



Liverpool School Of Tropical Medicine Annual Report 2014/15





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The image on the front cover shows part of a cloth with health education material. It is produced in West Africa and widely sold in local markets to enhance awareness about the Guinea Worm Eradication Programme. The material against a background of the water fleas from which people acquire infection shows filtration of water through filter cloth provided to all endemic villages. Other images on the material show the disablement caused by the disease now only endemic in four countries with less than 50 cases reported to date in 2015.

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A woman wearing a black headwrap and a colorful patterned top is sitting on a patterned cloth, tending to a child who is lying down. The child is wearing a colorful patterned shirt. The woman is looking down at the child with a focused expression. The background is a plain, light-colored wall.

## Vision:

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

## Mission:

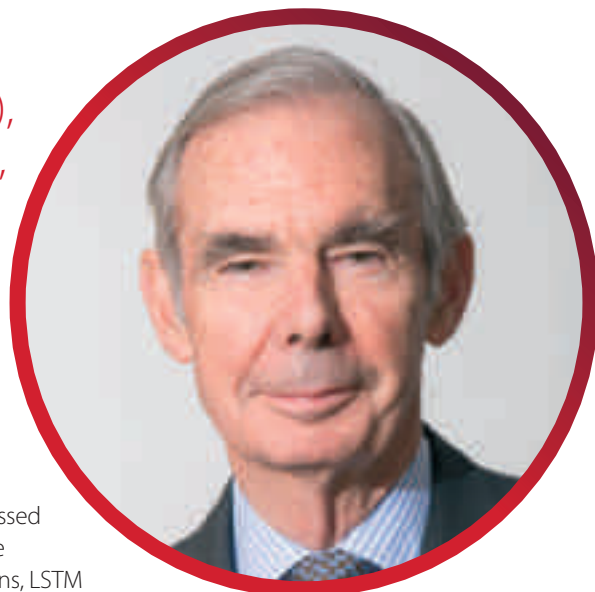
To reduce the burden of sickness and mortality in disease endemic countries through the delivery of effective interventions which improve human health and are relevant to the poorest communities

## 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

Each year in the summer, the Trustees of the Liverpool School of Tropical Medicine (LSTM), together with the senior management team, hold an 'away day'. We review our progress over the previous twelve months and prepare for the challenges ahead.



This year, as well as noting solid financial outcomes, we looked back on the opening of the Wolfson building by our Patron, the Princess Royal; we encouraged the next step in the build out of LSTM's campus with the Accelerator project; we discussed progress in achieving Degree Awarding Powers and in pursuing opportunities to grow our teaching portfolio.

Looking to the future, the emphasis was on developing Liverpool as a national and international centre for translational research into the issue of the increasing resistance to drugs, including those used in the treatment of infectious diseases. As always LSTM seeks to work in co-operation with key partners: in this case, the University of Liverpool and the NHS trust are important collaborators in our drive to address this emerging focus of our endeavours. Putting this initiative in the current political context of the 'Northern Powerhouse', the key conclusion of the 2015 'away day' was that we needed to plan for a step change in LSTM's size and impact over the coming years.

The Trustees have (again!) lost Stephen O'Brien to an important appointment, as in May 2015 he became United Nations' Under-Secretary-General for Humanitarian Affairs and Emergency Relief Co-ordinator. We are most grateful for his continuing commitment to LSTM as he becomes a Vice-President. We are mourning the passing of Vice-President Professor Herbert Gilles and remembering his outstanding contribution to LSTM. We welcome the appointment of new Trustees, Dr Jenny Amery and Dr Julian Lob-Levyt, as well as our first Student Representative Aduragbemi Banke-Thomas.

While the headlines may have been focussed on other people and organisations, LSTM made and continues to make its contribution to tackling the Ebola crisis and its legacy. Thus the work of the many individuals concerned should be recognised – as should the work of the Well Travelled Clinic in preparing people for front line activities. This was another example of the effectiveness of LSTM in its work for the public benefit.

A handwritten signature in dark ink, which appears to read 'James Ross'.

**James Ross OBE**  
**Chairman**

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**“As always LSTM seeks to work in co-operation with key partners”**

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# Director's Foreword

There are a few rare individuals who embody LSTM's vision, mission and values. Herbert Gilles, a former Director of LSTM, was one such individual. With his passing at the grand old age of 94, many staff, alumni and collaborators have lost a dear colleague, mentor and friend.

