Brian Greenwood

PERSONAL PARTICULARS

Date of birth: 11.11.38 Manchester, England.

Married: Two children.

EDUCATION

1952 - 56 St. Edward's School, Oxford, UK.
1956 - 59 King's College, Cambridge, UK.
1959 - 62 Middlesex Hospital Medical School, London, UK.

DEGREES AND DIPLOMAS

1959 BA (Cantab.) Natural Science Class 1.
1962 MA (Cantab.); MB, BChir (Cantab.) Distinction.
1965 MRCP (London).
1969 MD (Cantab.); DTM and H (Liverpool).
1977 FRCP (Fellow of the Royal College of Physicians, London).
1980 FWACP (Fellow of the West African College of Physicians).
1994 FFPHM (Fellow of the Faculty of Public Health Medicine, UK).
1998 FRS (Fellow of the Royal Society, London).
1998 FIBiol (Fellow of the Institute of Biology, UK).
1999 FMedSc (Fellow of the Academy of Medical Sciences, UK).

HONOURS AND ACADEMIC PRIZES

1959 Open Scholarship (King's College, Cambridge).
1962 Senior Broderip Scholarship (Middlesex Hospital).
1969 Yorke Medal in Tropical Medicine (Liverpool School of Tropical Medicine).
1977 Chalmers Prize (Royal Society of Tropical Medicine and Hygiene).
1978 Toosey Prize (Liverpool School of Tropical Medicine).
1982 Murgatroyd Prize (Royal College of Physicians of London).
1987 CBE.
1991 McKay Prize (American Society of Tropical Medicine and Hygiene).
1995 Adesuyi Prize (West African Health Community).
2001 Manson Medal (Royal Society of Tropical Medicine and Hygiene, London).
2004 Robert Austrian Prize for contributions to the study of pneumococcal disease

APPOINTMENTS

1962-65 House officer appointments at the Middlesex, Central Middlesex, Brompton and Hammersmith Hospitals, London, UK.
1965-67 Medical Registrar and Arthritis and Rheumatism Council Research Fellow, Department of Medicine, University College Hospital, Ibadan, Nigeria.
1968-70 Wellcome Trust Research Fellow, MRC Rheumatism Research Unit, Canadian Red Cross Memorial Hospital, Taplow, UK and Department of Immunology, Middlesex Hospital, London.
1970-78 Senior Lecturer in Medicine, Ahmadu Bello University Zaria, Nigeria (MRC External staff from 1972).

1979	Acting Head of the Department of Medicine and Psychiatry, Ahmadu Bello University, Zaria, Nigeria.
1980-95	Director of the Medical Research Council Laboratories, The Gambia.
1996-98	Professor of Communicable Diseases, London School of Hygiene & Tropical Medicine, London, UK.
1998-	Manson Professor of Clinical Tropical Medicine, London School of Hygiene & Tropical Medicine, London, UK. Director of the Malaria Centre, London School of Hygiene & Tropical Medicine (until 2006). Director of the Gates Malaria Partnership.

CLINICAL WORK

My initial clinical training was in adult medicine and I rotated through house officer and senior house officer appointments in London teaching hospitals before moving to Nigeria in 1965. At Ibadan, Nigeria I progressed rapidly from medical registrar to physician in charge of a medical ward following the collapse of the UCH clinical services as a result of the Nigerian civil war. On my return to Nigeria, after further training in the UK, I was a senior lecturer in charge of one of the adult medical wards of Ahmadu Bello University Teaching Hospital, Zaria but, as my research interests in malaria and meningitis developed, I became involved increasingly in the clinical care of children. In The Gambia I held a weekly out-patient clinic for both adults and children and I took my turn on the out-of-hours emergency rota throughout my 15 years in the country.

RESEARCH

The research described in the following sections has been undertaken in collaboration with many colleagues, too numerous to mention individually, but whose names are reflected in my publications. My participation in the research described below has varied from being principal investigator to advisor. However, in all the studies described below I have played a significant role.

