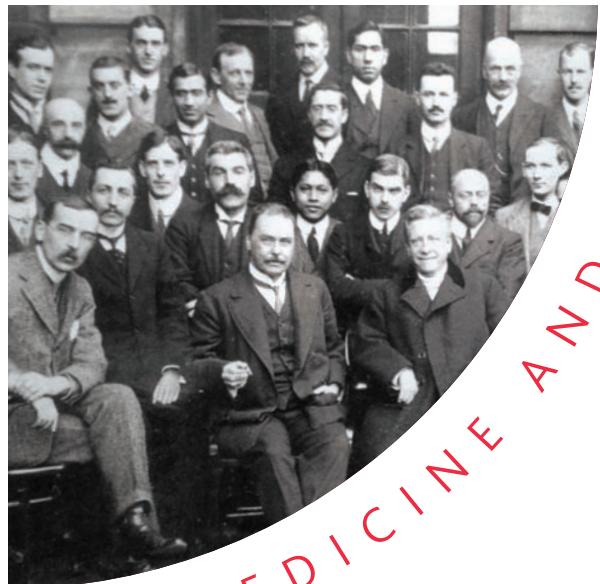


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175 YEARS OF EXCELLENCE

IN TROPICAL MEDICINE AND GLOBAL HEALTH



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Vision:

To save lives in resource poor countries through research, education and capacity strengthening

Mission:

To reduce the burden of sickness and mortality in disease endemic countries through the delivery of effective interventions which improve human health and are relevant to the poorest communities

Values:

- Making a difference to health and wellbeing
- Excellence in innovation, leadership and science
- Achieving and delivering through partnership
- An ethical ethos founded on respect, accountability and honesty
- Creating a great place to work and study

Chairman's Foreword

We will look back on 2013 as the year in which Liverpool School of Tropical Medicine was designated as a higher education institution (HEI) in its own right. This followed a very successful visit to Liverpool by the Minister for Universities and Science, the Rt Hon David Willetts MP.

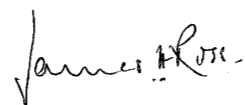
This designation recognises the world class research undertaken at LSTM and its contribution to saving lives in resource poor countries. It signals a further strengthening of LSTM's platform for continued growth in the future. It will enable access to further sources of funding and it will assist in raising the profile of LSTM at home and abroad. Together with the steps being taken to be granted degree awarding powers, it will facilitate a significant development of LSTM's teaching capacity.

But as I sit to write this message, news is coming in of the attack on the Westgate shopping mall in Nairobi, Kenya and the tragic loss of Dr Juan Jesus Ortiz-Iruri, a health consultant for LSTM, who was about to take up the post of Senior Technical Officer with our Centre for Maternal and Newborn Health.

This unwelcome news serves to underline that LSTM is made successful by its dedicated people, who 'go the extra mile' to help those who are less fortunate than themselves – and in so doing, may put themselves in the way of unexpected danger.

"LSTM is thriving because of the work of its outstanding women and men, together with their collaborators around the world."

So we celebrate a milestone in our 115 year history; our financial results remain strong and our research grant base reaches new highs; we continue to attract new talent and we have put the financing in place for an expansion of our buildings. LSTM is thriving because of the work of its outstanding women and men, together with their collaborators around the world.



James Ross OBE

Minister for Universities and Science, the Rt Hon David Willetts MP with Chairman James Ross (left) and Director Janet Hemingway (right)



Director's Foreword

Strategically, 2013 is an important milestone in LSTM's history. The recognition of LSTM as an HEI, with direct links to HEFCE, will increase visibility, freedom to operate in a rapidly changing international market and bring greater opportunities for funding and collaboration. It signals a change in our relationship with the University of Liverpool but not a lessening in our commitment to working with it in areas of mutual interest.

This year we have focused on strengthening those areas of LSTM that concentrate on delivering direct impact on health and working with overseas partners and normative bodies to influence policy and practice. We have made a number of excellent appointments, both directly and jointly with the University of Warwick.

We anticipate that these will catalyse a step change in our ability to draw together multi-disciplinary teams that are able to tackle major obstacles to improving prevention and treatment of disease in different settings.

Plans are well advanced to increase LSTM's physical footprint with building work about to commence on the new Centre for Maternal and Newborn Health, generously supported by a number of major donors. This will allow us to accommodate up to 100 new staff.

As the UK economy starts to pick up, LSTM's Well Travelled Clinics is also seeing increased trading in both its Liverpool and Chester branches. In response to demand from our major clients, we have extended

"LSTM's balanced portfolio of research, training, clinical service and technical assistance ensure that we continue to benefit local, national and international populations."

the range of services to include occupational health checks linked to travel, providing an enhanced service to local businesses.

LSTM's balanced portfolio of research, training, clinical service and technical assistance ensure that we continue to benefit local, national and international populations. The success of this approach is evident from the continued expansion of the organisation while it remains focused on its core mission, values and strengths.

We thank our many friends, donors and collaborators for their continued support and look forward to meeting the challenges ahead with this excellent network of support.



Janet Hemingway CBE

Director Janet Hemingway with the Lord Mayor of Liverpool, Councillor Gary Millar (right) and Chairman James Ross (left) ahead of LSTM's HEI announcement.



Treasurer's Report

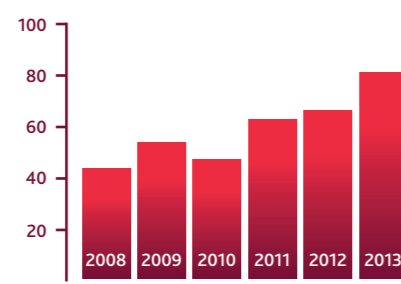
In recent years it has become customary for the Treasurer to report on continuing growth in income and I am pleased to say that this year is no exception. The year to 31st July 2013 saw the LSTM Group achieve its highest ever turnover, which at almost £60M represents an increase of £2.2M on the previous peak.

Research grant income, at £46.6M, amounted to approximately three-quarters of the total turnover and was more than 6% higher than the prior year.

Longer term retrospection shows a particularly satisfying picture with income having more than doubled in the past eight years.

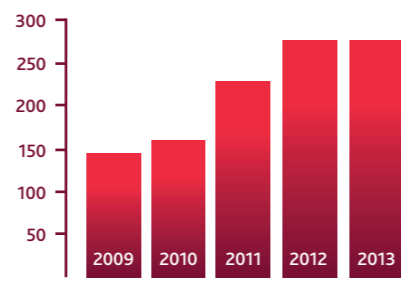
To achieve such growth, significant investments have been made in putting together a formidable team and providing first class facilities. This process, whilst ambitious, has been conservatively managed to ensure that LSTM does not overstretch itself. This is reflected in the Balance Sheet which now shows Net Assets in excess of £57M, with no external debt. During the year £4.4M was invested in fixed assets and further improvements to the estate are ongoing. It is appropriate

Number of New Awards



During the year, 84 new research grants were awarded to the Group, beating the record high of 69 achieved in 2011/12 in a single year. A total of £43.6M new active research was added to the research portfolio.

Active Research £m



The total value of active research has been maintained at £276M (inclusive of IVCC & LATH). The Group was successful with 82% of funding applications during 2012/13.

to note that the support of charities and funding bodies has been invaluable in progressing the improvement programme. On the trading front, a surplus of £2.1M has been achieved in the 2012/13 Income & Expenditure Account. This retained profit is similar to that of the previous year and is providing LSTM with much needed cash towards the development of its team and its property estate.

Whilst Research has performed strongly, Teaching remains a challenging area. Income has shown a steady decline in recent years, partly due to depressed economic conditions reducing the number of overseas students. Nevertheless Teaching continues to cover its own costs and it is hoped that LSTM's change in status to a designated Higher Education Institution will bring benefits.

Turning to the subsidiary companies, the integration of much of the activity of Liverpool Associates in Tropical Health into the parent company has gone smoothly and LATH achieved a profit of £75k on a turnover of £1.7M. Well Travelled Clinics Ltd is steadily overcoming the problems it encountered due to the big reduction in overseas business travel and the loss of £43k represents a significant improvement from the prior year's loss of £177k.

In summary, LSTM remains in a financially strong position, with a healthy balance sheet, satisfactory cash flow and a continually increasing level of research grants.

Ian Jones

LSTM designated Higher Education Institution

It was with pride and a sense of purpose that LSTM's Chairman James Ross and Director Professor Janet Hemingway announced at a press conference on 24 July 2013 that LSTM had become a higher education institution (HEI). The designation came into force a few days earlier on the 19th of July following an Order in Parliament under section 129 of the Education Reform Act 1988.

The Higher Education Funding Council for England (HEFCE) immediately recognised the change in status and added LSTM to their list of directly funded institutions.

The long-standing collaboration with the University of Liverpool (UoL) provided LSTM with accreditation of its MSc and PhD programmes and access to HEFCE, capital and council funding from the UK government. However, over time a great deal of this funding became increasingly difficult to access due to increased government regulations. In addition the

government compiled new lists of further and higher education institutions on which LSTM did not appear, making it difficult for overseas students coming to LSTM to obtain a visa. Those who managed to travel to the UK faced an additional hurdle as they would have to return home if they did not pass examinations in English, whereas they may have been allowed to stay if LSTM appeared on the HEI lists. As a consequence some overseas governments considered it a risk to send students to LSTM. This situation became unsustainable, incompatible as it was with LSTM's strategic plan.

"We are delighted that LSTM, which has always been an independent institution, is now recognised as an HEI in its own right. Amongst many practical benefits it will improve our profile nationally and internationally and support our ambitions for continued growth and expansion."

- Professor Janet Hemingway CBE,
Director of LSTM

Chairman James Ross, Director Janet Hemingway and the Lord Mayor of Liverpool during the HEI press conference at LSTM





LSTM began the HEI application in early 2012 with the support of, and in consultation with, the University of Liverpool. The rules and criteria that the government had established, allowing colleges to become higher education institutions, provided a framework for LSTM. However, the LSTM differs from most colleges in that it only provides post-graduate teaching but nevertheless fulfilled the required criteria. As the government could not introduce a separate system to accommodate one institution it allowed LSTM's application to progress along the 'college-route'.

Following a visit to LSTM by Universities and Science Minister David Willetts in April 2013, confirmation of HEI designation was received and the Order laid in Parliament. When it came into force Minister Willetts said that "this announcement is another step in creating a diverse and vibrant higher education sector."

"I congratulate Liverpool School of Tropical Medicine on this important achievement which will allow them to expand and build on their already excellent reputation globally."

- David Willetts, Universities and Science Minister

Becoming an HEI not only facilitates LSTM's access to funding and gives more potential students access to LSTM, it will also increase LSTM's national and international visibility, in turn enhancing LSTM's position in the formation of UK and international partnerships with academic institutions; commercial corporations and international organisations. HEI status strengthens LSTM's position as the partner of choice for relevant global health consortia.

"This is a great moment in LSTM's long history. It recognises our scientific achievements to date and greatly enhances the realisation of our future plans such as the creation of the Centre of Maternal and Newborn Health and our ongoing application to be granted Degree Awarding Powers."

- James Ross OBE, Chair of LSTM Board of Trustees

Amongst various benefits the new HEI status brings is also LSTM having immediately joined the Athena Swan charter which strives to advance the position of women in science.

While HEI status gives LSTM visibility and access to funds it does not allow for the awarding of many of our own education programmes. An application for Taught Degree Awarding Powers (T-DAPs) is being prepared for submission in 2014. Once granted all short-courses, diplomas and masters degrees will lead to LSTM awards. This will make it easier to establish new as well as overseas-based education programmes, in collaboration with Universities and institutions in resource poor countries where LSTM has a commitment to strengthen health systems.

LSTM's HEI status will strengthen the ongoing collaboration with the University of Liverpool in the delivery of expanding research and teaching portfolios. One such collaboration is the Wellcome Trust Tropical Centre (W TTC) recently renamed as the Wellcome Trust-Liverpool-Glasgow Centre for Global Health Research.

Closer to home, LSTM's work with the NHS and the pharmaceutical and agro-chemical industries in the region will be boosted as new funding leads to new partnerships, which will benefit and strengthen the local and regional economy. Collaborations with industry including Small and Medium Enterprises (SMEs) will translate LSTM's research into newly developed drugs and diagnostics to be used in the UK and overseas.

Future physical expansion of the LSTM campus will facilitate stronger links with the NHS and the University of Liverpool, in turn adding to the Liverpool BioCampus developments and increasing collaboration across the wider Knowledge Quarter in Liverpool. ■



Department of Education & Training

The learning and teaching activities in LSTM are diverse and wide-ranging. The prestigious Masters programmes continue to attract highly-motivated students from around the world and there is also a growing portfolio of Professional Diploma and short courses, which give participants seeking continuing professional development an opportunity for intensive study within a specialist field related to health care in the tropics.

This year saw a major restructuring of the Education and Training Department in order to better reflect the breadth of these activities. Staff are now organised into three teams – the Academic Registry, the Professional Courses Unit and the Quality Unit. As described below, these teams work together to support LSTM students from application to graduation and also help academic staff to deliver a Learning & Teaching experience of the highest quality.

A 'perfect storm' is on the horizon for postgraduate education in the UK. Students starting under the new undergraduate fees regime are likely to be less willing to incur further debt to undertake postgraduate study, whilst the immigration system poses challenges for international students. LSTM has actively prepared for the storm by expanding the diversity of what it offers, recognising the requirement for staff in an expanding range of professions to undertake continuing professional development (CPD) and upgrade skills while in employment. In recent years, LSTM has adopted a 'pick and mix' approach to course development that allows maximum use to be made of all learning opportunities (e.g. MSc modules also offered as stand-alone short courses). This strategy allowed a drop in the number of Masters students in 2012-13 (echoed across the UK) to be compensated by an increase in students following short courses and professional programmes, notably the new Diploma in Tropical Nursing (DTN).

Looking to the future, LSTM plans to extend its capacity to deliver courses overseas through strategic partnerships with other institutions, both face-to-face and through distance learning.

An important milestone for this development was the positive outcome this year of a review by the Quality Assurance Agency (QAA) as part of LSTM's application for HEI status. The QAA found that LSTM meets UK expectations in all areas of teaching, including the academic standards of the awards and the quality of student learning opportunities. It was particularly pleasing that the QAA commented in particular on the very strong links between research and teaching, noting that research informs the design and delivery of programmes and highlighting the contribution of research active academic staff to student learning. The review also complimented LSTM on its efforts to collect and respond to feedback from its students. LSTM is now moving on apace in its application for independent Degree Awarding Powers, which will allow LSTM to consolidate its position as an international centre of excellence for high quality education and training in global health.

Dr Sue Assinder
Director of Education

Academic Registry

Under the leadership of the Academic Registrar, the Academic Registry supports students on LSTM's credit-bearing programmes (Masters and PhD). These programmes continued to attract highly-motivated graduates from around the world in 2012-13. The portfolio was enhanced by offering two new modules - 'HIV in Resource Limited Settings' and 'Medical Bacteriology' – which can also be taken as short courses.

The re-structure of the Education and Training Department Registry included the creation of three new posts. The Student Support Administrator, located in the new Student Support Office, is the first point of contact for student enquiries, allowing students to be signposted more effectively to relevant support services. Support for PhD students was previously covered by three members of staff as part of other roles and the new post of Postgraduate Research Student Administrator will allow research students to have an enhanced level of targeted support. The Student Experience and Accommodation Officer has replaced the previous role of Welfare and Accommodation Officer and now includes responsibility for evaluating the student experience. Completing the team, the Registry Manager and three Registry Administrators provide 'cradle to grave' support for the Masters students, from processing applications right through to the final Board of Examiners and graduation.

Evaluating the student experience

LSTM takes seriously its responsibility to listen to the 'student voice' and student representatives sit on all Boards of Studies and on the Staff Student Liaison Committee. The QAA review recommended that LSTM should involve students more in its deliberative committees, so two students have been elected to Programmes Board for 2013-14 and will be actively involved in strategic discussions about future teaching developments in LSTM.

The Student Experience and Accommodation Officer facilitates student-led focus groups, runs surveys and questionnaires and communicates results of these surveys and important issues arising from committee meetings to the student body.