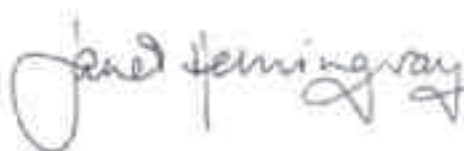
Herbert was a great advocate for and supporter of LSTM and his loss, along with that of former Dean Bill MacDonald and, as this report is about to go to press, news of the passing of Professor Richard Ward, feel like the end of an era representing a generation that built strong foundations from which LSTM can grow.

This year has been another busy and challenging one. We have put in place our own IT, library, payroll, HR systems, student information systems and virtual learning environment. The process of obtaining our own degree awarding powers is well advanced and a challenging timetable for expanding our learning and teaching portfolio to meet the changing expectations of our various stakeholders has been agreed.

The new Wolfson Building was opened in December and is already almost fully occupied. The next expansion of our estates, in collaboration with the NHS, is due for completion by November 2017. This will provide us with state of the art facilities to expand our translational activities to develop new products and processes to mitigate the impact of resistance to drugs, anti-microbials and public health insecticides.

The practical nature of LSTM's expertise was highlighted with the recent Ebola crisis in West Africa. Around 30 LSTM staff from Senior Clinicians to Junior Technicians and Programme Managers were deployed in Sierra Leone, with many UK based staff helping to shape UK government policy, ready NHS teams for travelling to the affected areas, and helping to monitor and treat volunteers on their return. We can be proud of the effective response that we mounted to this emergency.

We thank all our supporters, collaborators and funders for their continued engagement, without you LSTM would not be able to have the impact that it undoubtedly does on improving health in the tropics.



**Professor Janet Hemingway CBE**





# Treasurer's Report



Although LSTM is a not-for-profit organisation, a strong financial performance underpins the vital work of the institution and enables it to constantly invest in highly skilled people and world class facilities. It is pleasing, therefore, to report record income for the sixth successive year and a record retained surplus for the fourth successive year.

The Group income of £73.06M represented an increase of 11% on last year's previous high and generated a healthy surplus of £3.16M. During the year various non-recurring expenses were sustained as LSTM implemented independent systems required by virtue of the transition to HEI status. In a normal year, without these realignment costs, the retained surplus would have been even higher.

Research income, at £54.7M, accounted for 75% of the Group's income and was up 8% on the prior year. The Group's largest funder during the year was the Department of International Development (DfID) representing 30% of the total, followed by the Bill & Melinda Gates Foundation at 25%.

On the teaching side, tuition and education contract fees were very slightly down at £2.9M but the recent investment in these activities is expected to produce dividends shortly.

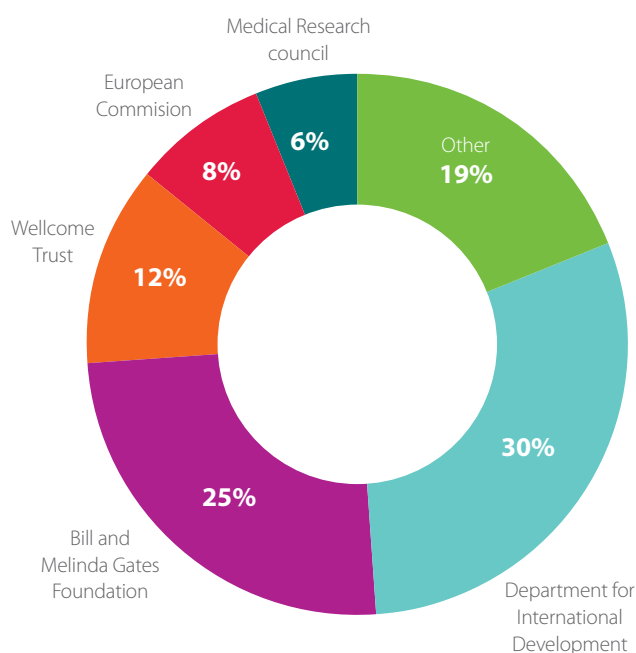
Other revenue includes income from travel clinics in Liverpool and Chester, operated through the subsidiary company, Well Travelled Clinics Ltd. This business continues to incur a small loss but is a key part of LSTM's commitment to the regional and national health economy.

The continuing programme of investment in people and facilities saw £5.7M invested in the property estate and the number of full time employees grow by 24 to 432.

Whilst this report is intended to provide an overview of the financial year it also provides an opportunity to reflect on the progress over a longer period and to demonstrate the positive trends which have seen LSTM flourish in recent times.

Comparing a few of the key financial indicators over a five year and ten year period is an illuminating exercise and demonstrates quite clearly the impressive progress that LSTM has made.