Malaria

Despite the difficulties posed by the Nigerian civil war, I was able to undertake some research during my three years at Ibadan. Having previously undertaken a residency in rheumatology at the Hammersmith Hospital, London, I developed an interest in the pattern of joint disease in the tropics, a subject about which little was then known, and this was the topic for my MD. This included description of a syndrome prevalent in some parts of the tropics of uncertain aetiology, now usually called acute tropical polyarthritis. I found that Still's disease was as common in Nigerian as in European children but that adult rheumatoid arthritis and other autoimmune diseases such as systemic lupus erythematosus (SLE) were not, despite the fact that these conditions are common in Americans and West Indians of African descent. I suggested that infections prevalent in the tropics, particularly malaria, might modulate the immune system in some way that has an impact on the pathogenesis of other diseases, an idea that has recently resurfaced in a variant form as the 'hygiene hypothesis' which postulates the beneficial effect of parasitic infections on immune mediated non-infectious diseases. During my training in clinical immunology in the UK, I provided some evidence for the malaria hypothesis by demonstrating that malaria infection prevents an SLE-like autoimmune disease in experimental animals. These experiments awakened my interest in malaria, an area of research that I have pursued throughout my career.

On my return to Nigeria, I demonstrated that malaria does have a marked effect on the overall response of the immune system by showing a decreased antibody response to vaccination in children with malaria. It has been shown subsequently in The Gambia and in Kenya that severe malaria predisposes to septicaemia, especially with non-typhoidal salmonella infections. In addition to causing suppression of the immune system during acute infections, malaria can, in some subjects, over-stimulate the immune system causing massive increases in serum immunoglobulin M and enlargement of the spleen, a condition known as the tropical splenomegaly or hyper-reactive malaria splenomegaly syndrome. At Zaria, we showed that this condition is associated with the production of large amounts of immune complexes and that in West Africa it is seen predominantly in people belonging to the Fula ethnic group, suggesting a genetic element in susceptibility to this condition. Subsequent studies by other research groups in Mali and Burkina Faso have shown that members of this ethnic group are partially protected against malaria, although in some cases producing an exaggerated immune response to the

infection, and that this protection probably has a genetic origin. This study encouraged my interest in the genetics of malaria.

On moving to The Gambia, I established a large case control study to try to identify the environmental and host genetic factors that determine why only a small proportion (around 1-2%) of African children infected with malaria develop severe disease as opposed to an uncomplicated infection. This showed that genetic factors are very important. In addition to the well known protective effect of haemoglobin AS and alpha-thalassaemia, an HLA class 1 association was shown suggesting that cytotoxic T cells are involved in protection against infected liver cells expressing HLA class 1 antigens. Environmental risk factors appeared to be less important than genetic ones in determining disease severity.

In the Gambia, I contributed to a number of studies on the pathogenesis of severe malaria including investigations which showed an association between the ability of a parasite to form rosettes with uninfected red blood cells and severe disease suggesting that this, or related mechanisms, are involved in the pathogenesis of severe disease. I also initiated studies which showed that malaria parasites can induce production of inflammatory type cytokines, such as tumor necrosis factor (TNF), and that high TNF concentrations are associated with a poor disease outcome. This finding led to clinical trials of an anti-TNF monoclonal antibody, one of the first studies of this kind. The monoclonal antibody reduced fever but, unfortunately, did not reduce mortality in children with severe malaria.

At the Farafenni field station, I developed the 'treatment re-infection' study design in which children are cleared of malaria infection by treatment, base line measurements made and these related to the subsequent rate of malaria infection. The initial study undertaken using this approach showed that protection against re-infection was related to the presence of antibodies to an antigen on the surface of malaria infected red blood cells that plays a key role in cytoadherence of parasite infected red blood cells to endothelial cells and thus in the pathogenesis of severe malaria. This antigen was subsequently found by others to be a highly variant antigen, now known as PfEMP1, which plays a key part in immunity to malaria. The 'treatment re-infection' design has subsequently been used many times by other research groups to investigate the potential protective role of various immune factors to malaria and it was used also by colleagues in The Gambia to establish the role of antibodies in protection against schistosomiasis.

In The Gambia, studies of the pathogenesis and immunology of malaria were frequently linked to trials of new forms of malaria treatment. The most important of these were trials of artemisinin based drugs, at that time little known or used in Africa. One of these studies involved a trial of artesunate versus quinine in children with severe disease studied in a factorial design with an antibody against TNF as described above, one of the first examples of the use of a factorial design in a malaria treatment trial. I also initiated one of the first two clinical trials of benflumetol/lumefantrine, then known as CPG 56697 but now known as Co-Artem and currently one of the most widely used anti-malarial drug combinations in Africa.