LSTM students are each year invited to participate in a national survey run by the Higher Education Academy, the Postgraduate Taught Experience Survey. A 61% response rate was achieved in 2012-13, which was 24% higher than the University of Liverpool's institutional response rate. All of the LSTM respondents indicated that the 'overall experience of the course' had 'met expectations'.

LSTM scored very well in the following areas: 'Skills and Personal Development (97% of our students felt that their MSc programme had developed their research and transferrable skills); 'Depth of Learning' (97% of students agreed that they were 'frequently expected to analyse ideas or examine a particular case or situation in depth') and scores relating to the quality of teaching were above 80% across the board.

A new Student Engagement Exit Survey was introduced this year based on the American National Survey of Student Engagement (NSSE), which measures factors that affect levels of student engagement as opposed to student satisfaction. Despite a relatively low response rate (26%), results showed that students at LSTM feel that their voice is valued and that there are ample opportunities to provide feedback.



Quality Unit

The overall aim of the Quality Unit is to help assure the quality and standards of all our taught courses, both at home and overseas. The team expanded as part of the departmental restructuring, reflecting the growing importance placed on academic quality and assurance in the UK Higher Education system. The Unit focuses on the development and management of key quality assurance processes and aims to ensure that these are aligned with UK requirements. This includes the approval, monitoring and review of programmes, recording and analysis of marks and monitoring of reports from external examiners. A key element of the Unit's role is supporting external reviews and it is now taking the lead in the preparations for LSTM's application for Degree Awarding Powers.

In addition to its work in assuring quality and standards, the Quality Unit supports the enhancement of teaching. Ideas for enhancing teaching are often identified during meetings and discussions and the Quality Unit maintains an action plan that ensures that good ideas translate into tangible enhancements to the student experience. The Unit also runs the scheme for peer observation of teaching in which staff are asked to have one teaching session observed each year by a colleague acting as a 'critical friend'. As well as encouraging staff to reflect upon their teaching, the scheme highlights examples of innovative practice that would otherwise go unnoticed and provides a route for these to be disseminated.

Professional Courses Unit

The Professional Courses Unit (PCU) was launched as part of the restructuring. It manages all Professional Diplomas and short courses as well as undertaking marketing activities for all LSTM teaching. In its first year, the PCU welcomed 269 students on LSTM Professional Diplomas, an increasing of 12.3% on the previous year. The Diploma in Tropical Nursing (DTN) continues to perform well and has been re-accredited with the Royal College of Nursing. With interest levels rising, the course is now running twice per year, with a full class of 60 students forecast each time. The DTN is also attracting overseas students, with over half the cohort being from North America.

"I have enjoyed all of the lectures; the lecturers are excellent in their presentation skills and make complex subjects accessible"

- DTN Course Survey 2013

The PCU also welcomed a further 219 students from over 40 countries on short courses. This was a rise of 43% on the previous year indicating that students are increasingly looking for CPD opportunities. Short course students are often sponsored by their employers, such as the NHS, Ministry of Defence, various large NGOs, religious organisations, international Ministries and other educational institutions, including University of Namibia, Bernhard Nocht Institute and Chalmers University.

This year, the PCU launched a pilot programme called 'Introduction to Ultrasound in Low Resource Settings'. This course was received very well by the students and all of them said they would recommend the course to others.

"The practical sessions were excellent. The facilitators were thorough, patient and explained the techniques in detail. There was always a good positive learning environment. One of the highlights of the practical sessions was indeed the possibility of scanning real patients."

- Ultrasound end of course survey

The launch of new courses continues to help diversity our course portfolio and show our teaching diversity and strengths to the general public and the world at large. We have also had a very positive response to our efforts to strengthen links with our alumni and their feedback is actively informing future developments in education. ■



Investing in the future: the continued expansion of LSTM's campus

LSTM's strategic plan for 2012-2017 outlines the direction of LSTM's research portfolio for the next five years and beyond. To facilitate the ongoing growth of LSTM's new and existing research initiatives a significant expansion and refurbishment of the current campus is required.

The Centre Tropical and Infectious Diseases (CTID), LSTM's state-of-the-art research facility for researching and developing new drugs, diagnostics, vaccines and pesticides to combat some of the world's most devastating diseases was only completed in 2006 but already operates at capacity: around 200 staff work on over 50 research projects.

LSTM has with the CTID firmly established itself as an important bioscience asset

as well as an international centre of excellence. The centre brings together teams of multidisciplinary scientists to collaborate, share equipment and facilities. This approach is echoed across the existing campus and forthcoming developments.

Since its completion attention turned to the development of buildings and land adjacent to the existing campus.

A new building to house the Centre for Maternal and Newborn Health

LSTM purchased Anson Court and Anson Terrace in December 2012, adjacent to the existing campus on Pembroke Place. It has now raised the necessary £7m of funding to allow onsite repurposing and refurbishment work to commence to create a modern building.

It will house 180 staff and aims to become an internationally recognised centre of excellence for maternal and child health. The building will also provide additional space for translational research projects which will allow LSTM to further develop a multi-national, multi-disciplinary team of researchers and innovation experts, delivering a range of research, teaching and technical assistance programmes.

Once complete in December 2014, the building will house LSTM's Centre for Maternal and Newborn Health, an expansion and re-branding of the former Maternal and Newborn Health Unit.

The project is supported by grants from the Regional Growth Fund; the European Regional Development Fund and the Wolfson Foundation.

The new building will provide an effective and efficient research environment to support; stimulate and promote interdisciplinary research activities and facilitate skills transfer in line with LSTM values.

Improvements and enhancements

The past five years have seen a rolling programme of refurbishment within the four existing interconnected buildings, the oldest of which dates back to 1915.

Over that period the laboratory, offices and teaching facilities have been refurbished. More recently, improvement works to third floor of the original building was completed in June 2013.

The building has also undergone cathodic protection: a technique employed to control the corrosion of a metal surface, usually steel reinforcement, ensuring that it will stand for a further 98 years. A computer-controlled direct current is introduced to the steel reinforcement, which prevents corrosion, ensuring a sound structure for the future.

A revamp of LSTM's forecourt has taken place over the summer of 2013. This included the reintroduction of partial railings to the right of the Nuffield Building. The original railings were removed during the Second World War to be melted down and used in armaments.

Further refurbishment work is planned for the basement and third floor of the original building, ensuring that each area of the building is used in a sustainable manner

Future planning

At the current rate of expansion LSTM will in just a few years need to begin another building project to accommodate larger teams of staff working in translational medicine. Current plans will involve starting to raise funds to eventually acquire and develop plots of land alongside the current development opposite the existing LSTM estate. With the support of Liverpool City Council and the Knowledge Quarter, there are many options available to LSTM as it will continue to expand its campus. ■

Architect's impression of the new building



Progress against Neglected Tropical Diseases: a window of opportunity

As consensus and resources build in the fight against Neglected Tropical Diseases (NTDs), we now require a multidisciplinary approach to research and treatment in order to capitalise upon political and financial commitments made at the 'London declaration' in 2010.

For the one billion people suffering from these infectious diseases, the effects can significantly impact upon physical and emotional wellbeing, as NTDs are often disabling, disfiguring and stigmatising. Typically this is combined with economic hardship, as when affected individuals are prevented from working and receiving education, NTDs ultimately perpetuate the cycle of poverty.

Important questions have been raised concerning current approaches to control and elimination of NTDs. Integrated mass drug administration (MDA) targets several NTDs using a combination of drugs administered at the same time to entire populations, rather than just infected individuals. MDA usually continues for 4-6 years, leading to the control and sometimes elimination of those NTDs and the relief of ongoing suffering, but this strategy remains insufficient for many NTDs. With more and more funding supporting MDA, questions are increasingly being asked as to whether the progress made so far can deliver the results previously thought achievable by 2020. By examining the barriers that exist, NTD control programmes must adopt a more flexible approach and consider alternative and integrated approaches to overcome the challenges ahead.



Elephantiasis patient

A biosocial approach

In an effort to improve the effectiveness of MDA programmes, there is an increasing call to introduce a biosocial approach. The introduction of social scientists to examine social, political and economic factors affecting MDA programmes is gathering momentum. Insights emerging from disciplines such as anthropology, parasitology, epidemiology and international development are combining to produce a more holistic approach to NTD control and prevention.

LSTM is leading drug discovery and development research against human filariasis – the parasitic worm infections that cause river blindness and elephantiasis, through the *Anti-Wolbachia* Consortium (A-WOL). The consortium is working with social scientist Eleanor MacPherson, to investigate if communities in Ghana, Cameroon, and Zanzibar are receptive to a 'test and treat' approach to complement MDA, in 'hot spot' areas, where existing strategies are failing to deliver the expected outcomes. The key question in pursuing this approach will be whether it is perceived as acceptable by everyone in the community who may be at risk of infection. By January 2014 investigators will commence qualitative studies to determine the acceptability to the communities involved.



Electron micrograph of an adult male *Schistosoma* parasite worm

Professor Russell Stothard and colleagues from LSTM's Department of Parasitology are investigating the factors instrumental in improving the control of schistosomiasis in sub-Saharan Africa. This work particularly focuses in infants and preschool children, who are particularly susceptible to infection. Alongside the existence of a significant treatment gap is the problem of estimating the level of exposure faced by young children. Children are particularly at risk from schistosomiasis, as they often play in or are bathed in bodies of water containing the parasite that causes the disease.

In a study conducted in Uganda, the findings of which were first published by Seto et al in *Geospatial Health* 2012, Professor Stothard and colleagues used cheap GPS data-logging technology and custom-made arm straps to measure the levels of direct water contact that young children and their mothers had along the shoreline of Lake Albert, in North West Uganda. By comparing the GPS data-logging patterns of mothers and children, results showed strong socio-cultural factors associated with water contact behaviour.

Mothers were occupied up to forty five minutes each day at the lakeside with domestic chores that increased their daily risk of acquiring schistosomiasis. Pre-school children who accompanied their mothers in these chores were at significantly higher risk of *Schistosoma* infection. The gathering of women and children in groups was significant to researchers, who monitored these social interactions, centred on domestic tasks, found to collectively increase the risk of infection.

Information gathered shows that pre-school children are at daily risk of acquiring infection and therefore need to be retreated throughout the year. At the same time, more needs to be done to engage with the mothers with behavioural modification to reduce the risk of becoming infected and to understand exposure, which may in turn reduce the disease burden.

New drugs under development

The effectiveness of MDA is dependent upon keeping drug resistance at bay. Antibiotics, antimalarial drugs and pesticides are all at risk of driving resistance, which represents a major threat to achieving control of NTDs.

In June 2013, A-WOL announced the A-WOL II Macrofilariocidal Drug Development Project. The aim of the project is to develop and optimise drugs and regimens of registered and re-purposed anti-*Wolbachia* macrofilariocidal drugs selected from the A-WOL I screening campaign and to test these in combination with standard anti-filarial drugs. It brings together world experts in drug development, chemistry and biology to fast-track active anti-*Wolbachia* compounds into field trials targeting river blindness and elephantiasis in Africa.

Professor Mark Taylor and Dr Denis Voronin were in May 2013 awarded a grant from the Grand Challenge Exploration (GCE) initiative, funded by the Bill and Melinda Gates Foundation to screen for drugs that activate the autophagy immune system of

filarial worms to kill their essential bacterial symbiont, *Wolbachia*. Such drugs could shorten the required treatment time and fast-track the elimination of river blindness and elephantiasis.

A second GCE grant was awarded to Dr Joseph Turner, to pursue an innovative global health and development project exploiting gene-knockout technologies to develop a small animal model of river blindness. The project is in collaboration with Professor Sam Wanji's team at the Center for Tropical Research in Cameroon. This new model could then be validated to increase the throughput of pre-clinical testing for novel macrofilariocidal drugs under development by the A-WOL consortium and other macrofilariocidal drug development approaches.

"It is quite an achievement to win one of these Grand Challenge Exploration grants, let alone to win two of them, and even more so, both grants are for researchers working for the same laboratory within LSTM."

- Professor Mark Taylor, Head of Parasitology

Taking advantage of vector control

The successful global elimination of elephantiasis could hinge upon the addition of insecticide-treated bednets to complement the current MDA strategy. Researchers from LSTM's Centre for Neglected Tropical Diseases (CNTD) and Case Western Reserve University published a study in the *New England Journal of Medicine* in August 2013, finding that the MDA strategy nearly eliminated the parasite from the human bloodstream but did not stop its transmission by the mosquito vector. It stressed that elimination and control programmes should not rely exclusively upon MDA to eliminate elephantiasis.

Insecticide-treated bednets are already widely used in areas where elephantiasis and malaria are both present. These bednets work in several ways to reduce disease transmission by mosquitoes. First, they serve as a barrier to female mosquitoes getting a blood meal, a process that is essential for the adult female insect to lay her eggs and produce offspring. Second, the insecticide works to reduce the life-span of the insect by half, preventing it from living long enough to allow the parasite to develop to a stage that is capable of infecting more people.

The study found that coupling the MDA strategy with bednet distribution in malaria-endemic areas also protected the same individuals from elephantiasis. Multiple bednet programmes already distribute the vector control tool for free



Community distribution of ivermectin for onchocerciasis

across Papua New Guinea, the South Pacific and sub-Saharan Africa. A relatively low-cost solution could complement the successes of the current elephantiasis elimination programme while bringing great benefit to both filariasis and malaria control.

An analytical review of past surveys of elephantiasis in Papua New Guinea enables better estimation of the national burden, identifies gaps in knowledge, quantifies and locates the population at risk, and can be used to predict the likely impact of MDA and/or vector control. Better targeting of districts by level of prevalence will strengthen the control programme, facilitate monitoring of the disease trend and increase the likelihood of reaching the target of elimination.

In another study entitled 'Can malaria vector control accelerate the interruption of lymphatic filariasis transmission in Africa; capturing a window of opportunity?', researchers from CNTD published in the February 2013 issue of *Parasites and Vectors* a study examining the magnitude, geographical extent and potential impact of vector control in the 17 African countries that are yet to or have only recently started MDA. The study found that vector control activities had increased significantly since 2005, with a three-fold increase in the ownership of insecticide treated nets and coverage of indoor residual spraying. Coverage, however, varied dramatically across the 17 countries.

The continued commitment and global financial support for NTD programmes and the concurrent expansion of vector control activities for malaria is promising, but monitoring and evaluating the impact of these activities over the next decade will be critical to its success.

In July 2013 the WHO announced that Colombia has become the world's first country to eliminate river blindness. This was made possible through the MDA of anti-parasitic drug ivermectin in affected parts of the South American nation, combined with a sustained health education campaign in local communities. ■




Bednet

As an institution with a vision to translate its research findings into practical benefits for people living in low and middle-income countries, the driving force for the development of our research questions comes from the communities where relevant diseases are prevalent.

This pathway leading from the field into the laboratory is often followed by taking research back into the field and, even during the laboratory phase, LSTM works together with its overseas partners to deliver as much of the science locally as possible, in order to support high-quality research and capacity strengthening.

In this Annual Report a series of four Special Reports looks back at LSTM's research trajectory over 2012 – 2013 and its impact. The continuous search for, and development of, new products will help to improve prevention and treatment of many diseases and address global health issues, together with knowledge of their effective implementation and an understanding of their impact through monitoring and evaluation.

A new way of looking at an old disease: **Thrombin and cerebral malaria**



Our work on the pathology of cerebral malaria came from observations made in Malawi and fits with national Malawian policy to conduct research on malaria. Almost all of the work was carried out in Malawi using the strong links between the University of Malawi College of Medicine, the Queen Elizabeth Central Hospital in Blantyre and the Malawi-Liverpool-Wellcome (MLW) Programme.

The human malaria parasite *Plasmodium falciparum* has been described as one of the biggest killers in human history but although we know much about the biology of this parasite and its interactions with the insect and human hosts, we have much less information about why it kills people. On being bitten by a female *Anopheles* mosquito the infective forms of the parasite invade the human liver and develop there for about a week. At this stage the infection is asymptomatic, but once the liver cells have released the expanded population of parasites, a cycle of growth is initiated in the red blood cells that can eventually lead to disease and, in some cases, death. Although seen as a 'killer disease' malaria results in death in approximately 1-2% of infections and the way in which immunity to malaria disease develops in affected populations is a story in its own right.