	2005/6	2010/11	2014/15	5 Year growth	10 Year growth
Group Income	£23,751	£53,525	£73,066	37%	208%
Research Income	£17,250	£41,251	£54,747	33%	217%
Net Assets	£19,624	£51,080	£67,168	31%	242%



This level of growth has required a significant investment in both people and new facilities and, in the latter respect, during the ten year period, over £50M has been invested in refurbishment of the original building and in creating world class facilities within the CTID and Wolfson Buildings. This has been done without any recourse to borrowings and the Balance Sheet remains strong and liquid.

In times of austerity, a typical business strategy is to batten down the hatches and wait for better days to return but, during the recent difficult economic conditions, LSTM has taken a much bolder line, investing heavily in people and facilities. The process has, however, been conservatively managed with much consideration given to balancing and mitigating the risks, particularly the financial aspects.

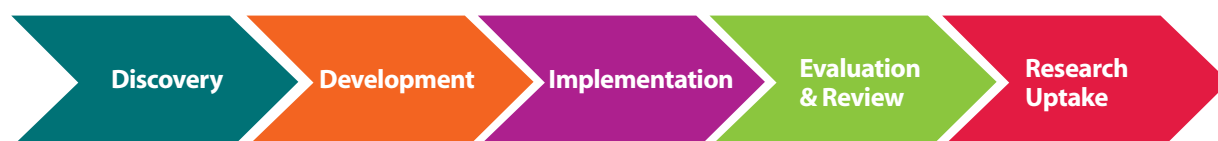
The chart on the left shows the financial year performance in terms of research income by funder

  
**Ian Jones**



# Introduction to the Feature Articles

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



This pathway, leading from the field into the laboratory, is often followed by taking the research back into the field again. Even during the initial laboratory phase, LSTM works together with its many UK and overseas partners to deliver as much of the science locally in order to support high-quality research and capacity strengthening there where it matters most.

The continuous search for, and development of, new products will help to improve prevention and treatment of many diseases and address global health issues. This, together with knowledge of their effective implementation and an understanding of their impact through monitoring and evaluation, aims to achieve the uptake of LSTM's research outcomes into policies and practices, all for the public benefit. An indicator of that benefit is LSTM's ranking on Impact in the results of the recent Research Excellence Framework

2014, scoring 6th place out of 128 assessed higher education institutions.

The following feature articles and departmental updates highlight LSTM's approach to the above and subsequent achievements over the past academic year in the areas of Neglected Tropical Diseases; Resistance Research & Management; Lung Health & TB; Malaria; Maternal & Newborn Health and Applied Health.

**Professor Steve Ward,**  
deputy director LSTM





## FEATURE ARTICLE:

# Neglected Tropical Diseases

Neglected Tropical Diseases (NTDs) have gained increased recognition as a 'brand' in global health. Ever since the term 'neglected tropical diseases' was coined at a scientific meeting in Berlin 10 years ago, LSTM has played a key role in bringing these diseases to the attention of health policy makers.

To address the ongoing challenges around NTDs, LSTM has reorganised its approach utilising its breadth of scientific expertise, from laboratory research to research uptake and implementation, benefiting patients worldwide. Having identified NTDs as a priority cross cutting theme, 'LSTM NTDs' launched in March 2015 at a meeting that brought together over 150 experts, including the Deputy Director-General of WHO and LSTM alumnus, Dr Anarfi Assamoah Bah, who led the creation of the Department of Control of Neglected Tropical Diseases in WHO in 2005.



**The relevance of NTDs to the core principle of Universal Health Coverage is evident from the messages from leaders of Global Health. It is time to reduce the inequities in financing NTD programmes and give the poor what they deserve: access to free and effective products.**

- Dr David Molyneux, Senior Professorial Fellow, LSTM

The creation of LSTM NTDs shows our commitment to a cause that, as a sign of remarkable progress over the past decade, has received a specific mention in the proposed Sustainable Development Goals (SDGs). Professor David Molyneux, who is heading LSTM NTD activities, gave the keynote address at a meeting of National Science Academies of the G7 nations in Berlin. Their statement called for greater

investment in NTD research and implementation, and followed the 3rd NTD Report of WHO, which launched at a meeting in the Royal Society in February. This report made the investment case within the context of the inclusion of NTDs in the Sustainable Development Goals and the drive for Universal Health Coverage. The increased recognition of NTDs as major drivers of poverty place LSTM in a key position given the need for new diagnostics, drugs and insecticides to maintain the momentum already created.