In The Gambia, I initiated several studies aimed at preventing malaria in African children. At the Farafenni field station, I set up a large trial of the effects of chemoprophylaxis with Maloprim ^{R} (daspsone + pyrimethamine) given to children under the age of five years by community volunteers during the relatively short Gambian malaria transmission season. This had a dramatic effect on malaria and even more remarkably reduced overall child mortality by approximately by over 30% Delivery was sustained for many years in about one half of the study villages. However, for many years after this trial, this approach to malaria control was neglected because of concerns about the impact of chemoprophylaxis on the development of natural immunity to malaria and on drug resistance. However, in recent years interest chemoprevention has had a resurgence following work by others in Tanzania which showed that anti-malarial treatment given with routine EPI vaccines (intermittent preventive treatment of infants) (IPTi) reduced the incidence of malaria and anaemia markedly in the first year of life. This finding has been followed up with a series of studies co-ordinated by the IPTi consortium, which I helped to establish and which has been generously funded by the Bill and Melinda Gates Foundation. These studies have investigated efficacy using different drugs, safety, cost effectiveness and the acceptability of this approach to malaria control. I have participated directly as an investigator in trials of IPTi in Ghana and Tanzania. A more direct follow-on to the chemoprophylaxis studies in The Gambia has been the application of the IPT principle to older children in areas where malaria transmission is seasonal such as the countries of the Sahel and sub-Sahel which comprise about half the population of tropical Africa. Studies undertaken with colleagues in Senegal have shown a dramatic reduction (approximately 90%) in the incidence of malaria in children under the age of five years given antimalarials on three occasions a month apart during the period of peak malaria transmission.

Similar encouraging results have been obtained in Ghana. This approach to malaria control is now being followed up with large-scale implementation studies. I have also participated in a number of trials which have investigated the role of chemoprophylaxis and intermittent preventive treatment in pregnancy.

A striking difference between villages in Gambia and those in which I worked in northern Nigeria is that bednets (mosquito nets) are used much more frequently in The Gambia than in Nigeria. Recognition of this difference led me to undertake an observational study of the impact of nets on the incidence of malaria, something that had not been studied formally before. This suggested a protective effect and so I initiated a community randomised trial which showed that untreated nets gave about 30% protection against clinical attacks of malaria. At about the time of this study, the first reports were emerging of the protective effect of nets treated with insecticide (ITNs) when used in an experimental setting. Thus, I initiated the first clinical trials of ITNs, initially on a modest size and then in a large community randomised trial which showed that ITNs gave a remarkable 37% reduction in overall mortality in Gambian children. This trial had economic and sociological components and was one of the first to adopt a comprehensive approach to the evaluation of a new malaria control intervention. The results of these efficacy trials led to the establishment of a national ITN programme which also showed a significant, although less marked, reduction on overall child mortality. The results of the Gambian studies played a key role in the adoption of ITNs as one of the primary tools for the control of malaria in Africa and elsewhere.

Final control of malaria in Africa may require an effective vaccine. Thus, when reports emerged from Colombia of successful trials of a malaria vaccine in that country I established contact with the vaccine's developer and persuaded him to allow a trial of his vaccine (SPf66) in The Gambia. Unfortunately, the UK MRC was initially reluctant to support such a trial and the first trial of this vaccine in Africa was undertaken by others in Ifakara, Tanzania where it showed a modest protective effect. However, when a trial was done shortly afterwards in The Gambia no protection was found. A second trial done in Tanzania also failed to show protection. These results were disappointing but these trials provided valuable experience in learning how to conduct a malaria vaccine trial in Africa, experience that was subsequently put into use in the conduct of the first trial in Africa of the RTS,S vaccine developed by the Walter Reed Army Hospital and GlasxoSmithKline. This trial showed significant, although short-term, protection in Gambian adults vaccinated with RTS,S, an effect subsequently confirmed by others in trials done in children in Mozambique. I am currently assisting with phase 2 trials of this vaccine in Tanzania and Ghana. If these and other related trials are successful, a large phase 3 registration trial of this vaccine will be conducted in about 10 sites across Africa in 2008. During the past few years, I have collaborated also with scientists at Oxford University who are using a different approach to malaria vaccination based on the prime boost approach with viral vectored vaccines. I have participated in trials of these vaccines in The Gambia, including a study of a novel trial design using PCR. Unfortunately, these vaccines have so far proved unsuccessful in the field although giving encouraging results in volunteers.

