



TECHNOLOGY

Multivalent Vaccine Against Staphylococcus Aureus

OVERVIEW

There are nearly 2 million healthcare-associated infections in the U.S. per year, according to CDC-reported statistics. Many of these infections are due to colonization of implantable medical devices with drug-resistant forms of bacteria such as methicillin-resistant Staphylococcus aureus (MRSA). The increasing incidence, morbidity and mortality attributable to bacterial biofilm-mediated infections, often untreatable with conventional antibiotics, makes the search for effective vaccines ever more important. A number of attempts at MRSA vaccine development have been made, all with limited success, which may be due to the focus of other programs on antigens that are highly expressed in a free-floating mode of growth. Such an approach ignores the significant period of time the bacteria spend in a biofilm mode of growth, along with the phenotypic heterogeneity of sessile *S. aureus* cells within a biofilm. Researchers at the University of Maryland, Baltimore have previously shown that a novel quadrivalent vaccine based on *S. aureus* biofilm antigens is effective at clearing infections in the rabbit osteomyelitis model, when used in combination with antibiotic treatment, whereas vaccine or antibiotic treatment alone was not (Brady et al., *Infect. Immun.*, 2011; 79(4):1797). The UMB inventors have further developed a uniquely effective pentavalent vaccine, consisting of four selected antigens expressed when the organism exists as a biofilm, plus one additional antigen expressed when *S. aureus* is in its free-floating form. In a murine model of bone implant infection, only this pentavalent vaccine was able to achieve complete clearance of MRSA, which has not been achieved by any other vaccine to date. (MS-2008-085 & MS-2012-065)

APPLICATIONS

In addition to causing thousands of deaths every year, *S. aureus* infections impose a huge burden on healthcare. Recent studies by the CDC suggest that the annual cost of treating *S. aureus* infections is in excess of \$5 billion in the U.S. alone. A recent study shows that, even at a 5% MRSA prevalence rate, a \$500 vaccine is cost effective if the vaccine has 70% effectiveness. At higher prevalence and effectiveness rates, a vaccine can be economically dominant (Lee et al., *Vaccine*, 2010 Mar; 28(12):2465). It is estimated that nearly five million Americans annually have some sort of medical device implanted. Pacemakers, artificial heart valves, catheters, replacement hip joints, bone cement and many other surgical implants are examples of devices prone to biofilm development. The target market for a MRSA vaccine and diagnostics is not limited to patients diagnosed with a MRSA infection. Patients about to undergo device implant surgery can be given the vaccine prophylactically and reliable tests for infection are needed prior to and after surgery.

ADVANTAGES

- Pentavalent vaccine targets all forms of Staphylococcus infections, and has shown 100% clearance in mouse models.
- A highly effective vaccine eliminates need for expensive adjunctive antimicrobial therapy.
- The UMB inventors have also developed (i) a diagnostic assay, and (ii) a detection screen for in vivo localization of infection that are highly advantageous companion technologies for clinical development of the multivalent vaccine

STAGE OF DEVELOPMENT

The multivalent vaccine has been optimized and proven effective at clearing MRSA infection in animal models.

R&D REQUIRED

Strategic pre-clinical studies prior to clinical trials.

LICENSING POTENTIAL

UMB seeks to develop and commercialize by licensing and/or sponsored research with a company active in the area.

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Additional Information

INSTITUTION

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PATENT STATUS

US Patent 9,265,820 (iss'd 2016) & US Patent RE48,137 E (iss'd 2020)

LICENSE STATUS

Available

CATEGORIES

- Therapeutics
- Vaccines

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EXTERNAL RESOURCES

- [Resolution of Staphylococcus aureus biofilm infection using vaccination and antibiotic treatment.](#)
- [Vaccine development in Staphylococcus aureus: taking the biofilm phenotype into consideration.](#)
- [Osteomyelitis and the role of biofilms in chronic infection.](#)
- [Staphylococcus aureus vaccine for orthopedic patients: an economic model and analysis.](#)

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