## Lymphatic Filariasis

The success of the NTD 'brand' is reflected in the numbers of programmes in endemic countries and the extensive numbers of annual treatments (circa 900 million given in 2014). This is best exemplified by the lymphatic filariasis programme, in which LSTM has played a key role since 2000, which has delivered a staggering 5.63 billion treatments so far. LSTM has hosted the Global Alliance to Eliminate Lymphatic Filariasis (GAELF) Secretariat since 2004. A recent estimate of the impact of the programme during the past 13 years suggests around 97 million cases were prevented or cured. In 2014 alone 559.3m were treated with a 70.5% coverage.

## COUNTDOWN

LSTM has been awarded a major 5-year DFID grant for COUNTDOWN. Launched in March 2015, the Consortium brings together researchers from many disciplines. A key focus of COUNTDOWN is the social science aspect of NTDs and its link to health systems, focussing on gender and equity as well as health economics of NTDs and their link to poverty. Alternative vector control approaches and novel molecular diagnostic approaches to evaluate worm burden in children will be developed. Results on evidence synthesis on NTD strategies will be used to further define policies.

**COUNTDOWN**  
Calling time on Neglected Tropical Diseases



# Supporting the response to the 2014-2015 Ebola outbreak

During 2014 the Ebola outbreak in West Africa rapidly became the deadliest since the discovery of the haemorrhagic fever in 1976, killing five times more people than all other known Ebola outbreaks combined. The number of new cases fell sharply during 2015, leading both Liberia and Sierra Leone to be declared free of Ebola in the second part of the year. The effects of the outbreak have reverberated across many already fragile public health programmes, with morbidity and mortality from other diseases far exceeding those directly attributable to Ebola. A VSO commissioned study conducted by LSTM's Centre of Maternal and Newborn Health showed the outbreak had a negative impact on health seeking behaviour amongst pregnant women with devastating consequences

Clinical data and observation from the testing of people who have recovered from the Ebola virus disease indicate that it can remain in the body for many months in some people; a situation requiring continued community-based observations and monitoring. LSTM clinicians and technicians have continued to travel to West Africa to support international efforts in diagnosis and treatment, contributing data to research publications, informing policy and practice.

To support the deployment of NHS staff seconded to Ebola treatment centres in Sierra Leone, LSTM's travel health subsidiary, Well Travelled Clinics (WTC), has coordinated the health screenings for 236 health workers via UKMed. Reacting to an urgent call for assistance, WTC set-up a temporary clinic at the Army Medical Service Training Centre in Strensall, England, to conduct health screenings and ensure the rapid deployment of the first wave of volunteer medics. Health screenings for many of those volunteers returning to the UK following their secondment were also carried out by WTC. A task only made possible due to the dedication of WTC staff who wanted to play their part in the UK's response to the deadly Ebola outbreak.

Concern over the Ebola virus disease being imported to the UK needed to be carefully addressed and LSTM clinicians have been advising medical professionals on the importance of rapid diagnosis in patients presenting with fever or a history of fever, returning from an endemic region within 21 days. A number of interviews have been given to the mainstream media to reassure the public with the facts about how the Ebola virus is contracted and the extensive procedures employed by Public Health England and the NHS, to identify and treat suspected cases before and after they arrive in the UK.

As the number of cases declined during 2015, international attention turned to rebuilding affected health systems. The ReBUILD Consortium, led by LSTM, is working with countries including Sierra Leone to strengthen policy and practice related to health financing and staffing. While another LSTM led research consortium, REACHOUT, has been contributing to the UK All Party Parliamentary Group on Africa offering guidance to those grappling with health systems strengthening in Ebola-affected countries.



### Schistosomiasis and Soil Transmitted Helminths (STH)

In northern Namibia LSTM developed a novel mapping strategy for schistosomiasis and soil transmitted helminths. This was an international first where rapid diagnostic tests were used alongside traditional parasitological methods to increase geographical resolution identifying areas where mass drug administration is needed.



African biomphalaria that  
spread schistosomiasis



## Onchocerciasis

In collaboration with colleagues in Cameroon, Dr Joe Turner has developed a new preclinical model of onchocerciasis for testing macrofilaricidal drug candidates. This is now being implemented to test anti-*Wolbachia* drugs emerging as lead candidates from A-WOL and macrofilaricide drug accelerator (MacDA) programmes.

## Visceral leishmaniasis

LSTM works in collaboration with the National Vector Borne Control Programme and the Rajendra Memorial Research Institute of Medical Science (RMRI) in India, to evaluate and quality assure the indoor residual spray programme aimed at eliminating visceral leishmaniasis from Bihar. Supported by the Wellcome Trust and Bill and Melinda Gates Foundation a diagnostic method has been developed to measure the amount of DDT residue on walls to assess the quality of the spraying. Entomological evaluation has been undertaken to ascertain the resistance status of the local vector and the effect of the spray programme on sand fly abundance. As a direct result of this work the Government of India is now piloting the use of pyrethroids to replace DDT and is moving from stirrup pumps to compression pumps. The findings of this work were published in PNAS and have effected policy change at the highest level. A randomised control trial in Bihar to assess the impact of the new spray regime is underway.