Why some people develop serious complications and potentially lethal infections is not fully understood but a clue to this comes from work conducted towards the end of the nineteenth century by two Italian pathologists Marchiafava and Bignami, who observed that the blood vessels in the brains of people dying with coma from malaria infection had accumulations of infected red blood cells that were at higher densities than observed in peripheral blood vessels. We now know that this concentration of infected cells is due to the ability of *P. falciparum* infected red blood cells to bind to receptors on the

surface of small blood vessels, thus withdrawing, or sequestering, them from the circulation. It is not clear why this human malaria parasite has developed this behaviour, particularly as other human malaria species are able to survive without it, but it is not difficult to see that by packing the blood vessels in the brain *P. falciparum* could cause impaired consciousness and the coma associated with one of the most dangerous forms of severe malaria disease, cerebral malaria. This clinical syndrome has a case fatality rate of 15-20% but even in survivors can cause a range of neurological deficits ranging from subtle learning difficulties to epilepsy.

Several researchers have suggested that the reduction in blood flow in vessels in the brain could explain the disease seen in cerebral malaria, but knowing for sure is difficult due to the lack of an animal model and the reasonable restrictions in comparing findings with the brains of people who do not die from cerebral malaria. For a disease that involves interactions between the small blood vessels deep in the brain and infected red blood cells binding in this tissue, taking blood samples from the peripheral circulation can only tell us part of the story. The breakthrough came with a simple observation by scientists working in the MLW Programme and the Blantyre Malaria Project who noticed that the blood vessels with sequestered infected red blood cells binding to them from the brains of children

normally associated with blood clots (Figure 1). The 'clots' were not blocking vessels and the overall ability of people with severe malaria to form blood clots was not overtly affected so this was something of a puzzle.

To begin to solve this puzzle required thinking about how clotting takes place and, more importantly, how it is controlled (Figure 2). When a blood vessel is injured, a protein called Tissue Factor is released. Through a cascade of reactions this results in the production of thrombin from its inactive precursor prothrombin. Thrombin is an enzyme that converts soluble fibrinogen into insoluble fibrin, the basis of a blood clot. During tissue damage this reaction takes place at a highly localized level, providing a means to repair the blood vessel, but clearly once this mechanism has been switched on, there needs to be a way to switch it off again. The production of thrombin is switched off by activated Protein C (aPC), which is produced at the surface of the vessel wall by the interaction of two important regulatory proteins Thrombomodulin (TM) and Endothelial Protein C Receptor (EPCR).

Under normal circumstances these proteins work together to restore the host vascular system back to normal. Dr Chris Moxon, then a Wellcome Trust Clinical Fellow working in the MLW Programme under the supervision of Professors Rob Heyderman and Alister Craig, developed a way to look at the cells lining blood

vessels and, in particular, what happens when they have infected red blood cells bound to them. He was able to show that, during a malaria infection, the levels of TM and EPCR in the blood vessels are reduced and that in the presence of infected red blood cells fibrin is produced in the blood vessels (Moxon et al (2013) *Blood* 122(5): 842-851). This loss of proteins that control clotting and the production of fibrin was strongly associated with cerebral malaria. The loss of EPCR and TM leads to localized loss of control of thrombin production due to the inability to produce aPC and therefore the conversion of fibrinogen into fibrin. However, thrombin does more than just produce clots and whereas in the presence of EPCR and aPC it communicates with the cells lining the blood vessels to produce a 'healthy' phenotype; if EPCR and aPC are not available it activates an inflammatory response in the blood vessel, leading to tissue damage and loss of fluid through the vessel wall. In many tissues this movement of fluid would have little consequence, but in the highly circumscribed environment of the brain surrounded by the skull, swelling due to vessel leakage can be very dangerous.

More work is needed to understand the exact mechanisms driven by this perturbation of the thrombin pathway in causing cerebral malaria, but by drawing parallels with the brain swelling seen in other diseases such as meningitis a number of potential interventions based on augmenting the feedback control mechanisms of the clotting pathway come to mind.

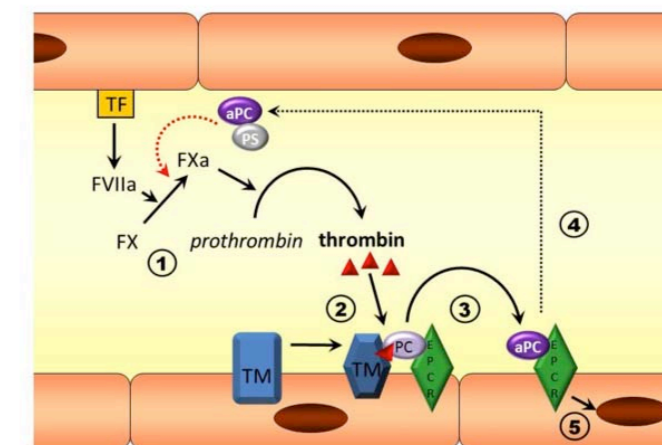


Figure 2 - Tissue Factor (TF) is released by the cells lining the small blood vessels activating a cascade of reactions (1) leading to the production of thrombin (2). The production of thrombin is controlled (3) by the conversion of Protein C (PC) into activated protein C (aPC) through the interaction between thrombomodulin (TM) and Endothelial Protein C Receptor (EPCR). EPCR and aPC working together also reduce the production of thrombin (4) and communicate with the host cells reducing inflammation and strengthening the cell-cell barrier (5). Binding of *P. falciparum*-infected red blood cells causes a reduction in aPC levels, over-production of thrombin and the induction of a local inflammatory state in the blood vessel.

In the curious way that science works, having made this discovery we found out during a trip to colleagues at the University of Copenhagen that they had independently made a similar discovery about the role of EPCR in severe malaria but using a very different approach.

Instead of looking at the host response, they had concentrated on the types of malaria parasite associated with disease and found that these often bind to a new host receptor, namely EPCR (Turner et al (2013) *Nature* 498(7455): 502-505). In doing so they block the conversion of Protein C to aPC and hence the control of thrombin production. These findings provide confirmation of the importance of this pathway and a great opportunity to work together to generate new knowledge to take back into the field. ■

"Translating this basic science into therapies is still some way off but the insights provided from this research at the clinical and laboratory interface provide a better understanding into the basis of one of the major aspects of pathology of severe malaria."

Professor Alister Craig, LSTM

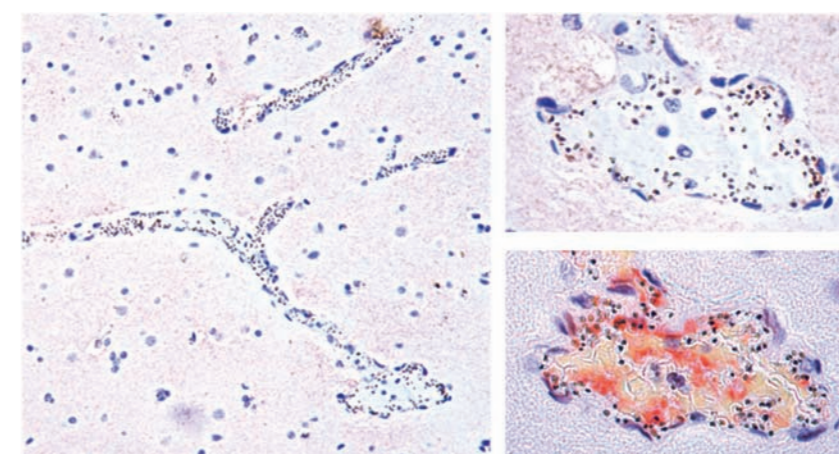


Figure 1 - Blood vessels from the brain of a child dying from cerebral malaria showing the accumulation of infected red blood cells (black dots) in the vessels and (see detail) the production of fibrin (stained red) associated with the presence of these sequestered forms.

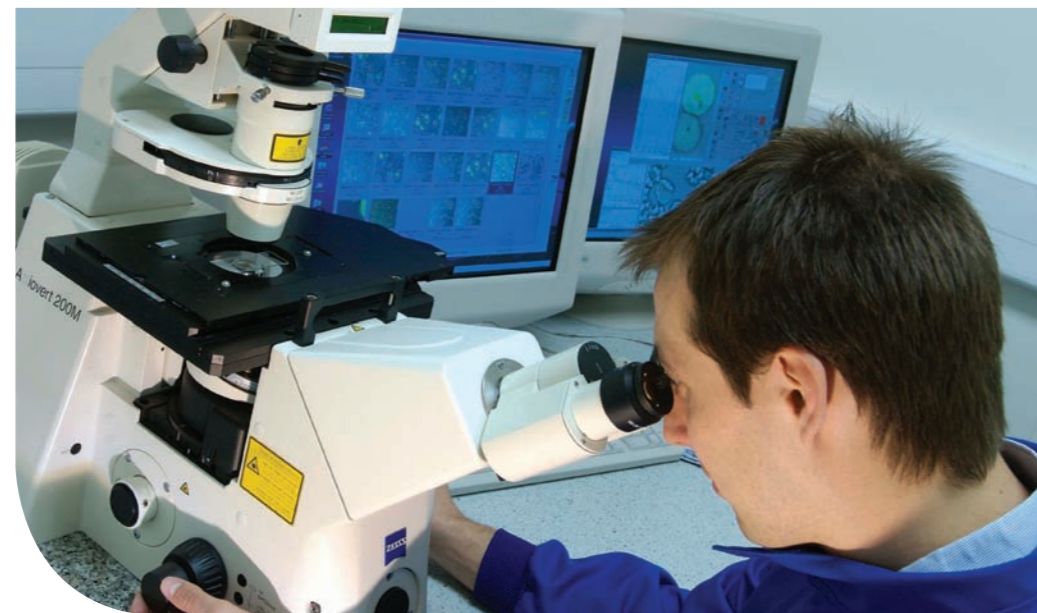
Department of Parasitology



DRUGS & DIAGNOSTICS

The department's pipeline for product discovery, development and delivery genuinely extends from molecule to man to policy. Our portfolio includes two novel antimalarials in preclinical development, an anti-TB drug in preclinical development and large discovery and development programmes focused on anti-*Wolbachia* based therapies for lymphatic filariasis and onchocerciasis (A-WOL).

The recently launched **Research Centre for Drugs & Diagnostics** (RCDD) is headed by Dr Giancarlo Biagini (drugs) and Dr Emily Adams (diagnostics). Dr Adams, a *Leishmania* expert and a joint appointment with Warwick University, was soon in the media spotlight as diagnostic expert on tick diseases. RCDD will work with industry, academia and NGOs to discover, develop and deliver novel therapies and diagnostics against major human pathogens and exploit our state-of-the-art facilities.



Dr Giancarlo Biagini

Probing Primaquine – Dr Giancarlo Biagini and colleagues work on the mode of action of the anti-malarial drug primaquine (MRC funded). Together with Professors Ward and O'Neil (UoL) the group published their discovery of a new class of quinolone anti-malarial drugs in Proceedings of the National Academy of Sciences. The potent activities of these drugs fulfill the requirements for the generation of a potent, safe and inexpensive drug with the potential for clinical deployment in the control and eradication of *falciparum* malaria.

Modeling malaria - Dr Ian Hastings and colleagues have been refining and validating pharmacological models to develop computer simulations of malaria drug treatment in patients. It is being used in the design of drug regimens reducing the numbers of patients required in clinical trials (MRC); evaluating how current drug regimens are threatened by drug resistance (Bill & Melinda Gates Foundation) and investigating whether increased drug dosage can overcome drug resistance in South East Asia (WHO).

A-WOL II – This year saw the renewal of the A-WOL programme (Bill & Melinda Gates Foundation), to find new cures for river blindness and lymphatic filariasis. Headed by Professors Taylor and Ward it will develop registered and repurposed drugs identified in the first five years of the programme to select the best candidates for clinical trials and in parallel carry out a lead optimization programme to work out which of a group of six classes of new anti-*Wolbachia* drugs can progress to a pre-clinical candidate.

A-WOL members Dr Joe Turner, Dr Denis Voronin and Dr Kelly Johnston received Grand Challenges Exploration (GCE) grants to develop new 'blue-sky' approaches to the discovery and development of anti-*Wolbachia* drugs. LSTM holds three GCE grants out of the seven awarded in the UK.

PARASITE PATHOGENESIS & IMMUNITY

Professor Alister Craig and Dr Chris Moxon and colleagues in Malawi made an important breakthrough in our understanding of the mechanism of cerebral malaria that results in localised coagulation and inflammation and damage to the blood vessels, published in the journal *Blood*.

Dr Britta Urban's group uncovered another new mechanism by which malaria causes disease, published in *Nature Medicine*. They show that parasites activate mast cells, an immune cell normally linked to allergic reactions. Dr Urban and colleagues from the KEMRI-Wellcome Trust Research Programme showed that the mast cell factor is increased in children with severe malaria.

VECTOR PARASITOLOGY

Our renewed linkage with the Vector Biology Department has begun to bear fruit. Professor Moses Bockarie, Director of the Centre for NTD (CNTD), has long been a champion of the use of vector control, such as bednets, to augment MDA control programmes for lymphatic filariasis (LF). Evidence was published in the *New England Journal of Medicine* together with lead author Dr Lisa Reimer, a new joint appointment with Vector Biology. Another joint appointee, Dr Alvaro Acosta-Serrano, is part of the team lead by the Wellcome Trust Sanger Institute that sequenced the genome of the tsetse fly - the vector of trypanosomes. PhD student Clair Rose studied the proteome of the fly's peritrophic membrane to identify potential targets for transmission blocking vaccines for sleeping sickness and Nagana.



NTD PARASITE ELIMINATION AND CONTROL PROGRAMMES

Professor Stothard's work on schistosomiasis in Uganda and Namibia with the Wellcome Trust SIMI project (Schistosomiasis in Mothers and Infants) finished this year. Highlights of this study revealed that young children from the age of 6-months can have active schistosomiasis and need treatment with praziquantel (PZQ). Data support the international initiative headed by Merck-Serona to develop a paediatric formulation of PZQ.

The Centre for NTD (CNTD) continues to support Ghana, Burkina Faso, Tanzania, Liberia, Guinea, Mozambique, Malawi, Zambia, Ethiopia, DRC, Nepal and Bangladesh in their efforts to eliminate lymphatic filariasis. It has received renewed funding from DfID and additional funding of the END Fund, OFID and the BMGF and partnership with Sightsavers.

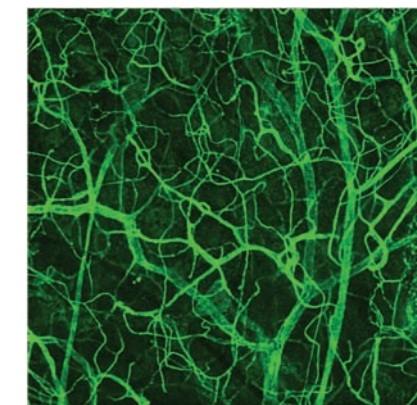
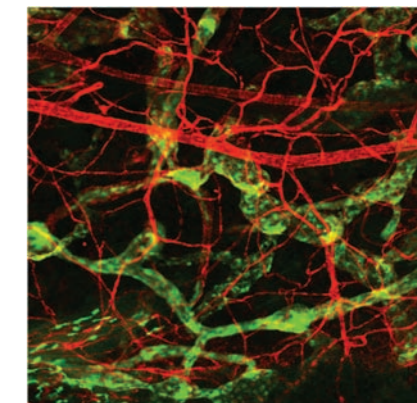
CNTD hosted a meeting of programme managers from our 12 project countries in Africa and Asia. The Chair of the UK parliament's All-Party Group on Malaria & Neglected Tropical Diseases (APPMG), Jeremy LeFroy MP, attended the meeting to discover more about neglected tropical diseases (NTD) control programmes.

