Research Programme

Meningitis UK's focus is to develop a vaccine to eradicate all forms of meningitis and associated diseases through research based exclusively in the UK. Established Research Groups at Institutions across the country are invited to apply for Grant Aid on an annual basis.

Since the charity's inception in 1999, Meningitis UK has invested over £2 million into meningitis research. Our Scientific Medical Advisory Panel, made up of top scientists within the field, use their expertise to assess applications for funding and provide advice on policy and strategy.

Meningitis UK is also a member of the Association of Medical Research Charities (AMRC) - the leading umbrella organisation representing medical research charities. We are also a member of the Confederation of Meningitis Organisations, which consists of over 20 member organisations worldwide and provides an excellent opportunity to learn and share best practices.

Current Research Projects

Here is an outline of our current research projects,which are in need of funds:

Identification of meningococcal antigens associated with development of cross-reactive immunity following colonisation and infection

January 2008 to January 2010 - Professor John Heckels, University of Southampton

Research Assistant Jenny Williams, Prof. John Heckels and Dr Myron Christodoulides

Scientists currently believe that the best way to develop a vaccine against Meningitis B is to focus on finding antigens - or tiny protein molecules - which sit on the outer surface of the meningitis bacteria and can be thought of as the bug's Achilles heel. In other projects we have already found antigens which induce an immune response against particular sub-strains of Meningitis B, but we need to find antigens which react to every single sub-strain of the disease if we are going to develop a vaccine which truly protects us. Our latest research therefore concentrates on identifying and analysing the lesser-known antigens which may enable us to fill in those vital gaps.

To do this we are working with Professor John Heckels at the University of Southampton, where he and his team have gathered a unique collection of blood samples taken from individuals before and after they naturally became carriers of the Meningitis B Bacteria. These 'before and after' samples give us vital insight into how the body naturally reacts when it comes into contact with the meningitis B bacteria, and which antigens are most important in causing the body to produce protective antibodies.

We are now planning to compare the 'before and after' samples to see which antigens are most popular, and which ones recur most frequently across all the sub-strains of Meningitis B bacteria. Once we have identified the top 20 antigens, we will look at them in greater depth and assess how they react when they come into contact with the different sub-strains of Meningitis B. By doing this, we hope to identify at least two or three antigens which cause a protective reaction when they encounter a range of Meningitis B sub-strains, and which may therefore provide an important step forward in the generation of cross-protective immunity against the entire Meningitis B family.

Total cost £117,627

Microserological determination of cross-protective meningococcal immunity following colonisation and infection

January 2008 to January 2010 - Dr Nigel Saunders, University of Oxford

As we get closer and closer to finding a vaccine, Meningitis UK is encouraging research centres to collaborate in order to accelerate the search. Professor Heckels has therefore kindly agreed to allow Dr Nigel Saunders at the University of Oxford to use his 'before and after' blood samples (see above) and in this project we will use these valuable samples in combination with cutting-edge technology which has recently been developed in Oxford.

Dr Richard Capper, Postdoctoral Research Assistant, Dr Ray Owens, Collaborator and Head of the Oxford Protein Production Facility, and Dr Nigel Saunders, Lead Investigator

Dr Richard Capper working with one of the two highly-sensitive protein array printers in Dr Saunders' laboratories

Currently, we know of many hundreds of antigens which exist on the outer coat of the Meningitis B bacteria, but up until now technological limitations have meant that we could only detect the antigens which appear in large quantities. However, Dr Saunders has developed a new technique to analyse blood samples which is 10,000 times more sensitive than existing methods and can delve deeper into samples, allowing the team to identify antibodies and antigens which appear in only trace quantities.

Dr Saunders has identified 100 antigens which are known to exist on the outer capsule of the Meningitis B bacteria, but which have - so far - not been detected during research trials. Using the Southampton blood samples, Dr Saunders will expose each of the 'before' and 'after' samples to each of the 100 antigens one-by-one, and measure the antibodies which are created during this interaction in order to assess their importance.