## Cutaneous leishmaniasis

An LSTM study revealed that in Saudi Arabia, the non-local population had significantly higher anti-sandfly saliva antibody levels and also developed a worse cutaneous leishmaniasis compared to the local population, indicating that they were bitten more frequently and had increased risk of contracting the disease. The results suggest that control efforts need to be aimed at this affected population, which currently represents the main work force of this country.

## Human African Trypanosomiasis (HAT)

LSTM scientists, working with European and African partners, have developed 'Tiny Targets', a cost-effective tool to control riverine tsetse flies, the vectors of trypanosomes that cause Gambian Human African Trypanosomiasis, also known as sleeping sickness. Following successful trials in Guinea, Kenya and Uganda, these targets are now being deployed at scale across five countries, Cote d'Ivoire, Chad, DRC, Guinea and Uganda, covering 11 sleeping sickness foci. The research examines the impact on tsetse and disease prevalence, through assessment of the economic costs of vector control, to quantifying and strengthening the capacity of national institutions to implement large-scale tsetse control operations. Vector control is establishing itself as an important tool in the global programme to eliminate Gambian HAT as a public health problem.

## Snakebite

The inclusion of the problem of snakebite as a non-infectious NTD also plays to the strengths of LSTM with its unique track record of addressing this truly neglected health problem. A grant from MRC will hopefully lead to the development of more effective and appropriate antivenoms for Africa as presently there is limited availability of such a product. LSTM plays a major role in advocacy to address the public health problem of snakebite as the true global burden both in terms of morbidity and mortality remains unknown.

## Looking forward a decade on

Overall LSTM staff have played a key role in bringing NTDs to the attention of health policy makers. Over the last decade LSTM has demonstrated that its research has the breadth, quality and relevance to impact directly on the lives of the poorest as well as changing global and national health policies. LSTM has made a difference and will continue to do so; the creation of LSTM NTDs reflects the need to emphasise our quality, relevance and commitment to a cause which had its origins a decade ago in work done at LSTM and which is now embedded in the UN Sustainable Development Goals.



HAT screening in progress



# Department of Parasitology

Professor Mark  
Taylor - Head of  
Parasitology



## Research Centre for Drugs and Diagnostics (RCDD)

The RCDD drug and diagnostic portfolio has continued to grow in the past year, along with its level of industry engagement and collaboration. The RCDD drug development pipeline has expanded and progressed in a number of disease areas. The antimalarial programme has progressed one molecule to candidate selection, whilst the anti-TB programme has progressed a novel combination strategy for the treatment of multi-drug resistant tuberculosis (MDR-TB) and is collaborating with Janssen Pharmaceutica to develop pre-clinical candidates.

The Diagnostics Unit has recently added Emerging Infectious Disease to its portfolio. Fruitful collaborations with Qiagen In vitro diagnostics unit are ongoing for the development of diagnostics suitable for detecting dengue and chikungunya. RCDD is also working with the Partnership for Dengue Control to develop Target Product Profiles to aid further development in this area. For tuberculosis, the team are working towards further field evaluations in Nigeria of the Episteme Genedrive for *Mycobacterium tuberculosis* (MTB) and rifampicin (RIF) resistance detection. The new Category 3 laboratories at LSTM have been utilised to prioritise sample handling devices and for sensitivity and specificity testing.



**A·WOL**  
ANTI-WOLBACHIA CONSORTIUM

A·WOL screens AstraZeneca's library of 1.3m compounds. Continuing their search for anti-*Wolbachia* drugs as new treatments for onchocerciasis and lymphatic filariasis, A·WOL's screening team worked alongside AstraZeneca staff in their high through-put centre (HTC). Over the course of a year they developed an assay to identify compounds with anti-*Wolbachia* activity. The assay screened 1.3 million compounds from AstraZeneca's library and a 500,000 library from Medicines for Malaria Venture (MMV). These screens provided ~21,000 hits that are currently being prioritised for further development. A·WOL has also progressed one macrolide-based analog, 'TylaMAC™' to candidate in partnership with AbbVie, as well as two registered drugs ready for clinical trials and three further molecules at late lead/optimisation phases. A·WOL has received further funding (\$3.5m) from the Bill and Melinda Gates Foundation to extend the programme until the end of 2017 to deliver clinical candidates of faster acting and safer macrofilaricides.