African trypanosomiasis (Sleeping sickness)

At the time when I worked in northern Nigeria, cases of sleeping sickness were still seen from time to time although the incidence of the disease was declining for reasons that are still not fully understood. Each year, with clinical colleagues, I took medical students to a research centre at Gboko, an area in central Nigeria where sleeping sickness was still endemic. Here we undertook research as well as training students in the diagnosis and management of this condition. One of the results to emerge from these studies was the demonstration that the characteristic morular cells of Mott found in the cerebrospinal fluid of patients with this condition are of plasma cells origin and responsible for the large amounts of IgM found in the CSF of patients with sleeping sickness thus finally settling a dispute as to the nature of these cells which has been in progress for many decades. Studies on CSF IgM concentrations showed the value of measurements of this immunoglobulin in diagnosis of sleeping sickness and in assessment of the response to treatment.

Meningococcal disease

Zaria is in the centre of the African meningitis belt and so it was not long after my arrival that my colleagues and I were confronted with a large epidemic of over 1,000 patients with this condition (combined with a cholera epidemic) an experience which stimulated a career-long interest in this condition. At Zaria we showed for the first time that some of the late complications of this infection such as curtaneous vasculitis, arthritis and pericarditis are due to immune complex formation and not to persistent infection and so do not require prolonged antibiotic treatment. Because of the enormous numbers of patients seen each day during epidemics, we developed a rapid diagnostic test based on detection of polysaccharide antigen in CSF by latex agglutination, a

test which is still used widely in clinics across the world today. We showed that chloramphenicol is as an effective an antibiotic as penicillin in treating this infection and undertook one of the first well conducted trials of oily chloroamphenicol which is effective when given as a single injection. This treatment has subsequently saved many thousands of lives across the meningitis belt.

When meningococcal polysaccharide vaccines became available in small amounts in the 1970s, I conducted one of the first efficacy studies of a meningococcal polysaccharide vaccine in Africa and demonstrated the way in which vaccination could halt an outbreak. Subsequently this vaccine has been used on a very large scale in Africa but its use has not prevented epidemics and a better vaccine is needed. The eastern part of The Gambia is within the African meningitis and so on my move to The Gambia I was able to continue with my research on meningococcal vaccination. At the Basse field station, I initiated one the first trials of a meningococcal polysaccharide/protein conjugate. The group C component of this combined serogroup A + serogroup C vaccine was highly immunogenic and induced immunological memory to infants. Descendants of this vaccine have subsequently been used with great success to control serogroup C meningococcal disease in the UK and elsewhere. Unfortunately, the serogroup A component of the vaccine was not so immunogenic and so development of this vaccine was not taken further, leaving Africa unprotected as most African epidemics are caused by meningococci belonging to serogroup A. Thus, in 2000 I was a member of a delegation to the Bill and Melinda Gates Foundation, led by WHO, which sought support for a programme to develop a serogroup A vaccine for Africa. This support was forthcoming leading to the creation of the Meningitis Vaccine Project (MVP) which is making excellent progress in developing a serogroup A vaccine for Africa. The vaccine is being produced in India and is currently in trials in The Gambia and Mali. I am a member of the advisory board of MVP and an investigator for the trial in The Gambia. A second serogroup A vaccine has been developed by GlaxoSmithKline. This is a heptavalent vaccine which includes serogroup A and C meningococcal conjugates as well as DPT/hepatitis B and Hib antigens. I have advised GSK on the development of this vaccine and participated in a key trial conducted in Ghana which has established its safety and efficacy in African infants. This vaccine is currently being considered for registration. It would be an excellent vaccine for infant immunization in countries of the African meningitis belt, the MVP vaccine being used for catch-up vaccination of older children and adults.