This innovative collaboration will allow Dr Saunders to identify whether any of the previously undetected antigens can generate cross-protective immunity against Meningitis B, and he may even discover that one or more of these 100 antigens is a vital missing ingredient in the final Meningitis B vaccine. Furthermore, this study will also assess the value of Dr Saunders' new technique, which could provide a cutting-edge method that can be adopted in laboratories throughout the UK, adding extra insight into many hundreds of research studies.

Total cost £156,512

Vaccine potential of meningococcal secreted proteins

January 2008 to January 2010 - Dr Karl Wooldridge, The University of Nottingham

The vast majority of known antigens live on the outer capsule of the Meningitis B bacteria, but researchers also believe that there may be other sources of antigens which have not yet been fully explored. One such theory is being explored at the University of Nottingham, where Dr Karl Wooldridge is looking at the tiny proteins which the Meningitis B bacterium secretes throughout its life. His team have proven that a number of these Meningococcal Secreted Proteins (MSPs) collect on the surface of the meningitis bacteria where they can be targeted by antibodies, so they could prove to be effective vaccine candidates.

Dr Karl Wooldridge in the laboratory

Preliminary experiments have shown that some MSPs not only provide immunity against the sub-strain of Meningitis B which they are secreted from but, promisingly, can also generate antibodies that kill other sub-strains of Meningitis B and they may therefore generate cross-protective immunity.

In order to fully investigate the vaccine potential of MSPs, Dr Wooldridge must now examine each of the main MSPs in greater detail by putting them through rigorous tests. To do this most accurately and effectively, Dr Wooldridge is collaborating with Professor Tang of Imperial College London, where they have extensive experience of this type of work, and are experts in looking at blood samples to detect antibodies and antigens.

We hope that this study will allow us to identify three MSPs which have the greatest potential to cause cross-protective immunity to Meningitis B, and this shortlist of candidate MSPs will be examined further for their ability to protect us.

Total cost £148,726

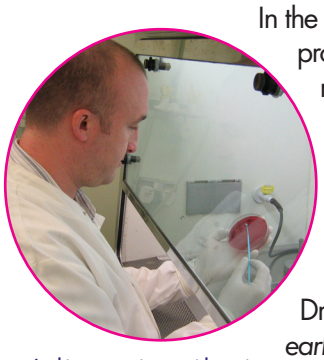
A protein vaccine against serogroup B meningococcal disease: from first proof in principle to phase I clinical trials

September 2007 to September 2009 - Dr Andrew Pollard , University of Oxford

Dr Andrew Pollard, Senior Lecturer in Infectious Diseases & Honorary Consultant Paediatrician at the University of Oxford

After the great success of their recent study into the development of a Meningitis B vaccine, Dr Pollard and his colleagues aim to progress their research in this project, to find a suitable vaccine to protect against the most prevalent strain of meningococcal bacteria currently in the UK - Group B.

Previous investigations into creating a Meningitis B vaccine have included the use of protein molecules which can be found on the outer surface of the meningococcal bacteria, but unfortunately, these studies have been hampered as the molecules vary between the different families of the Meningitis B bacteria. Dr Pollard, and his co-workers have however identified one protein which has limited variability within the families, suggesting that this protein might be a good vaccine candidate.



Looking at meningococci bacteria growing on an agar plate in Dr Pollard's laboratories

In the last study funded by Meningitis UK, the team were able to manufacture these proteins and although challenges had to be overcome in this process, they have now produced the proteins which can stimulate the production of antibodies against them, and which kill serogroup B meningococci. This is an important advancement in the development of a vaccine, as a successful vaccine candidate is thought to have to stimulate the production of antibodies that kill the bacteria. In addition to evaluating the suitability of this protein in creating a vaccine, important questions on how these proteins affect our immune cells can also be addressed.