Dr Joe Turner, Professor Mark Taylor and Professor Samuel Wanji (University of Buea, Cameroon) were awarded a Grand Challenge Phase II grant of \$1m from the Bill and Melinda Gates Foundation to develop new and improved preclinical models of human filariasis for drug development and basic research in immunobiology and inflammation.

## Tropical Infectious Disease Consortium

The Consortium (LSTM RCDD, LSHTM, Oxford Jenner, and PHE) secured further funding from the MRC (£0.5 million) for translational projects. The funded themes include drug discovery, adjunct therapies, intervention (bednets), vaccine and diagnostic discovery and development projects. The scheme has now been running for 3 years and this essential seeding money has already secured further funding and development for both drugs, biologics (e.g. the LSTM developed Hexagard™) and diagnostics.

## Multiuser Hazard Group 3 Pathogen Imaging Unit

2015 has seen the instalment and commissioning of the HG3 Imaging Unit funded in part by a grant from the Wellcome Trust Multi-User Equipment Grant and includes high content Operettas, BD FACSAria cell sorter and a Zeiss 880 Confocal Microscope. The demand for HG3-imaging comes from existing and incoming appointments across LSTM, colleagues in the overseas Wellcome Trust programmes, academic collaborators, industry and the wider health community who wish to work directly with HG3 organisms e.g. *Mycobacterium tuberculosis*, *Plasmodium falciparum*, HIV, arboviruses et al. and not their surrogates. The Unit will be the first dedicated facility of its type in the North West, supporting the regions' excellence in infectious disease research.

## The Alistair Reid Venom Research Unit (ARVRU)

The ARVRU, led by Dr Rob Harrison, has started its MRC-funded project to develop a single antivenom for sub-Saharan Africa by defining the protein composition, toxicity and pathology of venom from each medically important snake species. This is the most biologically comprehensive, region-wide, analysis of snake venoms.



Other Venom research highlights include:

- Studies on the non-venomous Burmese python and the venomous jararaca viper found that venom toxins are found in other parts of the snake, albeit with their greatest abundance in the venom gland.
- Analyses of resistance to toxins produced by toads and plants published in PNAS revealed that many different animals, including many venomous snakes, have evolved resistance to these toxic compounds by the same convergent molecular evolution.
- Studies on the world's most notorious jellyfish, the box jellyfish, revealed the first toxin gene and protein characterisation of its venom and also described a new method to collect venom from its tentacles by immersion in ethanol.

### Bioinformatics Unit

LSTM's Bioinformatics Unit, led by Dr Simon Wagstaff, has been developing new software and infrastructure to enable parasitologists to improve interaction with their data. Over the next few years, through-put and access to bio-computational tools will be greatly enhanced by developing a new scientific computing network and toolkit capable of coping with the increased demands required of 'big data' driven science.

### Sand flies return to LSTM

Dr Alvaro Acosta-Serrano, Dr Emily Adams and Professor Janet Hemingway started a new programme for the prevention and control of cutaneous leishmaniasis (CL) in Saudi Arabia. Dr Acosta-Serrano's laboratory established a new sand fly colony at LSTM, which will benefit not only the CL programme, but also the current sand fly control programme in India.

### COUNTDOWN launched

The COUNTDOWN Consortium's £8m DFID-funded programme launched their multi-disciplinary implementation research for helminths (onchocerciasis, lymphatic filariasis, schistosomiasis and soil transmitted helminths) and trachoma NTDs in Cameroon, Ghana, Liberia and Nigeria. Working across all LSTM departments and with endemic country partners COUNTDOWN will explore novel ways to scale-up NTD programmes using evidence from community based implementation trials, evidence synthesis, social science, health economics and capacity strengthening research. COUNTDOWN will support the process of expanding preventive chemotherapy to those who need it by translating high quality research into policy and practice.


### Filarial Programmes Support Unit (FPSU)

The Filarial Programmes Support Unit (FPSU, formerly CNTD), led by Professor Charles MacKenzie, is part of a group of multidisciplinary initiatives focused on Neglected Tropical Diseases (NTD) based at LSTM.

The FPSU supports NTD activities in 12 countries through a £30.5m DFID programme. This year app. 75 million people were treated with preventive therapy for LF. Mapping has been completed and mass treatment implemented in all 12 project countries. Five countries have entered the surveillance phase having reached the stage of scaling down.

FPSU has expanded its programme to implement morbidity management as part of the overall LF elimination programme to deal with the LF morbidity burden for the first time.