Haemophilus influenzae type b and pneumococcal infections in children

Haemophilus influenzae type b (Hib) and *Streptococcus pneumoniae* (the pneumococcus) are, with the meningococcus, the most important causes of bacterial meningitis so an interest in the meningococcus led inevitably to an interest in these two bacteria. This interest was strengthened early in my time in The Gambia by the unexpected outcome of a community-based study of the causes of death in Gambian children which showed that pneumonia is as an important a killer of Gambian children as malaria and gastroenteritis, a fact that was not appreciated at that time. Hib and the pneumococcus were known to be important causes of pneumonia but very little was known about the epidemiology of these infections in African children. Thus, I initiated a series of studies on the aetiology of pneumonia in young Gambian children. Initially, these were hospital-based but they were extended subsequently to a rural community, Upper River Division, producing the first information on the incidence of pneumonia and of invasive pneumococcal infection in African children. Both the hospital-based and the community studies established that the pneumococcus is the most important cause of pneumonia in Gambian children but that Hib was a significant, although minor, cause. Subsequent aetiology studies done by others in different parts of Africa have confirmed these findings.

Based on the findings of these epidemiological studies, a series of phase 2 trials of various Hib conjugate vaccines, which were just being developed, was undertaken in Gambian infants. These showed that these vaccines were safe and immunogenic in Gambian infants. Thus, a large phase 3, randomized, placebo-controlled trial involving over 40,000 children was undertaken in the western half of the country. This showed the expected high level of efficacy of the vaccine against Hib meningitis but, surprisingly, it also showed a 22% reduction against radiologically confirmed pneumonia in vaccinated children. This level of protection against pneumonia was much higher than that expected on the basis of aetiology studies. This trial showed how a vaccine trial can be used to define the burden of disease for infections which are difficult to diagnose, an approach now called the ‘vaccine probe’ technique. On the basis of the results of this trial the Government of The Gambia introduced Hib vaccination into the national EPI programme, the first country in sub-Saharan Africa to do so. This has led to a progressive disappearance of Hib meningitis from The Gambia. This decline has been accompanied by a marked drop in the incidence of nasopharyngeal carriage of Hib, suggesting that prevention of carriage and hence indirect protection of unvaccinated subjects has played a key role in its success. Experience in The Gambia, has played

an important role in the adoption of Hib vaccination by WHO and GAVI, the creation of the Hib Initiative and the adoption of Hib vaccination into the routine EPI programme by about 140 countries, including some of the poorest in the world where this vaccine is needed most.

Development of pneumococcal conjugate vaccines lagged behind that of Hib conjugate vaccines, in part because of the serological complexity of the pneumococcus with over 80 serotypes being described. However, following demonstration of the importance of the pneumococcus as a cause of childhood pneumonia in The Gambia a long series of phase 2 trials of pneumococcal conjugate vaccines of increasing valency were undertaken in Upper River Division. These demonstrated the safety and immunogenicity of these vaccines in African infants and that, like Hib conjugate vaccines, they had an impact on nasopharyngeal carriage. Vaccination led to a reduction in carriage of pneumococci of serotypes represented in the vaccine but demonstrated for the first time that this was accompanied by an increase in carriage of pneumococci of non-vaccine serotype and I raised concerns about what might happen if these vaccines of limited valency were used widely. Fortunately, serotype replacement has not been a major problem so far in the United States where pneumococcal conjugate vaccines have been used most widely but recent reports of a marked increase in the incidence of invasive pneumococcal disease caused by pneumococci of non-vaccine serotype in Alaska natives shows that surveillance will be essential when these vaccines are introduced in the developing world. This issue is currently being addressed in The Gambia in a community randomised vaccination trial in which all members of some communities are being vaccinated, putting the pneumococcus under maximum immune pressure, and longitudinal studies of carriage conducted.