CNTD is leading efforts to complete the mapping of NTDs in the 'mega' countries of DRC and Ethiopia. It also carries out a coordinated mapping of multiple NTDs in Nigeria together with a high resolution micro-stratification overlap mapping (MOM) strategy as a prerequisite for control and surveillance in areas where LF and onchocerciasis are co endemic with Loa loa.

Professor David Molyneux led the WHO Evaluation Mission for Guinea Worm Eradication in Nigeria. They concluded that there was no longer transmission in what was formerly the most endemic country with over 650,000 annual cases. It gives hope that Guinea Worm will be the first of the NTDs to be eradicated. ■

BIOINFORMATICS AND TECHNOLOGY PLATFORMS

LSTM's Bioinformatics Unit expanded with the appointment of Dr John Archer and 3 PhD students to collaborative projects within the Parasitology and Vector Biology Departments. Together with Warwick Systems Biology Centre, the group is developing tools and methodologies to address some of the key obstacles that limit our ability to fully extract biologically meaningful information from non-model organism datasets. Investments have provided a boost to our Bioinformatic Unit support for high throughput omics and two Operetta imaging platforms. Dr Joe Turner and Amber Fanthorne with a BBSRC / Integrative Mammalian Biology MRes Studentship have developed bio-imaging with laser scanning microscopy to visualize and quantify lymph flow and vascular remodelling in models of lymphatic filariasis as a pre-clinical screen for new therapies for lymphoedema and elephantiasis (pictured). ■



Professor Mark Taylor
Head of Parasitology

Translating research into policy and practice

Translational research, alongside product development against well-defined target product profiles, resonates strongly with many national and international higher education oversight and funding bodies. If such research includes a strong focus on strengthening health systems and capacity building it will enable potentially comprehensive interventions that will improve health outcomes and therefore fulfil LSTM's mission.

This approach is supported by LSTM's research strategy, which sets out the research direction and priorities for the period 2012 - 2017. It outlines how the strategic decisions underpinning LSTM's research activity will have maximal impact on global health, in particular in saving lives in resource poor countries.

As a result LSTM has made major progress in the translational field throughout the past academic year.

As a sign of confidence in the market potential of LSTM's scientific research, the Medical Research Council (MRC) and the Technology Strategy Board awarded LSTM £250,000 through the joint Biomedical Catalyst in 2012. This will help LSTM to progress research ideas towards clinical testing.

"LSTM is ideally placed to work with others to define, evaluate and support the implementation of effective interventions across a broad range of disease areas including Neglected Tropical Diseases; maternal and child health; respiratory and vector borne diseases."

- LSTM Strategic Plan 2012 - 2017

"LSTM will use the award to strategically fund specific early discovery research. This will pump-prime research to develop drugs that are active against multi-drug resistant tuberculosis, identification of new chemical starting points for new anti-malarial drugs or resistance breaking insecticides which will all play a role in the war against diseases in developing countries."

- Professor Steve Ward,
Deputy Director LSTM



Professor Taylor's breakthrough drug discovery and development research against human filariasis, a group of parasitic worm infections causing river blindness and elephantiasis affecting up to 150 million people in 83 countries, received US\$10 million from the Bill & Melinda Gates Foundation. This so-called 2nd phase funding will allow the global Anti-Wolbachia Consortium (A-WOL) to further expand on their pioneering research and focus on macrofilaricidal drug discovery as well as optimising and developing existing drugs. To facilitate this translational research further partnerships between academic groups and pharmaceutical companies are essential. A-WOL has set up a collaborative project with AstraZeneca where the latter allows open access to its facilities and compound collection.

LSTM's Centre for Maternal and Newborn Health (CMNH), previously known as the Maternal and Newborn Health Unit, has established itself as an internationally recognised centre of excellence and currently is the largest academic group in Europe focusing on global issues of maternal and newborn health. The Centre's research is being applied through a new evidence based competency based 'skills and drill' training in Emergency Obstetric and early Newborn Care (the EOC&NC training package) using proven adult education techniques

Ongoing research into insecticide resistance remains an essential component of LSTM's work, particularly important as insecticide resistance is the biggest threat to malaria control. The ongoing development of new tools to improve the quality of work to monitor this resistance informs the various programmes that aim to develop new insecticides. Commercial partners recognise LSTM's international expertise in this area and are keen to collaborate on product development based on LSTM's research outcomes. To facilitate this collaboration LSTM established the Liverpool Insecticide Testing Establishment (LITE), an insecticide-based product testing initiative which is at the forefront of the battle to manage insecticide resistance and to counteract the spread of infection by insecticide-resistant vectors.



A technician in Ethiopia sprays insecticide on the outside of a building to prevent malaria-carrying mosquitoes



Another example of LSTM leading the way in translational research is the Cooking and Pneumonia Study (CAPS). Pneumonia kills almost 1.6 million children each year. This particular study tracks 10,000 children under five in rural Malawi after supplying their homes with two cook stoves which have reduced emissions of almost 90%. Researchers monitor whether or not these new and cleaner stoves reduce the pneumonia incidence rates among these children.

Emerging from this study is the establishment of the tropical Clinical Trials Unit (tCTU), which will – based on lessons learned from the CAPS study – provide guidance, support and advice to clinical trials as part of wider studies in low and middle income countries.

A key objective in LSTM's organisational strategy is 'to provide a co-ordinated multi-disciplinary approach to strengthening capacity for delivering key large scale operational and translational research'. To achieve this, and in close collaboration with the University of Warwick, LSTM set up the Centre for Applied Health Research and Delivery (CAHRD), directed by Professor Bertie Squire.

Clean cookstove distributed in Malawi

"Effective, innovative, and affordable policies and practice are essential for improving health. Developing and successfully implementing such policies and practices to scale for the benefit of the health of poor populations is the focus of the Centre for Applied Health Research & Delivery (CAHRD)."

-Professor Bertie Squire, Director CAHRD

The work of the CAHRD requires a range of disciplines in addition to biological, clinical, epidemiological and public health approaches. Social and management sciences, economics, mathematics, statistics and modelling are among the many disciplines that bring new solutions to major health challenges.

CAHRD is a virtual network of organisations co-ordinated by LSTM. It brings together individuals and disciplines, working together across the full range of applied health research encompassing operational, implementation, and health systems research. Members of CAHRD also engage directly in supporting the delivery of a range of health interventions and services within developing countries.

CAHRD works across all four LSTM Departments and features a number of large research and delivery initiatives. It also collaborates with a range of organisations around the world including Ministries of Health, international and national non-governmental organisations, disease control programmes, public health institutes and universities.

As a result the CAHRD webpages on the LSTM website provide a range of practical resources, reports and policies developed with key global stakeholders that will help to pave the way in meeting one of the objectives of LSTM's Research Strategy: To translate research and knowledge into policies and practices that improve health outcomes, particularly for people living in resource-poor settings. ■



Department of Vector Biology

The Department of Vector Biology is made up of a diverse set of researchers, based in the UK and overseas, who are united by our mission to conduct and implement high quality research to reduce the burden of insect borne disease.

New appointments in Neglected Tropical Diseases

Two new members of faculty joined the Department in 2013 to strengthen our activities in the control of Neglected Tropical Diseases. Professor Steve Torr has joined us from the University of Greenwich. Professor Torr has spent over 30 years working on the behaviour and ecology of tsetse flies which spread sleeping sickness (Human African Trypanosomiasis) and nagana (African Animal Trypanosomiasis). Field studies, using a wide variety of research methods, have determined how and why tsetse flies are attracted to particular hosts. The results have led to novel methods of controlling flies by attracting them to lethal baits. These simple and cost-effective technologies have been widely applied to control human and animal trypanosomiasis in many parts of Africa.

Dr Lisa Reimer joins us after four years as the head of entomology at the Papua New Guinea Institute for Medical Research. Dr Reimer brings a wealth of laboratory and field experience on the mosquito vectors of filariasis and malaria. Her research spans from studies to identify the most efficient mosquito vectors of filariasis to field trials to evaluate how vector control can help reduce the transmission of lymphatic filariasis.

LSTM have also been key partners in the efforts to sequence and annotate the genome of *Glossina morsitans*, one of the key vectors of trypanosomiasis. The publication of this dataset will spearhead much needed research into novel control methods.

Supporting malaria control programmes in Africa

Research and technical assistance to evaluate alternative methods of malaria control continues to be a major activity of the Department. New activities in 2013 have included the implementation of an entomological data management system in Ethiopia; a review of the Indoor Residual Spraying programme in Ghana and development of an insecticide resistance management programme in Zambia.

AvecNet, a 16 partner consortium coordinated by LSTM, continues to generate new evidence for alternative malaria control tools that can tackle the rapid evolution of insecticide resistance in the mosquito vectors. New tools to track the behavior of insecticide susceptible and resistant mosquitoes have been developed and are being used in field studies in Burkina Faso and Tanzania. A clinical trial comparing the efficacy of a traditional bednet with a 'next generation' bednet, containing two active ingredients, will commence shortly in an area of West Africa where resistance to existing insecticides is already compromising malaria control. The outputs from AvecNet will help develop sustainable malaria control solutions for Africa.

The Department's research into insecticide resistance has been further strengthened by the award of a prestigious Wellcome Trust Senior Fellowship to Dr Charles Wondji. This will enable Dr Wondji to expand his successful current research on the mechanisms of resistance in *Anopheles funestus* to field trials to assess the impact of this resistance on control interventions. ■



Professor Hilary Ranson
Head of Vector Biology



Research excellence through partnerships

LSTM works in partnership with governments; international organisations; industry and other stakeholders to shape the global research agenda and to advocate for an environment where research, and its successful and demonstrable implementation, is central to the health and development agenda.

With the ongoing changes in the funding and policy landscape around tropical infectious diseases and global health it is essential that LSTM continues to position itself as a global leader and the 'partner to turn to' in its core expert areas of Neglected Tropical Diseases; malaria; maternal and child health; TB and respiratory diseases. Strategic partnerships that are consistent with the reputation and prestige of LSTM are essential to achieve this.

STRATEGIC PARTNERSHIPS LSTM AND UNIVERSITY OF WARWICK

The past academic year has seen the strategic collaboration between LSTM and the University of Warwick (UoW) go from strength to strength. Five joint appointments have been made, supported by a £4.5 million investment from both institutions and the Wellcome Trust. The appointments are in the areas of Diagnostics, Evidence Synthesis, Mathematics, and Neglected Tropical Diseases, including leading Entomologist Steve Torr, Professor of Neglected Tropical Diseases within LSTM's Vector Biology Department. Professor Torr is developing integrated approaches to controlling vector-borne diseases, including the use of insecticide-treated cattle to control tsetse, ticks, mosquitoes and midges, offering the prospect of controlling a range of diseases with a single intervention.



"The collaboration between LSTM and University of Warwick has, in the previous academic year, resulted in 5 joint appointments and £4.5 million investment from both institutions and the Wellcome Trust."

CAHRD strategic plan 2012 - 2017



LSTM's expertise in infectious disease control and international health complements UoW's strength in non-communicable diseases, health economics and statistics. The largest collaboration within this partnership is the Centre for Applied Health Research and Delivery (CAHRD). It is a network covering the full spectrum of applied health research, including research into the operation and implementation of health systems. It seeks to bring together a broad range of disciplines, in collaboration with ministries of health and non-governmental organisations in developing countries, to improve the health of poor and vulnerable populations. LSTM's strategic partnership with UoW is an essential component of CAHRD's strategy. One of its current collaborative research projects is developing and implementing TB diagnostics in developing countries, led by CAHRD Director and LSTM Professor of Clinical Tropical Medicine, Bertie Squire.

Demonstrating evidence for scaling-up health interventions is increasingly important to global health. Governments, funders and policy makers require evidence concerning the costs of interventions, their acceptability to communities and health system requirements. The combination of UoW and LSTM expertise creates a complementary team to improve evidence to support the scale-up of global health interventions such as TB treatment and diagnostics.

Staff and students at both institutions are finding seminars given by respective visiting academics to be a valuable method of accessing the latest research findings and facilitating this collaboration. Throughout the past academic year CAHRD 'themed' talks featured prominently in the LSTM Seminar Series.

Alongside joint research initiatives, LSTM will continue to explore how this partnership can support the expansion of education programmes. With further joint appointments and projects planned over the coming years, research from this collaboration will translate into cost-effective, affordable and scalable interventions for the world's poorest populations.

LSTM AND THE UNIVERSITY OF LIVERPOOL

Since 1900, only two years into its existence, LSTM has worked with the University of Liverpool (UoL) to deliver scientific achievement, excellence in teaching, improvements in global health and exceptional clinical services via the local NHS trusts throughout Merseyside. It was with the help of temporary laboratory facilities at the University of Liverpool that LSTM scientist Ronald Ross made the discovery that mosquitoes transmit malaria to humans and, in doing so, was awarded the Nobel Prize for Medicine in 1902. LSTM and UoL, collaborating in this manner to further research and teaching, laid a foundation for a long-term partnership.



"LSTM's new status as an independent HEI recognises their world-class research in tackling some of our most challenging health problems."

Sir Howard Newby, Vice-chancellor of the University of Liverpool

Until LSTM is granted degree-awarding powers, the delivery of specialist teaching programmes is the main area of collaboration with UoL. Eight education programmes and research degrees are designed and delivered by LSTM and at present continue to be awarded by UoL. However with LSTM's recent designation as a higher education institution (HEI), the process towards LSTM awarding its own diplomas, both in Liverpool and overseas, has begun.

Vice-chancellor of UoL, Sir Howard Newby, congratulated LSTM on receiving HEI status and highlighted the ongoing collaboration between both institutions by saying that "It will help build on Liverpool's reputation as a hub for knowledge and expertise in infectious disease. Together with the University's Institute of Infection and Global Health, we can make a significant contribution to the health and wellbeing of millions of people and we are proud to continue to partner with LSTM in this important area of research."

One of several joint initiatives is the Wellcome Trust-Liverpool-Glasgow Centre for Global Health Research (CGHR), previously known as the Wellcome Trust Tropical Centre (WTTTC). This was formed by the expansion of a pre-existing partnership between LSTM and UoL, funded by the Wellcome Trust, which now includes the University of Glasgow. Other partners of the Centre include the National Institute for Mental Health and Neurosciences, Bangalore, India; Instituto de Microbiología, Universidad San Francisco de Quito, Ecuador and Malawi-Liverpool Wellcome Trust Clinical Research Programme, Blantyre, Malawi. CGHR is promoting excellence in science; building capacity and driving strategic research collaboration in Global Health by supporting researchers in partner institutions to become independent researchers and future leaders in their field.

INTERNATIONAL PARTNERSHIPS

GLOBAL ALLIANCE TO ELIMINATE LYMPHATIC FILARIASIS (GAELF)

Formed in 2000, GAELF brings together public and private health partners in support of The Global Programme to Eliminate Lymphatic Filariasis (GPELF). It mobilises political, financial and technical resources to eliminate LF and alleviate the physical, social and economic hardship brought by the disease.

GAELF includes 12 academic and research institutions, including LSTM, who are strengthening the scientific basis of knowledge in LF, testing new treatment tools and strategies; providing postgraduate human capacity development and carrying out operational research. Its secretariat is based at LSTM's Centre for Neglected Tropical Diseases (CNTD) and contributes to the GAELF communications strategy, primarily through the organisation of biennial meetings. To address activities related to the GPELF the Centre receives funding from the UK Department for International Development (DFID) and GlaxoSmithKline (GSK). These include the implementation of mass drug administration (MDA) in 12 countries; laboratory strengthening within 6 countries; in-country workshops; PhD fellowships; operational research; advocacy and communications. The work is led by GAELF executive group member and CNTD Director, Professor Moses Bockarie.

Prof. Bockarie's Centre works closely with Professor Mark Taylor and his Department of Parasitology at LSTM, which, through the Anti-*Wolbachia* Consortium (A-WOL), is developing new LF treatments to address the growing threat of drug resistance. The public health benefits gained from the falling prevalence of LF are significant: analysis revealed that mass drug administration averted 32 million disability-adjusted life years and an estimated 6.6 million newborns were protected from clinical disease.

As a large-scale international public-private health partnership, GAELF is delivering advances towards the elimination of LF by 2020.