DFID is currently the only donor dedicating funds to LF morbidity management and FPSU are leading in development and management of strategies for provision of care, surgery and disability prevention for people with elephantiasis and hydrocoele.



A BD FACSAria III Cell sorter, part of the Multiuser Hazard Group 3 Pathogen Imaging Unit



# Resistance research & management

LSTM was among the first institutions to recognise the importance of studying and understanding the phenomenon of drug resistance. Pioneers such as Professor Warrington Yorke, the first Walter Myers Chair of Parasitology, established in 1929 an in vitro cultivation of drug resistant trypanosomes in order to understand how new drugs work.

Many factors drive resistance, and in recognition of this LSTM has developed an interdisciplinary approach involving the entire research continuum from bench, to clinical care, to public health and policy. This involves specialist teams of laboratory scientists, engineers, mathematical modellers, clinicians, public health specialists and social scientists working together within and across traditional disciplinary boundaries. LSTM's continued commitment to this important area of research is evident from our institutional strategy to use recent Wellcome Trust ISSF funding to drive appointments and projects in this area.

## Understanding resistance at the molecular level

LSTM scientists have helped to unravel the mechanisms of resistance in malaria parasites and in the mosquito vector. Parasitologists have helped find what causes resistance to chloroquine, Fansidar and atovaquone. Recently we have been working on studies to understand resistance to new antimalarials, the artemisinins, which represent the last line of defence against the malaria parasite. Resistance is already emerging in South East Asia, which may impact substantially on attempts to eliminate malaria worldwide.

The Department of Vector Biology is leading the search for the molecular mechanisms underpinning resistance to insecticides used against the *Anopheles* mosquitoes that transmit the disease. Using techniques including microarray, RNAseq, association mapping, metabolomics and transgenesis, researchers have identified the major genes responsible for resistance to the key classes of insecticides used to control malaria vectors. This is being used to identify patterns of cross resistance, develop diagnostics and plan insecticide resistance management programmes. Members of the Vector Biology department are working closely with industry to incorporate this knowledge into the design of new insecticides. Some of their findings were presented during an 'Industry Day' in July 2015.

At the genetic level, LSTM is driving the *Anopheles gambiae* 1000 genomes project, in collaboration with the Wellcome Trust Sanger Institute. The exploration of this rich data set is providing new clues about the selection process resulting in insecticide resistance.

## Accelerating the development of new drugs

Drug discovery has been a cornerstone of LSTM activities throughout its history. As early as in 1905 LSTM staff were establishing the effectiveness of the arsenical agent Atoxyl against African Trypanosomiasis. By 1921 the first clinical studies with Suramin were initiated and by 1927 Chemotherapy was established as a core subject by Yorke, Adams and Murgatroyd in LSTM.

The first demonstration of acquired resistance to an antimalarial drug was reported by Fulton and Yorke working with *Plasmodium knowlesi*.

Throughout the 40s and 50s LSTM was at the centre of studies to develop chemotherapeutic agents active against, malaria, trypanosomiasis and scabies.



Trophozoites



Drug and diagnostic discovery and development remain one of the pillars of LSTM's activities taking place in the Research Centre for Drugs and Diagnostics (RCDD). The centre works with industry (SMEs and larger organisations), academia and other NGOs to discover, develop and deliver novel therapies against a range of drug resistant pathogens.

RCDD has access to state-of-the art laboratories and equipment including Category 3 laboratories, medicinal chemistry laboratories, analytical laboratories, robotic liquid handling and high content imaging platforms. It has an active portfolio in drugs and biologics as well as diagnostics to support the rapid identification and treatment of pathogens in a variety of endemic settings. These activities are commonly delivered in Public Private Partnerships and take advantage of LSTM's unique cross-disciplinary expertise and global reach which affords access to patient populations and pathways to drug and diagnostic evaluation and implementation in the UK, Africa, Asia and South America, and links to policy makers.

Current drug discovery programmes include the BMGF-funded A-WOL consortium, an international academic-industry consortium led by LSTM aiming to develop a novel anti-*Wolbachia*-based macrofilaricidal drug for the treatment of lymphatic filariasis and onchocerciasis. Other drug discovery activities in the RCDD portfolio include several pre-clinical projects against multi-drug resistant malaria parasites and *Mycobacterium tuberculosis*. LSTM researchers are also investigating 'augmented passive immunotherapy' using P4 peptide, a novel therapeutic strategy that can stimulate phagocytic cells to better ingest and kill bacteria. This antibiotic independent mechanism has the potential to subvert antimicrobial resistance pathways by direct action on the host immune system. This work has led to a successful application for MRC Developmental Pathway Funding to develop pre-clinical toxicology data as a pre-cursor to first in human trials.

