Fundamental research into the bacterium *Staphylococcus aureus* led to the creation of spinout company Absynth Biologics\(^1\). The company is now working to produce a vaccine against the bacterium, including methicillin-resistant *S. aureus*, or MRSA.

Absynth Biologics, founded in 2007 by Professor Simon Foster\(^2\) and Dr Jorge Garcia-Lara from the University of Sheffield, has identified two promising protein targets for use in vaccines against *S. aureus*. The company aims to start preclinical development in the next few years.

“We had a finite number of targets, of which we’ve tested a number. We now have several lead targets, which are the basis of what Absynth is doing at the moment in terms of the *S. aureus* vaccine,” says Foster.

Much of Foster’s fundamental bioscience research, which led to the formation of Absynth Biologics, was funded by BBSRC. The MRC subsequently provided significant funding enabling Foster to study the interaction between *S. aureus* and humans, particularly how natural human defence mechanisms can be exploited to combat the bacterium’s drug-resistance, and to develop the vaccine. Absynth has also obtained funding from the Technology Strategy Board\(^3\). Funded through the Biomedical Catalyst, these awards will help to take forward the vaccine to a pre-clinical stage.

The company is currently in a funding round with investors, which, if successful, will enable Absynth to grow and move to the next stage of product development.

**The superbug**

*S. aureus* causes a wide range of infections, including septicaemia, endocarditis and wound abscesses. It is often resistant to antibiotics and one particular strain, methicillin-resistant *S. aureus* (MRSA), is the ‘superbug’ responsible for many hospital deaths.

It is a commensal organism, meaning that it lives alongside us all the time, and around one third of people carry it up their noses without suffering ill effects. Infections only occur when the bacteria are able to invade the body, for instance during a surgical procedure. In 2011 *S. aureus* was directly linked to 638 deaths in England and Wales, and MRSA killed 364 people in the same year\(^4\). MRSA was estimated to have killed over 11,400 people in the USA in 2010\(^5\), and has led to many more infections and deaths around the world.

Antibiotics have been the conventional treatment for bacterial infection for 60 years. However antibiotic resistance is becoming a pressing concern\(^6\). Although some new antibiotics are being developed, it is likely that over time, a similar pattern of resistance will develop and so alternative strategies will be essential. One alternative is to generate protective immunity through vaccination.

A vaccine could help protect people in situations where they are most vulnerable to *S. aureus* and MRSA infections, particularly during elective surgeries such as knee, hip or heart valve replacements, reducing healthcare costs. It could also be used to vaccinate some groups against the threat of ‘community-associated’ MRSA (ie an MRSA infection not associated with a medical setting); this includes people in care homes and prisons as well as the armed forces and hospital staff.

Impact summary

BBSRC and MRC-funded research contributed to the creation of spinout company Absynth Biologics by Professor Simon Foster and Dr Jorge Garcia-Lara from the University of Sheffield.

The company is developing vaccines against *S. aureus* and MRSA infection, and aims to enter preclinical development within three years.

The company also received further funding from the MRC and Technology Strategy Board via the Biomedical Catalyst to take forward the vaccine to a pre-clinical stage.
Ground-breaking research

Absynth Biologics arose from Foster’s research into S. aureus. In particular, Foster’s group had been studying genes in S. aureus that are essential to its survival, with support from BBSRC’s Exploiting Genomics initiative; Garcia-Lara was the senior researcher on the grant.

The researchers used a genomics approach to identify over 200 potential essential genes in S. aureus. Several of the proteins encoded by these genes were associated with the cell membrane, but with loops or domains predicted to be on the outside, which could make suitable vaccine targets. However, the prevailing view was that these proteins were protected by the bacteria’s impermeable cell wall so were unlikely to stimulate an immune response. Foster disagreed. “We had done a lot of work on cell wall structure and architecture over the years, and we knew the cell wall wasn’t quite as impermeable as people might have thought.”

With Follow-on funding from BBSRC in 2006, the team demonstrated that they could protect against S. aureus infection by vaccinating with a peptide derived from a loop of membrane protein, giving them a number of potential new vaccine targets. In particular, they focused on developing vaccines against proteins essential for the existence of S. aureus and its ability to cause disease. “The problem with many of the surface proteins is the bacteria alter them, or can do without them, so there is a lot of variability,” says Foster. Absynth Biologics’ initial funding enabled them to spend two years collecting more data. The researchers subsequently established a collaboration and license agreement with German company MorphoSys in 2010. Subsequent funding from the MRC in 2011 allowed Professor Foster to test combinations of the vaccine targets and identify the most effective formulation for protection against S. aureus.

In 2012, Absynth received a feasibility award through the Biomedical Catalyst, a translational research programme run by the MRC and the Technology Strategy Board to begin development of a vaccine. Following that, in 2013 Absynth received more than £2m from the Technology Strategy Board and the MRC, again through the Biomedical Catalyst and part-administered through the MRC’s Developmental Pathway Funding Scheme (DPFS), to continue this work.

Notes and references

1. See: [Reference/webpage no longer available – August 2016]
2. See: [Reference/webpage no longer available – July 2016]
3. £1,552,975 to Absynth and £460,731 to University of Sheffield for “Staphylococcus aureus Infections - Development of A Novel, Effective Vaccine”
5. See: http://www.cdc.gov/abcs/reports-findings/surveysreports/mrsa10.html
7. See: [Reference/webpage no longer available – October 2016]
8. Biomedical Catalyst: https://www.innovateuk.org/-/biomedical-catalyst#