AFUTUREFREEOFLF
GlobalAlliance

COCHRANE INFECTIOUS DISEASE GROUP

Over the past 20 years the Cochrane Collaboration has helped policy makers, patients and health care practitioners make informed and evidence-based decisions. The Cochrane Reviews provide systematic reviews of primary research in human healthcare and policy and are internationally recognised as the highest standard in evidence-based healthcare.

“The Cochrane Review process is widely recognised as the most rigorous way of collating the evidence to provide the necessary information to assist policy making.”

The Cochrane Collaboration

The Cochrane Infectious Diseases Group (CIDG) is one of 53 review groups that make up the Cochrane Collaboration. CIDG is a partnership of over 300 reviewers from over 40 countries. LSTM provides the editorial base, led by Professor Paul Garner. Each of the reviews conducted looks at the benefits and risks a particular healthcare intervention poses, particularly in relation to malaria; TB; diarrhoea and neglected tropical diseases.

In the past academic year CIDG presented a number of reviews, one of them in July 2013 showing that a diagnostic test for tuberculosis (TB) can accurately and quickly detect both TB and drug-resistant strains. The findings can provide timely advice for clinicians and policy makers in countries where TB is a major public health problem. The World Health Organization (WHO) has recognised the contribution made by Professor Garner and the Group's wide commitment to evidence-based medicine by designating LSTM a Collaborating Centre for Evidence Synthesis for Infectious and Tropical Diseases.



THE COCHRANE COLLABORATION®

COUNTRY PARTNERSHIPS MALAWI-LIVERPOOL WELLCOME TRUST CLINICAL RESEARCH PROGRAMME (MLW)

Based in Blantyre, Malawi, MLW is a partnership that conducts biomedical research relating to tropical health and provides research training for clinical and laboratory scientists from Malawi and across the world. MLW is affiliated to the University of Malawi's College of Medicine (COM); the national medical school for Malawi. The partnership consists of COM; the University of Liverpool (UoL); LSTM and the Wellcome Trust, who are the major funder of MLW. The latter renewed its support by announcing in the summer of 2013 a donation of around £14 million for the next 5 years.

Overseen by MLW Director and LSTM Professor of Tropical Medicine Rob Heyderman, LSTM provides support to MLW's expanding translational research portfolio; state of the art research and teaching facilities and active hospital and community-based teams. Its research focuses on malaria; TB; HIV; non-communicable diseases; microbes; immunity and vaccines. Six LSTM PhD students are based in Malawi, contributing to this research portfolio.

“The Malawi-Liverpool-Wellcome programme has an excellent track record not just for its research, but for investing in the next generation of African researchers.”

Dr Jimmy Whitworth, Head of International Activities at the Wellcome Trust

A recent study by MLW showed a positive uptake of HIV self-testing in Blantyre, Malawi. Allowing people to self-test within their own homes was shown to provide more and better privacy and convenience than testing in public health facilities. Of almost 13,000 people recruited to the study, an uptake of 78 percent self-testing was demonstrated. One of the risks associated with self-testing was a perceived lack of support for those who tested positive. But Trial Coordinator Augustine Choko did not find a single case of suicide or serious adverse events, thanks to a strong network of local counsellors. A low uptake of regular HIV testing throughout the world is one of the major barriers to HIV control.

LSTM and MLW Clinical Research Fellow Dr Peter MacPherson, principal investigator on the study, said: “This is an approach that could be rapidly scaled-up as part of community HIV testing programmes to improve access to Antiretroviral Treatment (ART). Importantly, our results suggest that most people who have self-tested positive do need extra help to get them into HIV care in a timely fashion – so that this type of additional intervention may need to be factored in from the start.”

LOCAL PARTNERSHIPS A LOCAL ACADEMIC HEALTH SCIENCE SYSTEM

Launched in 2012, Liverpool Health Partners (LHP) is a Liverpool-based academic health science system bringing together the expertise from within the University of Liverpool (UoL); LSTM (represented by Professor David Lalloo) and seven local NHS trusts, to help ensure that medical research breakthroughs lead to direct clinical benefits for patients. LHP is organised around clinical academic programmes that demonstrate international excellence in research, supported by clinical services that can be developed in a coordinated way across LHP.

“The University of Liverpool's long standing relationship with LSTM underpins Liverpool's reputation as a leader in Infection and Global Health”

Professor Ian Greer, LHP Chief Executive

LHP is one of only a handful of Academic Health Science Systems in the UK, leading developments in the rapid translation of research into healthcare practice. The partners are working to position Liverpool as a leading centre nationally and globally for the uptake of innovative applied health research and education.

Clinical research is growing within the NHS and some of the research done at Liverpool's NHS trusts is informed by research conducted by LSTM in research poor countries. The work of LSTM's Respiratory Infection Control Group in sub-Saharan Africa is directly benefiting work with Royal Liverpool and Broadgreen University Hospital NHS Trust, Aintree Hospital and the University of Liverpool to improve outcomes for community acquired pneumonia. This area of research will undertake clinical trials at the Royal Liverpool University Hospital's Clinical Trials Unit (CTU), which has become the first NHS facility in England to be granted Medicines and Healthcare products Regulatory Agency standard and supplementary Phase I Accreditation. Likewise, this Liverpool-based research activity informs the treatment of patients in countries where respiratory infections, including TB, kill over a million people each year.

At a showcase event in June 2013 at Liverpool's Town Hall, LHP Chief Executive Professor Ian Greer commended LSTM's unique relationship with the University of Liverpool. It illustrates a partnership of organisations that add up to far more than the sum of its world-class parts: LHP will build a reputation as a national model for collaboration between the NHS, academic and research institutions and industry.



PARTNERING WITH INDUSTRY

A-WOL AND ASTRAZENECA

The Anti-*Wolbachia* Consortium (A-WOL) is an LSTM led consortium working to develop new drugs against onchocerciasis (river blindness) and lymphatic filariasis (elephantiasis). In order to identify those new medicines, in June 2013 A-WOL established a partnership with global innovation-driven biopharmaceutical company AstraZeneca.

A shared commitment to the World Intellectual Property Organization (WIPO) and the fight against neglected tropical diseases (NTDs) has allowed access to intellectual property for pharmaceutical compounds; technologies and data available for research and development. In this case AstraZeneca has committed to allow access to its High Throughput Screening (HTS) Centre and compound collection, which has not previously been freely accessible to academic institutions.

“This project marks a paradigm shift in the way knowledge is being shared (...) As a result; partnerships of this kind – between pharmaceutical companies and academic groups – are an essential component of translational research for NTDs.”

AstraZeneca statement, 27 June 2013

Having access to the screening compounds will allow A-WOL to determine if they are effective in killing *Wolbachia* – a bacterium that lives inside the parasitic worms that cause both river blindness and elephantiasis. Drugs can then be developed that are potentially suitable for mass drug administration programmes, as some such programmes are experiencing problems with resistance to new drug treatments.

The new UK-based HTS Centre, which opened early 2013, has access to leading automation and screening technology with a capacity for up to 50 HTS per year. It combines this with a carefully curated chemical library of 1.8 million drug-like and lead-like compounds which will create a leading infrastructure for hit discovery. This type of infrastructure has long been carefully guarded by industry, with chemical libraries of this nature being referred to as the ‘crown jewels’ of drug discovery. It is very rare for academic institutions working on NTDs to have access to diverse collections of this scale for their research. Manos Perros, Head of AstraZeneca's Infection iMED commented: “Over 100 million people suffer from river blindness, lymphatic filariasis and loaiaisis and most do not have access to treatment. This collaboration is part of our commitment to develop novel treatments for the most neglected diseases. We are very pleased that A-WOL is accessing this novel offering that is available via WIPO.” ■

High Throughput Screening at AstraZeneca



Department of Clinical Sciences

During its first year, the Department has brought together staff working across the spectrum of clinical science: experimental medicine, evidence synthesis, clinical trials, implementation and evaluation, teaching and clinical practice. The strategy has been defined, research successes achieved, new studies started and significant grants won.

Experimental medicine studies using controlled human infection with pneumococcus have led to significant publications and advancement towards an understanding of mucosal vaccination. We collaborate with the Butantan Institute in Brazil with MRC-FAPESP funding awarded to Dr Daniela Ferreira to promote joint work using controlled human infection to develop new pneumococcal vaccines. We have developed a new collaboration with the Centres for Disease Control and Prevention in Atlanta and University of Liverpool to advance a strategy for treating sepsis using augmentation of the natural immune response to infection.

Evidence synthesis team outputs have impacted in several policy areas. The Cochrane Infectious Diseases Group (CIDG) review of primaquine for reducing malaria transmission raised questions in the World Health Organization about evidence of true impact of this on malaria transmission; the committee advising on global vaccines used the Cochrane rotavirus vaccine review extensively when recommending the vaccine in Africa and the Group's re-analysis of the deworming for schoolchildren continued to impact on the policy debate.

Clinical trials work has expanded with the Joint Global Health Trials grant to fund an advanced cookstove intervention to prevent pneumonia among young children in Malawi. The Cooking and Pneumonia Study (CAPS) will study an advanced stove intervention that is expected to reduce smoke exposure by up to 90% potentially improving health by reducing infection and other smoke related lung damage. (See page xx) Studies to measure the effects on adult lung health have been added to the CAPS study, funded by an MRC New Investigator Research Grant awarded to Dr Kevin Mortimer.

We have ongoing work on the neglected needs of adolescent schoolgirls through an MRC/DfID/Wellcome Trust clinical trials grant with collaborative partners in western Kenya. This year has seen considerable international interest in our work around menstruation and the effect of health practices on education.

The department also hosts the secretariat of the global Malaria in Pregnancy Consortium undertaking 8 multicentre trials to evaluate new drugs, regimens and strategies for the treatment and prevention of malaria in pregnancy, to prevent and reduce the negative consequences of malaria in pregnancy. Multidisciplinary economic and implementation research studies to assess the acceptability, feasibility and cost effectiveness of these interventions are also being done.

Implementation and evaluation: In the field of applied health research, we are collaborating with Kenyan colleagues to determine the causes of mortality in 240,000 rural poor. Further, interventional studies to address the needs of rural people with chronic lung disease are being established. They build on work recently completed in collaboration with Epi-Lab in Sudan and REACH Trust in Malawi on engagement of informal providers in improving access to HIV and TB treatment.

Professor Stephen Gordon
Head of Clinical Sciences



ACE cookstove in Lesotho

Our TB studies in Ethiopia and Nigeria, lead by the clinical epidemiology group and funded by WHO, EDCTP and Grand Challenges, aim to increase access to diagnosis and treatment. Our work was highlighted by the WHO, the UN Assembly and the UK parliament. Our group is evaluating new TB diagnostic platforms in studies funded by the EDCTP and Grand Challenges Canada. Together with KIT Amsterdam we have identified markers that confirm TB in smear-negative patients.

Department projects: The portfolio of clinical trials has expanded considerably and we have responded to the growing need for large multi-site trials by developing a tropical Clinical Trials Unit (tCTU). It will provide research advice, support and training and act as resource investigators can access to develop ideas; protocol and grant application writing; project management; evaluation and finally preparing papers/reports.

Cookstove as used in the CAPS study



We have ongoing work on the neglected needs of adolescent schoolgirls through an MRC/DfID/Wellcome Trust clinical trials grant with collaborative partners in western Kenya.

Teaching and clinical practice: We link research strategy with capacity development by innovative teaching. For example, we teach Methods in Epidemiologic, Clinical and Operational Research (MECOR) to active physicians in Africa and host the LSTM Diploma in Humanitarian Assistance. This year, the 7th Annual MECOR course took place outside Nairobi just after the attack on Westgate Shopping Mall. The students and Faculty decided to go ahead with the course in solidarity with the Kenya Lung Conference and research colleagues in Kenya.

International links: These remain strong, particularly with Malawi. Professor Feiko ter Kuile and Dr Penny Phillips-Howard have moved to Kenya to work with the Kenyan Medical Research Institute/Centers for Disease Control (KEMRI/CDC) to develop research activities around malaria elimination, adolescent health and public health priorities. ■

The impact of LSTM's research on policy and practice

LSTM strives to translate its research outcomes into policy and practice. It does so by providing a coordinated and multi-disciplinary approach to strengthening capacity and delivering large scale operational research.

To measure its impact LSTM develops and provides monitoring and evaluation methodologies and systems and operates as a centre of excellence in research synthesis for evidence-informed policy. The resulting outcomes will be used to advocate for scale-up of effective interventions in areas such as maternal and child health; respiratory, neglected tropical and other vector borne diseases. To illustrate this scale-up, the highly successful Making it Happen programme from LSTM's Centre for Maternal and Newborn Health (CMNH) will build the capacity of over 17,000 healthcare workers to provide evidence based, woman friendly, high quality care. By training of a cadre of 1,000 national facilitators or 'Master Trainers', providing training equipment, influencing pre-service training and introducing additional quality improvement methodology, the benefits of the programme will be sustained beyond the immediate funding period and original facilities.

Building a replicable model for HIV Testing and Counselling

LSTM has developed a successful approach to the rapid scale-up of HIV testing and counselling (HTC) services in high prevalence countries, a vital component of the global HIV response. The model combines comprehensive quality assurance with operational research and has led to HTC expansion in mobile, home and facility-based settings. It has also allowed for responsiveness to local needs leading to post sexual violence care services linked to HTC, services for the deaf and HTC for men who have sex with men (MSM) and other hidden populations in Africa. The global impact of

A woman in Mozambique receives malaria medication



this model is reflected in World Health Organization (WHO) policy, the Ministry of Health HTC guidelines in numerous countries in Africa, the continuing work of an indigenous Kenyan Non-Governmental Organisation and expansion of HTC through community outreach in the UK.

While Kenya continues to scale up services, the principles established in the early research have enabled its rapid scale-up through a variety of approaches including mobile, outreach and home-based testing. LSTM Senior Clinical Lecturer, Dr Miriam Taegtmeier recently led the development of a practical handbook on planning, implementing and monitoring home-based HTC. LSTM also convened the first international symposium on HIV self-testing in April 2013 where evidence on social and public health issues was presented and ethics, human rights and scale-up debated.

New WHO guidelines for HIV treatment

At the 2013 International Aids Society Conference in Kuala Lumpur, Malaysia, the WHO released new HIV treatment guidelines recommending offering antiretroviral therapy (ART) earlier than was recommended by previous guidelines. These new guidelines were produced by the development group for the operational and service delivery section of WHO recognising the importance of expanding access to treatment.

Dr Miriam Taegtmeier, a core member of the guideline development group said: "Unlike previous HIV guidelines, the new update goes beyond clinical recommendations (What to do?) to include operational (How to do?) and programmatic (How to decide what to do and where) recommendations to provide comprehensive guidance to national programme managers and policymakers. Another key feature of the guidelines target all age groups and populations."

The guidelines were also informed by a Cochrane Review, authored by the LSTM-based Cochrane Infectious Diseases Group (CIDG) and authors from the Cochrane HIV/AIDS Review Group. The study found that fewer patients were lost to care when they continued on antiretroviral therapy at a health centre or in community settings, rather than in hospitals.

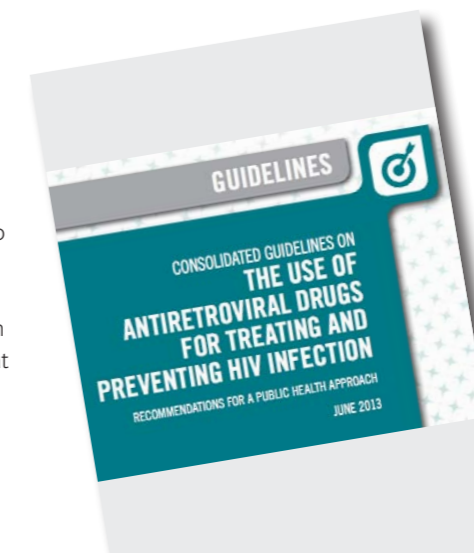


WHO believes that the new guidelines, entitled "Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection", could avert an additional 3 million deaths and prevent 3.5 million new HIV infections between now and 2025.

