesis

6. "Vaccination is potentially one of the most effective interventions at the population level and has historically been shown to be cost-effective."

M. Drolet et al., Value in Health (2018)

7. "Microfluidics devices have potential to revolutionize a wide range of fields, including healthcare, environment monitoring, food, and agriculture, all of which enduring high-tech upsurges as a result of advancements in the field of microfluidics."

S. Shimali et al. Chapter 12, Next-Generation Smart Biosensing (2024)

8. Co-delivery of adjuvant and antigen into the same dendritic cell is crucial, as antigen delivery in the absence of adjuvant may induce immunologic tolerance.

Adapted from Y. Yan et al., Biomaterials (2024)

9. "Almost all children are vaccinated in the world today. This is amazing. It means that almost all human beings alive today have some access to basic modern healthcare. But most people don't know this. On average just 13% of people get the answer right."

Factfulness: Ten Reasons We're Wrong About the World — and Why Things are Better than You Think" (2018)— Hans Rosling

10. "Que sera, sera" (whatever will be, will be)

Doris Day

Malene Aaby Neustrup
Leiden, September 23, 2025