Bacterial Delivery of Vaccine Antigens “UPTOP”

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Vaccines - a “Shot in the Arm” for Pharma

Vaccines are catching up with prescription drugs as the most lucrative segment of the pharmaceutical business, as more biotech and drug firms invest in vaccine development.

- **Vaccines become more attractive to drug developers**
- **Prevnar (Wyeth):** $2.7 billion*
- **Gardasil (Merck):** $2.3 billion*

* 2008 sales

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“Blockbuster Vaccines”

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Live Bacteria Vaccines

- Stimulates mucosal immunity
- Easy administration (orally, nasally)
- Favorable manufacturing and formulation
- *Lactococcus lactis* - GRAS status
- Amenable to genetic manipulation

Needed: Antigen Presentation Technology
Antigen Presentation

Unhindered Presentation on Tips Of Pili (UPTOP)

Bacteria pili

Gram⁺ bacteria

Peptidoglycan cell wall

MBP expressed on tips of pili

Protein on pilus tip

Immunogold-EM

Gateway to Discovery, Innovation, and Products
Mucosal Immunization
Proof-of-Principle

Gateway to Discovery, Innovation, and Products
Market

- Increase in global vaccine sales ($19 billion in 2008 to $39 billion in 2014)*
- Absence of generic competition
- *L. lactis* vaccine suitable for use worldwide
- Additional acceptance by the investment community needed

Intellectual Property

• “Methods & Compositions for Display of Polypeptides on the Pili of Gram-Positive Bacteria”
  – PCT pending (filed 5/8/09)
Future Plans

• Proof-of-principle for *L. lactis* vaccine against infectious agent
  – RSV (UGA collaboration)
  – Influenza (STTR submitted)
  – HIV (NIDCR oral vaccine program submission)

• Address environmental safety
  – Containment strategies
  – Re-engineering of genetic modifications

• Explore suitability of technology platform for a start-up company
UPTOP Vaccine Advantages

• Induces both mucosal and systemic immune responses
• Manufacturing and material handing benefits
• Antigen flexibility
• Probiotic delivery