LSTM provides the editorial base for CIDG, which is part of the Cochrane Collaboration, the not-for-profit, global health research review network of approximately 28,000 reviewers across 120 countries. CIDG has contributed hundreds of systematic reviews, many of which have directly led to changes in health policy or guidelines.

"These guidelines represent another leap ahead in a trend of ever-higher goals and ever-greater achievements,"

WHO Director-General Dr Margaret Chan



LSTM study leads WHO to update its malaria prevention policy

A study led by LSTM has been a critical element in informing the new WHO policy recommendation on intermittent preventive treatment for malaria in pregnant women (IPTp) who live in malaria-endemic regions of sub-Saharan Africa. Study results show that when pregnant women received three or more doses of preventive therapy instead of the standard two-dose regimen the newborns had higher birth weights.

"This updated policy will benefit pregnant women in the 36 malaria endemic countries in sub-Saharan Africa which have adopted IPTp with SP as national policy."

Dr. Robert Newman, Director of the WHO Global Malaria Programme

Results of this study were published in the Journal of the American Medical Association (JAMA) in February 2013. LSTM Professor of Tropical Epidemiology and senior author of the study, Feiko ter Kuile said that the team was pleasantly surprised by the consistency and magnitude of the beneficial effect that can be achieved by providing these additional doses during the last 10 weeks of pregnancy, which is a critical period for foetal growth.

The updated malaria prevention policy could contribute to increased uptake and quality of antenatal care services in Africa. The adapted protocol is now more closely aligned to WHO's Focussed Antenatal Care (FANC) schedule, ensuring that intermittent preventive treatment can be given to pregnant women during each scheduled Antenatal Care (ANC) visit, improving outcomes for the mother and child.

Dihydroartemisinin-piperaquine added as a treatment option for malaria

In the WHO malaria guidelines LSTM and the Cochrane Collaboration were commissioned to assess new Artemisinin-based combination therapies (ACT) treatment options. In the Cochrane review prepared for the WHO Guidelines panel, the analysis clearly showed that this drug consistently performed as well as and often better than other ACTs, and led the panel to recommend this as a new option for treating malaria. This drug is likely to become one of the most important ACTs in the next five years.

Building an evidence-based blood transfusion service for sub-Saharan Africa

LSTM's Capacity Research Unit (CRU) is leading an EU funded project to build research capacity for blood transfusion services in Africa (T-REC). Led by LSTM's Professor Imelda Bates, this consortium has partners in the Universities of Copenhagen (Denmark) and Groningen (Netherlands), and blood transfusion services in Ghana and Zimbabwe. Their recent achievements include a successful PhD programme with four students in Zimbabwe and Ghana who are all progressing well. Their projects include changing HIV patterns, the economics of infection screening, donor motivation and rationalising syphilis screening.



Finger prick being undertaken on pupil as part of blood donation drive at school in Zimbabwe

The CRU's Diploma in Project Design and Management is a work based part-time course, for which graduates receive an LSTM Professional Diploma award. The course has been extended from Kumasi in Ghana to Accra and also to Harare in Zimbabwe. The popularity of this course has increased substantially. It is already self-sustaining in Kumasi and staff is currently working to ensure that the Diploma can run independently of T-REC in the two additional sites after 2015.

T-REC also provides student bursaries: supplementary research funds provided to undergraduate and postgraduate students in Ghana and Zimbabwe to undertake research on a blood transfusion related project. This initiative is working well for encouraging students from local universities to conduct research related to blood transfusion in a range of disciplines including medicine, science and media studies, and for forging new collaborations between the transfusion services and their local universities.

Close-to-Community Health Providers boost community-based healthcare

Close-to-community providers, including midwives, traditional birth attendants, community health workers, and lay counsellors form the backbone of the health system in many settings. Working directly with individuals and families, often in their homes and workplaces, they are in a unique position to observe and understand the factors that influence good health. Health programmes that employ close-to-community providers show a great deal of promise in extending access to quality services. But they also face challenges. Loss of staff motivation; problems with health worker retention; inadequate resource management; multiple workloads; a lack of quality assurance and poor monitoring and evaluation systems can mean that they fail to have the impact that they should.

The REACHOUT programme, launched in March 2013 and funded by the European Commission's Seventh Framework Programme for Research and Technological Development, is working in Bangladesh, Ethiopia, Indonesia, Kenya, Malawi, and Mozambique to address these challenges. REACHOUT is using action research to test different interventions to strengthen close-to-community programmes through 'improvement cycles'.

Through its multi-country and systematic approach to researching close-to-community providers REACHOUT has the potential to provide valuable insights on how countries that are grappling with human resource constraints can scale up to universal coverage, particularly amongst the poor and the marginalised. Importantly it will also lend support to close-to-community providers, who often work as volunteers in very challenging circumstances.

REACHOUT has already conducted an in-depth situation analysis of what is happening in close-to-community programmes. This is helping to uncover what kind of systems and structures are in place, any weaknesses in the implementation of programmes and the opinions of communities on potentially beneficial changes.

Development of effective cures for Neglected Tropical Diseases

In recent years, more attention has been brought to bear on eliminating neglected tropical diseases (NTDs), of which lymphatic filariasis and onchocerciasis are two. Millions of people are at risk or are infected with NTDs.

Scientists at LSTM have found a cure for filarial parasitic worms, targeting an essential bacterial organism (*Wolbachia*) with a course of antibiotics, which cures patients of their worms and improves disease outcomes. This discovery offers superior results compared to existing anti-filarial drugs by permanently blocking disease transmission and improving case management therapy.



Onchocerca larvae

The breakthrough of anti-*Wolbachia* therapy is of major global importance. The antibiotic treatment is already tried and tested for other bacterial diseases and therefore does not need to undergo a series of safety trials. The drugs are readily available to people with filariasis and are cheap as well which is very important in countries where these diseases are endemic. This approach has been recognised by donor agencies, such as the Bill & Melinda Gates Foundation, through a \$34 million investment in the Anti-*Wolbachia* (A-WOL) consortium and has been adopted by elimination programmes for onchocerciasis (OEPA) and lymphatic filariasis (GPELF) as new strategies for elimination and morbidity management.



Drug distribution against Onchocerciasis

Anti-*Wolbachia* therapy delivers safe macrofilaricidal activity with superior therapeutic outcomes (92-98% cure rate) compared to all standard anti-filarial treatments, with the added benefit of substantial improvements in clinical pathology (improvement in lymphedema stage in 44% of patients cf. 5% with standard therapy). These outcomes can be achieved with existing registered drugs, e.g. doxycycline, that are affordable, available to endemic communities and have well known safety profiles.

In terms of the impact on policy, in 2012 the Onchocerciasis Elimination Programme of the Americas (OEPA) adopted doxycycline for the treatment of residual cases in the North-Eastern focus in Venezuela. In 2012 the Global Alliance for the Elimination of Lymphatic Filariasis (GAELF) endorsed the use of doxycycline as a new tool for morbidity management of elephantiasis.

Informing other WHO policy and guidelines

WHO regularly reviews policies and guidelines for international healthcare or re-enforces existing ones such as the one on a diagnostic test for tuberculosis, following the publication of research from LSTM and global partners. The organisation has also improved the way it develops global guidelines, with the help of researchers from LSTM and the South African Cochrane Centre, who were invited to re-evaluate WHO guidelines.

"WHO recognizes the importance of high-quality guidelines when making recommendations in public health. The Organization therefore values both the recognition of the current gains and welcomes the encouragement for continuous improvement."

Dr Charles Penn, Chair of Guidelines Review Committee, WHO

Published in the medical online journal PLOS One, the researchers found that the procedures put in place to assure quality could still be derailed by WHO departments wanting to do things their own way. Researchers found substantial resistance to change, however LSTM and partners have continued to inform WHO policies and guidelines, producing real change. ■



A woman on TB treatment at a hospital in India

A health worker measures a newborn in a Bangladeshi village



Department of International Public Health

Our department brings together diverse, highly skilled professionals and supports a range of research models from individual fellowships and project grants to large, multi-partner consortia. We focus particularly on health systems research and the use of research to guide policies and programming.

Each unit is led by highly experienced academics and supported by effective managerial and administrative staff.

This year there has been a significant expansion in the number of projects and staff in the Department of International Public Health (DIPH). REACHOUT, a new EU funded project was launched and works closely with deprived communities in low income countries. Fieldwork for REACHOUT is now underway in six countries. One of our well-established EU projects, ReBUILD was represented at the Health Systems Research (HSR) symposium in Beijing late 2012. At HSR the ReBUILD team led a Thematic Working Group on health systems in Fragile and Conflict Affected States and early evaluations of financing schemes for delivery care in India under Maternal health in India (MATIND) were presented.

Our academics convened the first ever global meeting on HIV self-testing at the Brocher Foundation in Geneva and a new cross-departmental post has been established in social science and NTDs.

In the PERFORM action research programme District Health Management Teams in Ghana, Tanzania and Uganda have developed and begun implementing strategies to improve health workforce performance. Our Improving post-abortion family planning in China (INPAC) project has completed analysis of current post-abortion family planning services in China and is designing improved services. DIPH's Monitoring, Evaluation, Technical assistance, and Research Team (METRe) unit has been supporting UNICEF to establish decentralised monitoring systems and develop online M&E tools. In South Sudan METRe is establishing national information systems to improve clinical healthcare services and in Uganda they are supporting mother/child HIV services and supporting DFID's evaluation of its performance based financing policy. In Odisha, India METRe is assisting national Vector Programme in its fight against malaria. DIPH's Centre for Maternal and Newborn Health continues to expand as a global centre of research excellence.

Professor Imelda Bates
Head of International Public Health



Lab technician in Kenya

Striving for global equality in maternal and newborn health

Almost 300,000 women die each year from complications during pregnancy and childbirth. This equates to a woman dying every 2 minutes. For each death, 30 women live but suffer lifelong morbidity. In addition, 3 million babies per year across the world are stillborn and an additional 3 million babies die in the first week of life.



Community health workers oversee drug distribution

Our Capacity Research Unit uses multi-disciplinary participatory and developmental research to design and track capacity strengthening projects in health and non-health contexts.

Examples of our current projects include strengthening laboratory systems for neglected tropical diseases, evaluating a national health research capacity strengthening programme in Malawi, and helping the Royal Society to maximise the potential for enhancing research capacity across multi-national non-health research consortia.

DIPH staff provides a significant input as leaders and tutors for LSTM's teaching programme. Because our course tutors are at the forefront of generating research and guiding policy, their teaching is strongly research driven and is highly valued by our all of our students. ■



Training participant in Somaliland

LSTM's Centre for Maternal and Newborn Health (CMNH) has continued to position itself as a global centre of excellence in implementation research. The Centre's work falls into 3 main categories: **design, implementation and evaluation.**

Design

This year CMNH has redesigned its Emergency Obstetric Care and Newborn Care (EOC&NC) "skills and drills" training package, which is based on extensive evaluation of the effectiveness of implementation across African and Asian countries. The Centre has been approached by global and national organisations to deliver and franchise it in additional settings.

The Making it Happen with Data package was piloted this summer with excellent results, building the capacity of healthcare providers in collecting and using data for monitoring and evaluation of practice as part of the wider Making it Happen (MiH) project.

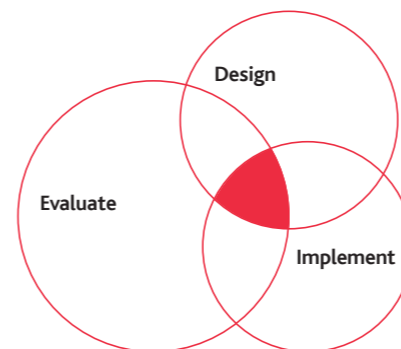
A new Quality Improvement (QI) package was designed, peer-reviewed, and piloted in Zimbabwe, Kenya, Sierra Leone and Malawi. Quality of Care is about delivering effective health services consistent with the best evidence, i.e. healthcare which is safe, effective, patient-centred, timely, efficient and equitable. QI teams in 150 healthcare facilities will use this package in the next 2 years. New indicators for measuring QI were also developed.

CMNH has worked with international partners to define non-severe maternal morbidity as an outcome indicator, and has designed an assessment tool, which will be piloted in Pakistan and Malawi in 2014.

A leadership and management package for Maternal and Newborn Health (MNH) is being developed, which aims to improve the capabilities of managers from the facility level right up to the Ministry of Health.

"LSTM has a proud tradition of leading the way in research, with Maternal & Newborn Health an example of an area of excellence and strategic importance. The Centre for Maternal and Newborn Health has developed a unique reputation for designing, implementing and measuring intervention packages"

Baroness Helene Hayman,
External Advisory Group to CMNH





An obstetrical emergency survivor and healthy baby in a Bangladesh hospital

Implementation

Over the last year the Centre forged ahead with its mission of reducing maternal and newborn mortality and morbidity by supporting 169 healthcare facilities to increase the availability and quality of Skilled Birth Attendance and Emergency Obstetric Care and Newborn Care.

“The concept of composing and utilising standards to improve quality of care is relatively new to me and my colleagues. Thank you to LSTM for emphasising the structure and process we should be using to improve outcomes.”

QI Training Participant, Sierra Leone, May 2013

CMNH £18 million flagship project, Making it Happen (MiH), is now operational across 11 countries in Africa and Asia, working in partnership with Ministries of Health, LSTM offices and staff in-country, and leading local research partners.

By September 2013, just over 3500 healthcare providers were trained in EOC&NC; 152 attended Making it Happen with Data workshops; 82 were trained in QI workshops; 498 new Master Trainers were trained; 15 Skills Labs were established in hospitals allowing staff to improve skills with up-to-date equipment and 236 training rooms were equipped.

In 2013 a new programme started to build capacity of Maternal and Child Health (MCH) Aides, the biggest group of health care providers providing Skilled Birth Attendance (SBA) across Sierra Leone, through support to and evaluation of an expanded scope of work including Family Planning.

Evaluation

Building on the success of the monitoring and evaluation framework used under Phase 1 of MiH, the Centre expanded the framework which includes measurement of healthcare provider reaction to the training; the change in knowledge and skills health care facility functionality and indicators of Quality of Care. In addition the availability, uptake and effect of care packages are being measured.

The past academic year saw the Centre win the contract with UNICEF to conduct a three-year programme evaluation of the Health Transition Fund (HTF) in Zimbabwe, a national initiative which aims to revitalise the public health system with a particular focus on mothers and babies.

CMNH is currently completing a mapping of MNH data collected in Emergency and Humanitarian settings, for WHO.

The Centre has continued to increase its publications over the year and its paper on Emergency Obstetric Care in Somaliland was selected by the Global Emergency Medicine Review out of a field of 5000 papers as one of the top global emergency medicine articles of 2012.

In the coming year it will also be launching a Quality of Care supplement for the British Journal of Obstetrics and Gynaecology (BJOG).

CMNH played a key role in the Royal College of Obstetricians and Gynaecologist's World Congress in June 2013, showcasing the Centre's research by delivering 3 keynote scientific presentations and 2 pre-congress workshops.

In October 2013 staff attended FIGO's (International Federation of Gynaecology and Obstetrics) first Africa Regional Conference in Ethiopia to disseminate research findings in four scientific presentations and three free communications sessions as well as hosting two pre-congress workshops on EOC&NC and QI.



Mother with baby in Pakistan

Looking Ahead

CMNH's research grant total now stands at over £20 million with a further £10 million worth of proposals awaiting approval.

To assist in the Centre's future development and provide external critique of its work CMNH convened an External Advisory Group (EAG), chaired by Baroness Helene Hayman. The EAG comprises leading figures from the world of Maternal and Newborn health, and has supported the 5 year Business Strategy and supporting Communications Plan, which lays out the Centre's key objectives and priorities for growth.

The CMNH has a team of over 60 members of staff working in Liverpool and overseas and this number is expected to expand further in 2013/2014.

Maternal conditions are the second most common cause of death in women of reproductive age in low and middle income countries. In contrast, maternal death does not feature in the 10 most common causes of death in high income countries.

