Weill Cornell Medicine

Bacterial RNAs as Vaccine Adjuvants

Lead Inventor:

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Bacterial RNAs as Vaccine Adjuvants

Background & Unmet Need

- Vaccines containing live, attenuated pathogens trigger stronger and longer-lasting immune responses compared to those containing killed pathogens
- Live vaccines carry potential risks to immuno-compromised individuals, as well as a more expensive and complex supply chain
- Adjuvants are compounds which increase local and systemic immune reactions to vaccines
- Current adjuvants (aluminum, oils, or salts) do not elicit the same immune response as live pathogens
- Canonical molecular patterns that alert the immune system of pathogens are present in both live and killed vaccines, suggesting an uncharacterized signal of pathogen viability to our immune system
- **Unmet Need:** Development of a non-live vaccine which elicits a robust immune response comparable to that of live vaccines

Technology Overview

- **The Technology:** Bacterial mRNAs as adjuvants to induce robust immune response in both prophylactic and therapeutic vaccines
- **The Discovery:** The inventors showed that RNA is destroyed when a pathogen is heat-killed prior to injection, and that heat-killed bacteria alone elicit poor immune response
- Addition of purified bacterial RNA to heat-killed *E. coli* (HKEC) vaccines induced strong cytokine production and increases adaptive immune response
- **PoC Data:** Compared to HKEC alone, HKEC + RNA induced higher levels of IL-1β and IFN-β in dendritic cells
- HKEC + RNA stimulated an increase of class-switched IgG antibody titers in mice ($p \leq 0.01$)
- HKEC + RNA improved both primary and memory T cell responses, as well as increased death of infected cells

Inventors:
Julie Magarian Blander
Leif Erik Sander

Patents:
US Patent 9,844,592
US Patent 10,588,964

Publications:
Sander, et al. *Nature*. 2011.
Barbet, et al. *Immunity*. 2018.

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Technology Applications

- Improved vaccine potency for humans, pets, and livestock
- Use as adjuvant for vaccines against infectious disease, cancer prevention, and cancer immunotherapies
- Can be used in live, antigen, or mRNA vaccines

Technology Advantages

- Stronger and longer-lasting immune response compared to traditional killed vaccines, without the safety risk and supply chain considerations of live vaccines
- Synthetic bacterial RNAs also elevate immune response, suggesting potential for design of even more effective RNA adjuvants

Supporting Data / Figures

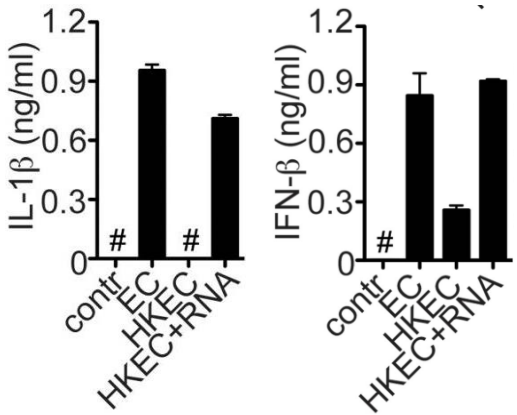

Figure 1: Dendritic cell IL-1β and IFN-β levels in response to *E. coli* (EC), heat-killed *E. coli* (HKEC), or HKEC + bacterial RNA

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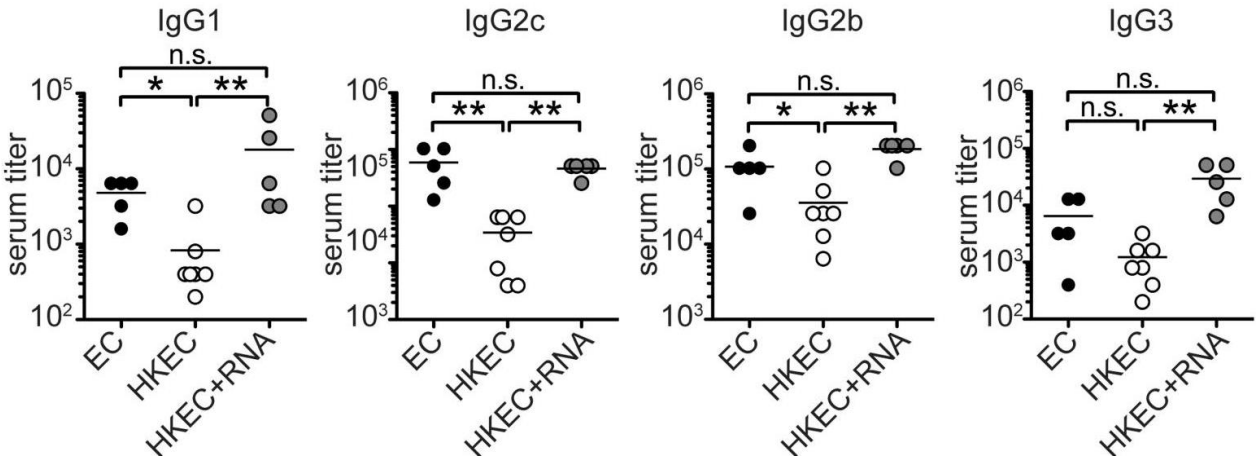

Figure 2: IgG serum titers of mice injected with *E. coli* (EC), heat-killed *E. coli* (HKEC), or HKEC + bacterial RNA.

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