Following the successful pilot studies of pneumococcal conjugate vaccines in The Gambia, a large efficacy trial was undertaken in Upper and Central River Divisions in which a nine-valent conjugate vaccine was given to infants at the ages of 2, 3 and 4 months. This produced the expected major impact on invasive disease caused by pneumococci of vaccine serotype but, unexpectedly, showed a 16% reduction in overall child mortality and a 15% reduction in overall hospital admission suggesting that, as in the case of Hib, aetiology studies had underestimated the importance of this infection as a cause of mortality and severe infections in African children. Taken together with the results of aetiology studies undertaken by others in other parts of Africa and the results of an efficacy trial conducted in South Africa the results of the Gambian pneumococcal vaccine trial have played a key role in the adoption by WHO of a policy recommendation on the use of this vaccine in countries with a high child mortality, the acceptance by GAVI of an investment case for provision of this vaccine to poor countries and the adoption of pneumococcal conjugate vaccines as the test case for the Advance Market Commitment scheme. National immunization with a seven-valent pneumococcal conjugate vaccine should commence in The Gambia, with support from GAVI, in 2008 or 2009.

Viral infections

My main research interests have been malaria and the main bacterial infections of young African children. However, I have also been involved closely in a number of studies of important viral infections. I helped to initiate the Gambian Hepatitis Intervention Study which is still ongoing 25 years later. This trial, which covers the whole country, employed a novel study design, now known as the stepped wedge design, which involved progressive introduction of the vaccine countrywide. This provides an ethically acceptable way of evaluating an established intervention which has subsequently been used in several other trials. This trial has demonstrated a high level of efficacy of the vaccine against chronic carriage with hepatitis B. However, liver cancer is the main trial end-point and the trial will probably have to continue for another 10 years before this is end-point is met.

In the Gambia I initiated the first rotavirus vaccine trial conducted in Africa but, unfortunately, the vaccine did not provide a high enough level of protection to be developed further and it has taken many years of further development until further more effective vaccines have become available. I also contributed to detailed studies of the epidemiology of respiratory syncytial virus (RSV) undertaken to set the background for future vaccine trials but so far no RSV vaccine has yet reached the stage of development that qualifies it for field testing in Africa.

The objective of my research has been to combine good science with studies of public health value to the populations where these have been conducted. With help from many colleagues, support from Ministries of Health and funding from many donors it has sometimes been possible to achieve these dual aims.

CAPACITY DEVELOPMENT

Ensuring that research done in Africa is accompanied by support for African scientists has been one of my key objectives.

During my time in Nigeria, I undertook a substantial amount of undergraduate teaching and, for one year when I was acting head of the Department of Medicine and Psychiatry, I was responsible for organisation of teaching in these subjects. I also undertook laboratory training of a number of Nigerian and UK physicians who worked in the clinical immunology laboratory that I established with my colleagues at Ahmadu Bello University, including local supervision of PhD and MD students.

In The Gambia, I did less formal teaching but I provided 'on the job' training in laboratory and field studies for many UK and African graduates and I supervised about 10 PhD students as a local supervisor. On my arrival in The Gambia, I initiated training programmes for laboratory and field staff - training that has subsequently expanded to cover all categories of the unit's staff. I also persuaded the UK Open University to recognise the MRC Laboratories, The Gambia as a sponsoring organisation for the Open University, one of the first institutions outside the UK to be accredited in this way. This has allowed many scientists from The Gambia and other countries in Africa to proceed to a masters or PhD degree whilst continuing to work in Africa.

At the London School of Hygiene & Tropical Medicine (LSHTM) I have participated fully in the teaching of MSc and DTM & H students. During the past 10 years I have supervised 4 PhD students, been on the advisory panel of a further 8 and supervised about 15 MSc students.

On my arrival at LSHTM, I set up a cross-departmental Malaria Centre which I directed until 2006. The establishment of a multidisciplinary Malaria Centre was probably the key factor that lead to the award to the LSHTM in 2000 of a $40 million grant from the Bill and Melinda Gates Foundation to support malaria research and capacity development in Africa. The Gates award has been used to establish the Gates Malaria Partnership (GMP), which I direct, a collaboration between four northern partners in the UK and Denmark and groups in, Ghana, Malawi, Tanzania and The Gambia. GMP has built two research laboratories in Tanzania and helped them to achieve sustainability. Four malaria training centres have been built in Ghana, Malawi, Tanzania and The Gambia and these are playing important roles in these countries in the training of various categories of staff involved in malaria control activities and in advocacy for malaria. GMP has run an active programme for African post-doctoral and PhD students. Thirty-three African PhD students have been supported through the programme, nearly all of whom have now graduated. They were encouraged strongly to undertake the majority of their project work in Africa. About half of the successful graduates are now being supported in their home institutions by re-entry grants and mentoring. Several have shown themselves to be highly proficient scientists who are already making major contributions to research on malaria in Africa.