As long as this disparity exists CMNH will continue with its vision of 'striving for global equality in Maternal and Newborn health'. ■

Working with the NHS

LSTM works with several UK National Health Service (NHS) Trusts across Merseyside and the North West to deliver clinical services; conduct clinical research and promote public health.

Clinical treatment

The Tropical and Infectious Diseases Unit (TIDU) at the Royal Liverpool Hospital provides treatment for patients with infections including tuberculosis (TB) and HIV as well as a host of tropical diseases including malaria. TIDU is the regional adult unit for tropical and infectious diseases and offers a wide variety of inpatient and outpatient services. The unit is supported by clinicians from LSTM, whose international expertise ensures that patients receive the highest standard of treatment. TIDU was the focus of a Discovery Channel documentary partly filmed in the hospital during 2012 and broadcast over summer 2013. The series 'Bugs Bites and Parasites: Tropical Diseases Uncovered' explored the diagnosis and treatment of patients by LSTM and NHS doctors. disseminate research findings in four scientific presentations and three free communications sessions as well as hosting two pre-congress workshops on EOC&NC and QI.



Research to improve respiratory medicine

LSTM's Respiratory Infection Group, led by Professor Stephen Gordon, conducts laboratory and clinical research aiming to understand susceptibility to respiratory infection and to develop new preventative and therapeutic strategies. LSTM coordinates a cross-Merseyside respiratory research strategy encompassing themes of airways and physiology, infection and inflammation, cancer and global health. The NHS continues to be a crucial partner in developing new diagnostics and treatments in respiratory medicine.

A good example of collaboration across NHS, academia, primary and secondary care in Merseyside is a £1,879,410 National Institute for Health Research grant, funding a study into 'the clinical and cost-effectiveness of temporarily quadrupling the dose of inhaled steroid to prevent asthma exacerbations; a pragmatic, randomised, normal care controlled, clinical trial: FAST' with LSTM as the lead local academic institution.

Building upon the success of the first joint respiratory medicine appointment of Dr Kevin Mortimer, LSTM and Aintree University Hospital jointly appointed Dr John Blakey, who brings expertise in asthma and technology-enabled innovation for unscheduled medical care. A third joint appointment of a Senior Academic (Clinical) in Respiratory Medicine is now being made between LSTM and the Department of Respiratory Medicine at the Liverpool Heart and Chest Hospital (LHCH).

Research into respiratory medicine relates to pulmonary infection and non-communicable diseases, particularly pneumonia and tuberculosis, including the effect of inhaled air pollutants particularly biomass smoke exposure. These research themes are being explored in partnership with the University of Liverpool, the Liverpool Wellcome Trust Tropical Centre, the NIHR Comprehensive Local Research Network, Liverpool Heart and Chest Hospital (LHCH), Aintree University Hospital (AUH), the Royal Liverpool University Hospital (RLUH) as well as the Malawi-Liverpool-Wellcome Programme in Clinical Tropical Medicine.



Arrival of cookstoves in Malawi

Exposure to smoke produced when biomass fuels are burned in open fires is a major avoidable risk factor for pneumonia. A team from LSTM and AUH are leading on the development of the Cooking and Pneumonia Study (CAPS), investigating how to reduce the effects of domestic smoke inhalation, which is a problem in low and middle income countries around the world. In June 2013, LSTM hosted the first meeting of the CAPS Trial Steering Committee, where Co-Principal Investigator Dr Kevin Mortimer said: "the implications could be enormous and benefit millions of people around the world."

Clinical Research Unit (CRU)

The Clinical Research Unit (CRU) at the Royal Liverpool University Hospital provides state of the art dedicated facilities to support high quality clinical research. The CRU is a resource open to researchers from all disciplines encouraging collaboration with investigators in Liverpool and beyond. In 2013 it became the first NHS facility in England to be granted Medicines and Healthcare products Regulatory Agency (MHRA) standard and supplementary Phase I Accreditation. This accreditation will allow the Royal, together with the University of Liverpool, LSTM and six other local NHS Trusts that comprise Liverpool Health Partners (LHP) to be at the forefront of clinical developments and drug trials to prevent illnesses; provide faster diagnoses and find new treatments.

The CRU is facilitating clinical trials of some of the newest treatments under evaluation. LSTM's Respiratory Medicine Group is conducting two clinical trials at the CRU, both led by Professor Stephen Gordon.

The first trial is part of a larger project aiming at developing novel pneumococcal vaccines for the future. Pneumococcus is a bacterium that is the leading cause of pneumonia and is responsible for the death of 500,000 children each year. The Pneumococcal conjugate vaccine and experimental human pneumococcal carriage (PCV and EHPC) is a randomised controlled trial at the Clinical Research Facility (CRF) at the RLUH, investigating the effects of the PCV vaccine upon nasal carriage of pneumococcal bacteria compared with Hepatitis A vaccine as a control. Healthy volunteers are randomly allocated to receive either PCV or Hepatitis A vaccination and following vaccination they are inoculated with live pneumococcal bacteria in the nose. Volunteers are closely monitored for 4 weeks to determine if they develop pneumococcal carriage.

A second CRU-based trial involves P4 peptide treatment in severe Community Acquired Pneumonia (CAP). This trial, ongoing in the Intensive Care Units of RLUH and Aintree University Hospital (AUH) and funded by Grifols and Liverpool Health Partners (LHP), aims to test a novel treatment ex vivo to determine if this can benefit future patients in the Intensive Care Unit (ICU) diagnosed with CAP. The Respiratory Medicine Group has previously demonstrated that this peptide can up regulate the immune response to kill more bacteria in healthy adults. The aim of the study is to determine if this can also be observed in the ICU patient population as this will be the intended patient group for the treatment.

Liverpool Health Partners (LHP)

LHP facilitates many of LSTM's joint clinical research projects with the NHS and showcases Liverpool as a hub for funders, industry and academic institutions to collaborate with the NHS. Representing LSTM within the partnership, Professor David Lalloo said:

"By working together, the partnership aims to enhance and improve research, clinical education and healthcare delivery throughout Liverpool and the wider region. Membership of the partnership will facilitate the NHS research undertaken by LSTM."

Professor David Lalloo, LSTM



Promoting public health

LSTM hosts the regional co-ordinator of the North West TB Cohort Audit as a secondment from Public Health England (PHE). The cohort audit was pioneered in developing countries to improve clinical outcomes of TB patients. It has been adapted and implemented by the North West TB Summit which is a joint initiative between PHE, NHS Trusts and others. The regional co-ordinator works with Professor Bertie Squire within the Collaboration for Research on Equity & Systems in TB & HIV-AIDS (CRESTHA). More than 200 health professionals are involved in audit of approximately 700 TB cases across the UK's North West each year. The purpose of audit is to prevent TB transmission through improved TB case management. CRESTHA staff and the Regional Co-ordinator are working on a qualitative evaluation of health professional perspectives on the process. Because of its track record of using multi-disciplinary applied health research to promote quality of care in TB control in developing countries and its link, through Professor Squire, to TIDU (see above), CRESTHA is hosting the TB Cohort Audit and contributing to the efforts of the North West TB Summit towards making the North West TB-free. ■

Well Travelled Clinics Ltd

Well Travelled Clinics had its strongest trading year ever in 2012-13 with patient numbers up by 11.2% in Liverpool and by over 25% in Chester. Overall, income rose by 7.5% on the previous year.

In October 2012 the Chester clinic relocated to a more visible row-level property just below our original clinic. The more commercial location of this property has led to an increase in patient numbers with more patients walking in to book appointments and buy products.

In Liverpool, a number of key new corporate contracts have been developed this year and our income from business travel has grown. In addition, we have also started providing some occupational health services to both LSTM and our external clients.

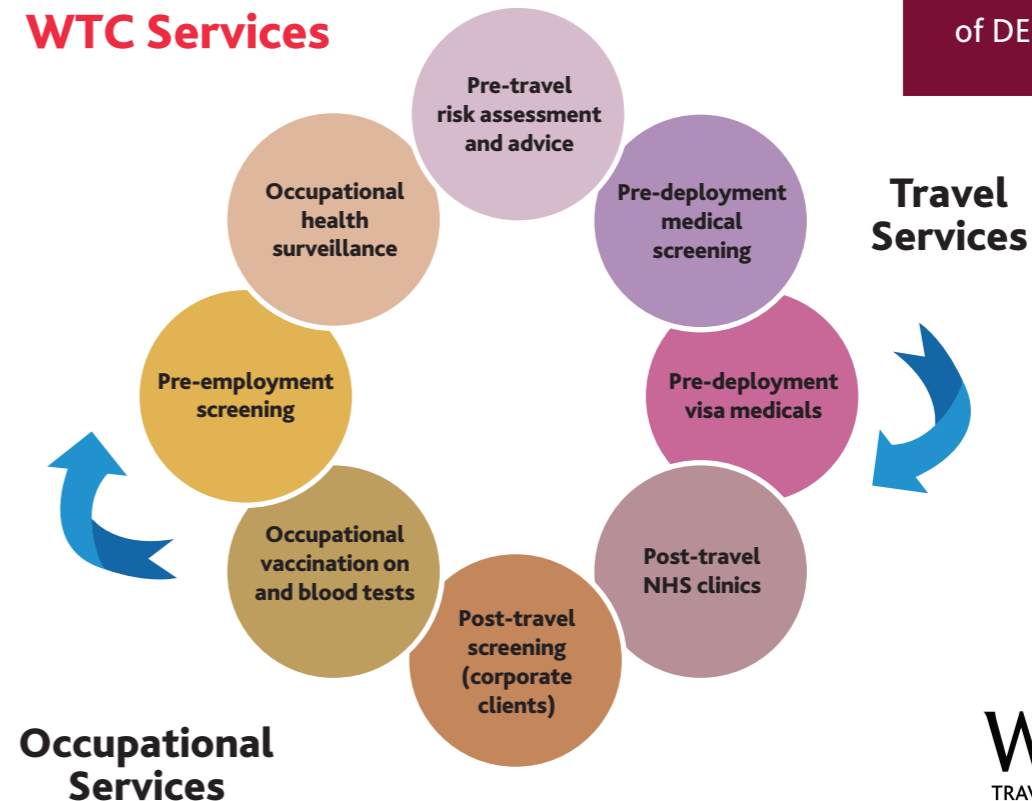
In the year ahead, WTC is going to develop a new four year business plan to grow sales to secure profitability. We plan to extend our opening hours at the Chester clinic; broaden our occupational health base in Liverpool and re-develop our on-line retail section of our website. We will continue to extend and expand our clinical services to ensure that we meet the needs of our corporate clients to ensure the health of their workforce in the UK and overseas. ■

2012/13 AT A GLANCE

This year, Well Travelled Clinics:

- Saw **10,554** patients
- Answered **22,323** phonecalls
- Gave **12,008** vaccines
- Dispensed **91,150** malaria tablets
- Sold **2775** bottles of DEET repellent.

WTC Services



Social mission

LSTM has been working for 115 years to save lives in resource poor countries through providing high quality, scientifically robust and relevant research evidence, education and capacity strengthening. Our staff aims to reduce the burden of sickness and mortality in disease endemic countries through the delivery of effective interventions which improve human health and are relevant to the poorest countries. To achieve this mission, we need to have the right people, with the right skills working together to achieve our organisational goals.

Our values underpin the core behaviours for LSTM staff and support us in achieving our mission. These values are:

- **Making a difference to health and wellbeing**
- **Excellence in innovation, leadership and science**
- **Achieving and delivering through partnership**
- **An ethical ethos founded on respect, accountability and honesty**
- **Creating a great place to work and study**

As LSTM continues to grow, the Human Resources Team has been working hard to ensure that staff embeds these values, recognising the importance of developing not just the organisation but its people. In 2013 we were happy to announce the renewal of our Investors in People (IIP) Standard, an accreditation that we are proud to have maintained. The findings from the IIP review showed that people at LSTM enjoy their roles and that we continue to encourage a diverse and talented workforce willing to share ideas and promote an inclusive learning culture.

Christine Greenway, Director of Human Resources said: "I would like to thank all staff for their support in achieving the reaccreditation status under the IIP award. Part of the work underpins our ambition in achieving the Athena Swan Award and informs the Equal Opportunities Committee in areas for future development."

The review particularly praised the School's exemplary equality and diversity practices, the introduction of coaching to support the leadership and management of our organisation, our investment in communications, the introduction of a salary review process, the investment in growth through new premises, and the introduction of a new HR management information system in-house. LSTM has improved considerably since the 2010 review and hopes to see this approach continue as we begin our time as a higher education institution.

Our senior management team also recognises the importance of continued development for all of our staff and is now working towards the Bronze Standard for the Athena Swan Award. This Award recognises commitment to advancing women's careers in academia for science, technology, engineering, mathematics and medicine. ■



Christine Greenway
Director of Human Resources



Fundraising

Being both a charity and a higher education institution means that LSTM is facing an increasingly restricted UK funding environment, with individuals having less disposable income, charitable trusts reducing the levels of support they can offer and government cutbacks hitting education and health budgets. The requirement to create a broad funding mix is stronger than ever.

Diversity of support

Online donations have risen by almost 200% in 2013 thanks to a documentary featuring LSTM shown on the Discovery Channel. The 'Bugs Bites and Parasites: Tropical Diseases Uncovered' programme, highlighted the work of LSTM clinicians and researchers both in the local Royal Liverpool Hospital and overseas. Donors left encouraging messages alongside their donations praising the efforts of LSTM doctors.

Training to boost the skills of sexual and reproductive health professionals requires the support of scholarships to attract students from low-resource countries. The Oglesby Charitable Trust is a long-standing supporter of the Diploma in Reproductive Health in Developing Countries (DRH) education programme, funding scholarships that allow students to reduce reproductive mortality and morbidity. Trustees of the Trust take an active interest in the students, meeting with them in person to learn first-hand about improving reproductive health within low-resource communities, hospitals and health centres.

LSTM's Centre for Neglected Tropical Diseases hosts the secretariat for the global alliance responsible driving the elimination of lymphatic filariasis (LF), a parasitic disease also known as elephantiasis. One anonymous supporter has for many years given a monthly donation to help the Centre support NTD control programmes. Regular giving can help to drive forward research that provides health professionals with the right knowledge, skills and resources to meet disease elimination targets and, in doing so, relieve suffering.

The expansion of LSTM's estate is only possible with the support of major public and private sector funders. The Wolfson Foundation, following an earlier grant for the construction of the CTID building, awarded in 2013 another grant of £1.5 million towards the Anson House project opposite CTID that will house the Centre for Maternal and Newborn Health. This commitment has been echoed by the UK Regional Growth Fund, which has contributed a further £1.5 million and the European Regional Development Fund with a grant of £2 million. ■

Attracting the world's best students to become some of the world's best scientists, researchers and doctors requires your support, so that LSTM is in a position to offer scholarships.

There are many ways to support LSTM, from corporate sponsorship to leaving a gift in your will.

If you would like more information on how to support LSTM please contact:

Billy Dean, Development Officer,
Liverpool School of Tropical Medicine,
Pembroke Place, Liverpool, L3 5QA.

Or alternatively you can email:
william.dean@liverpool.ac.uk
or phone **0151 705 3272**

A full list of donors during this period can be found in the LSTM Financial Statements 2012 – 2013 publication.



Governance

LSTM was originally set up as a private, limited by guarantee, company that holds no share capital, and has registered charitable status. Private is self-explanatory, and limited by guarantee is just what is described in that members act as guarantor of £1. As a registered charity, LSTM reinvests all surpluses into its core activities in support of its charitable objective.

Members elect a Board of not more than fifteen trustees - on a three year rotation. The Board is responsible for the governance of LSTM and empowering the senior management to run the operations of the organisation.

On the 19th of July 2013, the Secretary of State, by an order of parliament, designated LSTM as a higher education institution and consequently LSTM is now a public body. Some minor amendments will be introduced to the constitution after approval by the Privy Council who are advised by the Department for Business, Innovation and Skills [BIS] and the Higher Education Funding Council for England [HEFCE].

LSTM continues to be a registered charity and will consider the consequences, both positive and negative of evolving to an exempt charity over the next years.