Dr Pollard said: "*Human trials could take place in around three years. If all the testing goes well in these early trials in adults, it would still take some years to complete large scale studies in children to show that the vaccine could be used*"

Total cost £105,941

Mechanisms of mucosal immunity to systemic immunisation with a meningococcal serogroup B outer membrane vesicle vaccine

January 2007 to July 2010 - Professor Robert Heyderman, University of Bristol

Professor Heyderman and his team are studying people's natural immunity to meningitis-causing bacteria. They hope that by understanding this, they will then be able to mimic the body's natural response to make a successful vaccine against Meningitis B.

The success of existing vaccines, for example the one which protects against Meningitis C, is in part due to their ability to produce 'herd immunity', so even people who have not received the vaccine are protected because carriage rates are reduced across the whole population.

Professor Heyderman's team believe that a successful Meningitis B vaccine not only needs to stop the harmful bacteria invading the body but also to reduce the carriage rates of the bacteria which normally live harmlessly in our noses and throats.

Professor Heyderman and his team will be looking specifically at mucosal immunity as it is this naturally acquired immunity which is believed to reduce carriage rates by preventing the bacteria from living in people's noses and throats. Through this research they hope to develop a vaccine which not only protects individuals from Meningitis B - but whole communities.

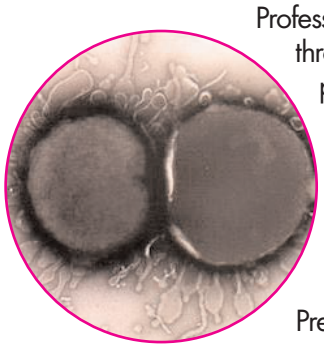
Professor Robert Heyderman (back left) with his co-researcher Professor Neil Williams (back right), along with other staff at the laboratories

Total cost £200,000

Human immune response to experimental colonisation with *Neisseria Lactamica*

October 2006 to October 2008 - Professor Robert Read, University of Sheffield

Professor Robert Read and his team are looking at how harmless bacteria which live in the noses and throats of babies and young children might help the immune system to develop antibodies to protect against Meningitis B.



The Neisseria lactamica bacteria, which is a harmless relative of the meningitis-causing Neisseria meningitides bacteria

At any one time, the majority of the population is naturally immune to the meningitis-causing bacteria *Neisseria Meningitidis*, with one in 10 of us having it living harmlessly in our noses and throats. This natural immunity is thought to be thanks to a harmless relative of *Neisseria meningitidis*, *Neisseria Lactamica* which also colonise in people's noses and throats.

Cariad Evans, Clinical Research Fellow in the laboratory at the University of Sheffield

Previous studies suggest that a high prevalence of *Neisseria Lactamica* is associated with a low incidence of meningococcal disease. Professor Read's team are going to inoculate *Neisseria Lactamica* into the noses of healthy adults and then measure their immune response.

Although Professor Read thinks *Neisseria Lactamica* is unlikely to be a vaccine candidate on its own, he and his team are confident that what they learn about how it stimulates the body's immune response will be invaluable in the searchfor a successful vaccine.

Total cost £205,062

Developing new techniques to assess the nature and duration of protection immunity to pneumococcus after vaccination

November 2005 to October 2008 - Dr Helen Baxendale, Institute of Child Health, London

Dr Baxendale and her team are developing new techniques to measure how effective existing meningitis vaccines are, as well as how effective new vaccines might be.

In order to do this, Dr Baxendale's team are looking specifically at the new pneumococcal vaccine which was introduced into the Childhood Immunisation Programme across the UK in 2006. While the vaccine is known to protect young children from pneumococcal disease including pneumococcal meningitis - a very deadly form of the disease - it is not known exactly how long this immunisation lasts.

Dr Helen Baxendale, Clinician Scientist of Infectious Diseases,Institute of Child Health,London

By developing new laboratory techniques, Dr Baxendale and her team will measure how a person's immune system responds over time to pneumococcal bacteria following immunisation by refining the technology used to analyse blood samples from children and adults. This will enable them to measure the duration of effective immunity and to understand why in rare cases immunisation may fail to protect someone from pneumococcal disease.

This information will enable better, longer lasting vaccines to be developed.

Total cost £99,989

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