COMMITTEES AND ADVISORY GROUPS

Over the years I have worked with a number of organisations concerned with international health including WHO, USAID, NIH and the Bill and Melinda Gates Foundation (BMGF). I have served on three WHO steering committees - the TDR epidemiology steering committee, the steering committee on the development of vaccines to encapsulated bacteria and the TDR immunology of malaria steering committee. I have served on and/or chaired many WHO informal consultation groups in the areas of malaria and meningitis, including the committee which recommended the adoption of artemisinin based combination therapy (ACT) for Africa. In 2003/4, I was a member of an Institute of Medicine Committee that came forward with suggestions as to how the enhanced costs of adopting ACT therapy could be met through a subsidy. Since the start of GMP, I have frequently been asked for advice by the BMGF on malaria related and other issues and I am a member of the Executive Committee of the BMGF supported Innovative Vector Control Consortium (IVCC). I am currently a member of the advisory committee to the Meningitis Vaccine Project (MVP), the GAVI panel that directs the pneumococcal and rotavirus ADIPs and the Hib Initiative and also a member of the External Advisory committee of the Medicines for Malaria Venture. I am a member of the board of the CERMES research laboratories in Niamey, Niger.

Since my return to the UK I have served on a number of boards and panels in the UK. For 6 years I sat on the Wellcome Trust Tropical Medicine panel which reviewed most major tropical awards made by the Trust and I am a frequent reviewer of the Trust's project and programme grants. I was a founding trustee of the Tropical Health Education Trust (THET) and completed my 6 year term in support of this charity. This charity, which establishes links between hospitals in the UK and those in Africa, has gone from strength to strength and is now seen as model for capacity development in Africa. I have also recently completed a six year term as member of the

scientific advisory panel to the UK's Meningitis Research Fund, a major UK charity. In 2006, I was appointed chairman of the board of directors of a resurrected Jenner Vaccine Foundation which supports research on human and animal vaccines undertaken at the University of Oxford and the Institute of Animal Health, Compton, UK.

For many years I have worked with Sanofi/Aventis (previously Merieux and Pasteur Merieux) and GlaxoSmithKline on the development of new vaccines against meningitis and malaria. I was a founding member of a public private partnership, which includes GSK, WHO and DFID, established to develop new antimalarial Lapdap and the fixed combination of Lapdap and artesuante for first line treatment of malaria in Africa. This was one of the first public-private partnerships established to develop a drug or vaccine for Africa and many lessons have been learnt during the course of this successful venture.

I am a long-standing member of the Royal Society of Tropical Medicine (RSTMH) and Hygiene and the American Society of Tropical Medicine and Hygiene and I am currently president of the RSTM in its centenary year.

EDITORIAL RESPONSIBILITIES

I am a member of the editorial boards of the Annals of Tropical Medicine and Parasitology, the Annals of Tropical Paediatrics and Human Vaccines and have previously been n the editorial board of Infection and Immunity. I review regularly, one or two articles a week, for many journals including the Lancet, Nature Medicine, Infection and Immunity, Journal of Infectious Diseases and most of the tropical journals.

PUBLICATIONS IN PEER REVIEWED JOURNALS

I am an author of 600 publications on various aspects of infectious diseases. Approximately one half of these publications describe the results of epidemiological, immunological and clinical studies of malaria. I have also published on meningococcal disease, particularly as it relates to Africa, pneumococcal disease and other forms of acute respiratory infections in children. I am co-author of a book on the immunology of tropical diseases and co-editor of a book on emerging infections. I have contributed chapters to a number of textbooks on general medicine, infectious diseases or tropical medicine including the Oxford Textbook of Medicine.

CONFERENCE PRESENTATIONS

I have presented at many international conferences during the past 20 years, on average 3-4 a year. I have been involved in the organisation of several national and international conferences on malaria and other infectious diseases of the tropics including a Gordon Conference on malaria. Currently, I am chair of the committee responsible for the organization of the meeting being held to celebrate the centenary of the Royal Society of Tropical Medicine and Hygiene.