These minor amendments will include:

- Incorporating the phrase "Higher Education Institution" in the name.
- Replacement of the two University of Liverpool nominated Trustees with an elected student representative as a Trustee and another elected member to the Board.

LSTM's Board is selected to provide assurance to the members that it has the skills, ability and experience to guide senior management in all its activities. The Board's composition is organised by performing a skills audit to compare the specialities of the individual Trustees with the governance demands of a leading international organisation. When vacancies arise the skills gap is identified and new recruits are selected to fill that gap, complementing the existing Board.

It is important to note that LSTM places high demands on its Trustees who generously contribute many days of their time in the course of any year without remuneration.

In addition to the normative structure, the constitution offers an enhanced member role identified as vice president. There are currently twenty one vice presidents actively supporting LSTM in addition to a president who presides over the annual general meeting. The role of the vice presidents is predominantly ambassadorial, but also advisory, and reflects LSTM's links with political notables and multinational business leaders. It is crucial to recruit new contemporary industry leaders and political policy makers but also essential to retain the networking links and experience of our older ambassadors. A new category of emeritus vice president has now been introduced, which will maintain continuity and prolong the lifespan of these influential individuals with LSTM.

It is LSTM's intention to use the change in status to modernise its governance statements by integrating its memorandum and articles, incorporating values such as academic freedom and reflecting the new relationship with HEFCE. ■



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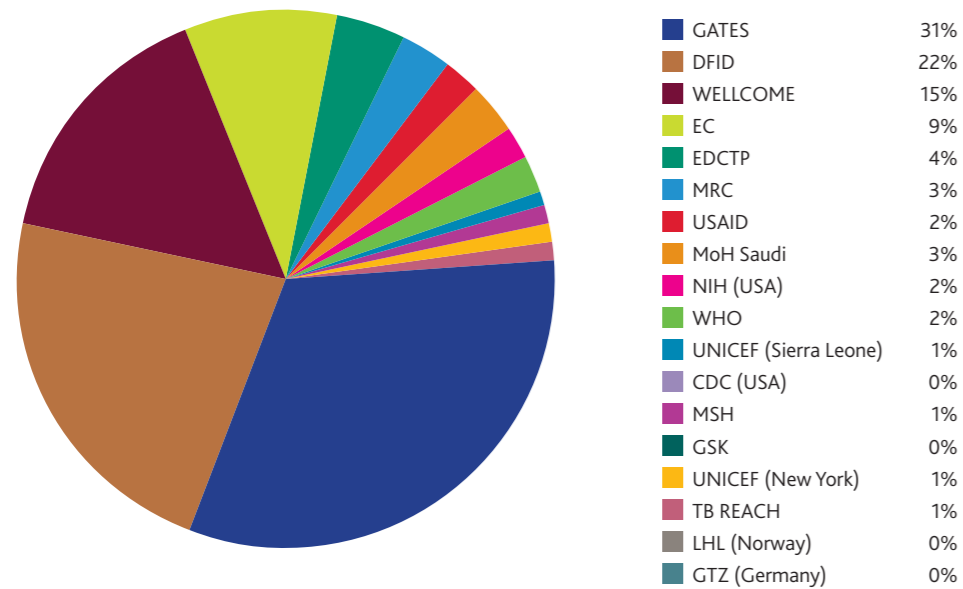
R Einion Holland FCCA MBA



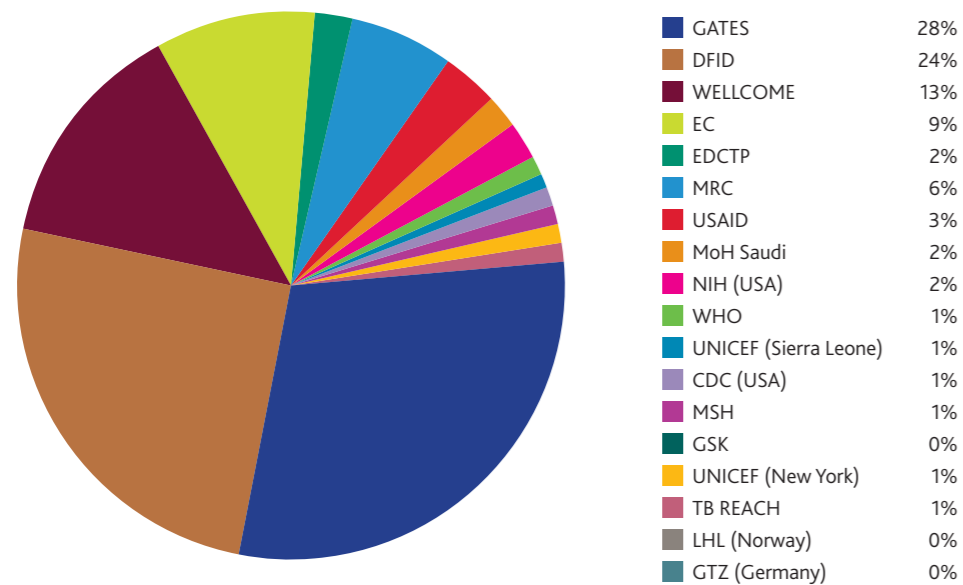
Facts and Figures

Funding bodies 2012 - 2013

Funding Bodies 2012



Funding Bodies 2013



Staff overview



Current number of staff working overseas:

34

a further **308** are based at LSTM and one offsite in the UK

(as of 1 September 2013).

Cameroon	1
Crete	1
D R Congo	2
Ecuador	1
India	1
Kenya	5
Malawi	15
Mozambique	1
South Africa	1
Tanzania	3
Uganda	3

Publications

One of LSTM's main objectives is **"conducting first class research and disseminating the results of that research"**.

The Online Archive is another step in fulfilment of that aim; helping to ensure the accessibility of our published research outputs worldwide.

LSTM Online Archive is a digital archive of research output produced by Liverpool School of Tropical Medicine staff and can be accessed via: <http://archive.lstmliverpool.ac.uk/>

List of honorary appointments

Name	Title	Department
Dr Mohammed Yassin	Research Fellow	Clinical Sciences
Dr Terrie Taylor	Research Fellow	International Public Health and Clinical Sciences
Dr Catherine Molyneux	Research Fellow	Clinical Sciences
Dr Saye Khoo	Research Fellow	International Public Health and Clinical Sciences
Professor Tom Solomon	Research Fellow	International Public Health and Clinical Sciences
Dr Melita Gordon	Research Fellow	International Public Health and Clinical Sciences
Professor Peter Winstanley	Research Fellow	International Public Health and Clinical Sciences
Dr Gerry Davies	Research Fellow	International Public Health and Clinical Sciences
Dr Liz Joeke	Teaching Fellow	Education
Dr Alexander Egyir-Yawson	Research Fellow	Vector Biology
Dr Michael Chance	Research Fellow	Parasitology
Dr Vittoria Lutje	Research Fellow	Clinical Sciences
Dr Oliver Hassall	Research Fellow	International Public Health
Dr Guy Barnish	Teaching Fellow	Education
Professor S Tang	Research Fellow	Clinical Sciences
Professor Mark Woodhead	Research Fellow	Clinical Sciences
Dr Patricia Graves	Research Fellow	Clinical Sciences
Professor Jimmy Volmink	Research Fellow	Clinical Sciences
Dr Luc Djobenou	Research Fellow	Vector Biology
Dr I Marshall	Teaching Fellow	Education
Dr Tom Blanchard	Fellow	International Public Health and Clinical Sciences
Dr Poliaro	Research Fellow	International Public Health
Professor N Hall	Research Fellow	International Public Health and Clinical Sciences
Professor D Hornby	Visiting Professor	Parasitology
Dr Theresa Allain	Research Fellow	International Public Health and Clinical Sciences
Dr Kondwani Charles Jambo	Research Fellow	Strategic Operations
Christopher M Parry	Research Fellow	Clinical Sciences
Christopher Alan Moxon	Research Fellow	Parasitology
Dr Henrik Ullum	Teaching Fellow	International Public Health
Dr Alastair Miller	Teaching Fellow	International Public Health and Clinical Sciences
Professor J Gyapong	Research Fellow	Parasitology
Dr L Savioli	Research Fellow	Parasitology
Dr Seif Al-Abri	Research Fellow	Clinical Sciences
Dr Prathap Tharyan	Research Fellow	Clinical Sciences
Dr Victor Mwapasa	Fellow	International Public Health and Clinical Sciences
Dr M Beadsworth	Fellow	International Public Health and Clinical Sciences
Elaine Richardson	Fellow	Human Resources

Students and courses

Research Students

Research students 2012 – 2013: **95**
 (38 UK/EU and 57 were from outside the EU, as per 1 December 2012)

Taught Students

Taught students 2012 – 2013: **533**
 (380 were from the UK/EU and 153 were from outside the EU)

The breakdown for individual programmes was:

MScs:

- MSc in Tropical & Infectious Diseases: **7**
- MSc in Tropical Paediatrics: **7**
- MSc in Biology & Control of Parasites & Disease Vectors: **6**
- MSc in Molecular Biology of Parasites & Disease Vectors: **9**

- MSc in International Public Health: **16**
- MSc in Humanitarian Studies: **13**
- MSc in Humanitarian Health Programme Management: **4**
- PG Cert in Humanitarian Health Programme Management: **1**

Professional Diplomas:

- Diploma in Humanitarian Assistance: **16**
- Diploma in Reproductive Health: **15**
- Diploma in Tropical Nursing: **57**
- Diploma in Tropical Medicine & Hygiene: **181**
(credit bearing)
- Other short courses: **201**

Diploma of Tropical Medicine & Hygiene students April 2013



Awards and Honours

LSTM Director **Janet Hemingway** receives the Knowledge Leader of the Year Award in November 2012. The award is part of a Liverpool Post event to identify key leaders who play a pivotal role in the Liverpool city region.

TB REACH project Ethiopia - **LSTM** wins a gold medal in Ethiopia at the 8th Annual Conference of the TB Research Advisory Committee of the Ethiopian Federal Ministry of Health in March 2013.

Professor Hilary Ranson receives the Royal Society Wolfson Research Merit Award for her research to develop and evaluate new control tools in April 2013.

Catrin Jones, an MSc student in Humanitarian Studies, wins in the same month the Royal Society of Medicine medical student essay prize in the category Catastrophes and Conflict.

PhD student **Ako Victorien** is a prize winner at the University of Liverpool's postgraduate research Online Poster Day in May 2013 for his poster on insecticide resistance.

Dr Lucy Asamoah-Akuoko, a PhD student, receives the 'Outstanding Female Doctor' award in the Ghana Women's Awards 2013 in June.

Dr Charles Wondji of the Vector Biology Department is notified in July that he has been awarded the prestigious Wellcome Trust Senior Research Fellowship for his research on the mechanisms of resistance in *Anopheles funestus*.

In September it was announced that **Professor Stephen Ward**, Deputy Director of LSTM, is to be awarded the Thai Sornchai Looessuwan Medal, which is given to researchers whose efforts have been devoted to malaria.

Professor David Molyneux receives the Manson Medal in September, the Royal Society of Tropical Medicine and Hygiene's highest mark of distinction, for his long standing contribution in the field of tropical medicine.

Professor Richard Pleass wins the Universal Biotech Innovation Prize in October. His project deals with the development of Hexagard™, a biomimetic to replace intravenous immunoglobulin (IVIg) therapy for treating autoimmune diseases.

Professor David Molyneux (centre)



Research consortia hosted by LSTM



AVECNET

AVECNET aims to develop and evaluate new tools for malaria control in Africa.

Funded by: European Union
www.avecnet.eu



MiP

The Malaria in Pregnancy (MiP) consortium improves the control of malaria in pregnancy in Africa, Asia and Latin America by researching malaria treatment, prevention and public health impact.

Funded by: Bill and Melinda Gates Foundation, European Union and the European and Developing Countries Clinical Trials Partnership
www.mip-consortium.org



A-WOL

A-WOL's academic and industrial partners aim to develop new drugs against onchocerciasis (river blindness) and lymphatic filariasis (elephantiasis).

Funded by: Bill and Melinda Gates Foundation
www.a-wol.net



PERFORM

The PERFORM consortium uses an action research approach to support decentralised management to improve health workforce performance in Sub-Saharan Africa.

Funded by: European Union
www.performconsortium.com



CENTRE FOR NEGLECTED
TROPICAL DISEASES

CNTD

CNTD supports national NTD programmes; provides technical assistance; strengthens the evidence base to inform policy makers and identifies and prioritises interventions that will eliminate lymphatic filariasis and reduce the burden of other neglected tropical diseases.

Funded by: UK Department for International Development and GlaxoSmithKline
www.cntd.org



REACHOUT

The REACHOUT consortium supports and strengthens the vital work of close-to-community providers of healthcare in Africa and Asia.

Funded by: European Union
www.reachoutconsortium.org



ReBUILD

The ReBUILD consortium explores different approaches to health system development in countries that have been affected by social and political conflict / crisis in Africa and Asia.

Funded by: UK Department for International Development
www.rebuildconsortium.com

EHCRC

The Effective Health Care Research Consortium (EHCRC) focuses on reliable, relevant evidence in malaria and tuberculosis, child health, maternal health and health systems. It prepares and updates Cochrane Reviews about the effects of health care relevant to low-income and middle-income countries. LSTM hosts the Cochrane Infectious Disease Group.

Funded by: UK Department for International Development
www.evidence4health.org
<http://cidg.cochrane.org>



T-REC

T-REC is a consortium of academics and health practitioners who want to improve blood transfusion services across Africa.

Funded by: European Union
www.t-rec.eu

IntHEC

IntHEC develops evidence-based strategies to increase equity, integration and effectiveness of reproductive health services for poor communities in sub-Saharan Africa.

Funded by: European Union
www.inthec.org



IntHEC

115 years of excellence in Tropical Medicine and Global Health



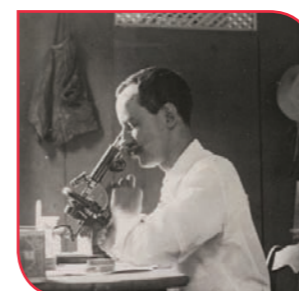
Sir Alfred Lewis Jones

LSTM's long history started in 1898 when **Sir Alfred Lewis Jones**, a prominent Liverpool ship owner, together with fellow businessmen and health pioneers, provided the funding and political influence to establish the Liverpool School of Tropical Diseases (later to be renamed Liverpool School of Tropical Medicine), the first institution in the world dedicated to research and teaching in tropical medicine.



Sir Ronald Ross

A series of early expeditions culminated in **Sir Ronald Ross** receiving the Nobel Prize for Physiology or Medicine in 1902 for demonstrating the method by which mosquitoes transmit malaria to humans. Further breakthroughs in relation to sleeping sickness (see below), river blindness, elephantiasis and malaria would follow as well as expansion into Global Health issues, placing LSTM as a leading international centre for research, health system capacity building and teaching.



Joseph Everett Dutton

LSTM undertook 34 expeditions between 1899 and the outbreak of the First World War in 1914. Here, **Joseph Everett Dutton** is shown during an expedition to The Gambia 1902-3. He was responsible for the first demonstration of sleeping sickness trypanosomes in human blood.



Professor David Molyneux

The latest in a rich history of achievements came in 2013 with the awarding of the Manson Medal to LSTM Emeritus **Professor David Molyneux**. The medal is the Royal Society of Tropical Medicine and Hygiene's highest mark of distinction.

The 98-year old stained glass window in LSTM's old school building featuring the original crest underwent much needed restoration work in 2013.

Designed by Scottish artist Herbert McNair in 1905, the exact meaning of LSTM's original crest remains unclear. It has been suggested that the boat represents journeys to tropical destinations, with the eye in the sail referring to the Egyptian falcon god Horus, who was connected with healing and protection from evil.

The original crest was replaced by LSTM's current one in 2008.



Editorial team: Billy Dean; Helen McFarlane; Tanith Palmer and Diderik van Halsema (Coordination).

Contributors: Sue Assinder; Imelda Bates; Alister Craig; Stephen Gordon; Christine Greenway; Einion Holland; Hilary Ranson; Bertie Squire; Mark Taylor, Phil Tubb and Fred Yeomans.

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