Synthetic archaeosome adjuvants for improved vaccine formulation (L-11784)

Highlights

Vaccine adjuvants are immune stimulating compounds that, when combined with antigens, enhance the magnitude, the quality and/or the duration of immune responses. Though adjuvants play a central role in vaccination, few non-toxic adjuvants are currently available to vaccine developers. Alum is the leading approved adjuvant for human use, yet it fails to facilitate strong cell-mediated immune responses necessary for tackling evasive and/or chronic pathogens. Also, no single approach currently targets both vaccine delivery (formulation that delivers the antigen cargo to the immune cells) and immunomodulation (sufficient stimulation of the antigen-specific immune cells), both needed for an effective vaccination strategy.

To address this need, the NRC has developed synthetic archaeal lipids for the production of well-defined, tailor-made, non-toxic and thermo-stable adjuvants that can be can combined with a wide range of antigens. The NRC's synthetic archaeosomes have both immuno-modulating and antigen-delivery adjuvant properties. They can be customized to evoke specific immune responses that are long and durable.

Technology transfer

- Commercial exploitation licence
- R&D agreement for development

Market applications

- Adjuvants for vaccines against infectious diseases or cancer
- Adjuvants for dose-sparing

How it works

The stability of an archaeal core lipid (archaeol) is used as the lipid precursor to synthesize a series of glyco-archaeols. Liposomes carrying the antigen cargo are made with these stable semi-synthetic lipid immuno-modulators. Archaeal synthetic lipid mimetics, not limited to those found naturally in *Archaea*, are screened to optimize the carrier/adjuvant effect desired.

The archaeol lipid core was first obtained from *Halobacterium salinarum*, chosen because this easily grown archaeon has only one core lipid: fully saturated archaeol. Upon head group removal, the mixture of natural polar lipids is converted to archaeol that is easily recovered in high yields and serves as a chemically stable precursor for synthesis. This approach preserves all of the desired archaeal lipid features.

All processes used are readily scalable to industrial quantities and pharmaceutical purities.

Synthetic archaeal lipids are mixed in the proportion desired and hydrated to form 100-nm diameter vesicles with the active ingredient attached or entrapped within the vesicles. Mouse trials have shown strong antibody and cytotoxic T lymphocyte responses to peptide and protein antigens and protection in model systems of infection and cancer.

Benefits

- Easy-to-apply semi-synthetic approach for deriving well-defined, tailor-made adjuvants
- Can be used with a wide range of antigens
- Promotes long-term immunity with few injections and evokes minimal inflammatory side effects in pre-clinical models
- Readily scalable to industrial quantities and pharmaceutical purities

Patents

NRC file 11784: Patent issued in Canada, pending in the United States, Europe, and Hong Kong.

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