### Pharmacology

Drug resistance can be mitigated at the clinical level by ensuring that the correct drug doses are being taken for the correct target population. For example many drugs are incorrectly dosed and do not take in to account differences between children and adults or effects due to co-morbidities or drug:drug interactions. The Department of Parasitology is using PK-PD (pharmacokinetics-pharmacodynamics) methodology to identify safe and effective malaria dosing strategies that are robust to the threats posed by poor patient adherence and by the potential spread of drug resistance. A novel high-content imaging platform is being used to study the response of intracellular pathogens, e.g. *M. tuberculosis* or *Salmonella* to drugs, in order to perform PK-PD modelling to select optimal doses that reduce the emergence of resistance.

These laboratory and mathematical studies are being translated to the clinic, where LSTM and the MLW programme

in Malawi, together with partners, are involved in several clinical trials that aim at dose optimisation of antimalarials used in transmission reduction settings.

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**LSTM works through the entire diagnostic pipeline from discovery of biomarkers, through development, evaluation and implementation.**

- Dr Emily Adams, Lecturer in Tropical Diagnostics, LSTM

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### Diagnostics

LSTM works through the entire diagnostic pipeline from discovery of biomarkers, through development, evaluation and implementation. Staff have expertise in the discovery of genomic biomarkers for drug resistance with the bioinformatics group and partner this with assay design and sample preparation, working closely with industrial partners for true product development and pathway to market.

The Diagnostic Evaluation Platform enables high-quality studies to be performed. It has set up multi-centre studies to evaluate drug-resistance diagnostics for tuberculosis including GeneXpert MTB/RIF®, Epistem's Genedrive® and Hein's Line Probe Assays®.

The Department of Vector Biology have developed diagnostics for the common mechanisms of insecticide resistance in malaria and dengue vectors. Several of these are now in routine use by national control programmes in disease endemic countries to assist in their insecticide resistance management plans.

LSTM plays a critical role in the development of new public health insecticides, working closely with the Innovative Vector Control Consortium (IVCC) a product development partnership established to accelerate the introduction of new vector control products into the market. LSTM contributes technical expertise in insecticide resistance mechanisms and the impact of resistance on current control programmes.

LSTM also hosts the Liverpool Insect Testing Establishment (LITE), which provides a professional service to evaluate new insecticides against a wide range of fully characterized insecticide susceptible and resistant strains of mosquitoes (See separate chapter in this Annual Report).

The AvecNet programme is developing and evaluating new tools to control insecticide resistant malaria. Its activities, led by LSTM, include a clinical randomized controlled trial of a new type of insecticide treated net in Burkina Faso, evaluation of new products for indoor residual spraying against insecticide resistant populations in the field, measuring both mosquito and human behavioural traits that affect the performance of vector control products, and mapping the regulatory and policy processes that influence the rate of uptake of new malaria prevention tools.



## Epidemiology of drug resistance

LSTM's largest overseas partnership is with the Malawi Liverpool Wellcome Trust Clinical Research Programme (MLW), where a quality controlled diagnostic microbiology service has been operating for over 15 years. This longitudinal surveillance identified sequential epidemics of multidrug resistant *Salmonella* bloodstream infection, in the process identifying novel pathotypes of *Salmonella*, in collaboration with the Wellcome Trust Sanger Institute.

The use of ivermectin for the control and elimination of onchocerciasis is one of the most successful public health programmes in tropical medicine as recognised in this year's Nobel Prize for Physiology or Medicine. Yet even Nobel Prize winning drugs are at risk of developing resistance and concerns of sub-optimal responses to ivermectin have been raised in communities in Ghana. One strategy to try to overcome this early resurgence in parasites is to treat bi-annually. However in a recent study co-authored by LSTM it was shown that although bi-annual treatment in general had a positive impact, this strategy is insufficient to meet the WHO control and elimination goals for river blindness in Africa and raises the need for alternative strategies. Implementation research as part of LSTM's COUNTDOWN programme will address how best to introduce these alternative strategies at the community and policy level.

LSTM works with a strong network of partners to understand more about the impact of insecticide resistance on malaria transmission. This complex relationship is being addressed by both detailed laboratory and field studies on the impact of resistance on the behaviour and life time fitness of

mosquitoes, modelling studies to predict the impact of resistance, and at the programmatic level by recording the impact of insecticide resistance on the number of malaria cases. LSTM currently serves on the WHO Technical Expert Group on 'Drug resistance and containment'.

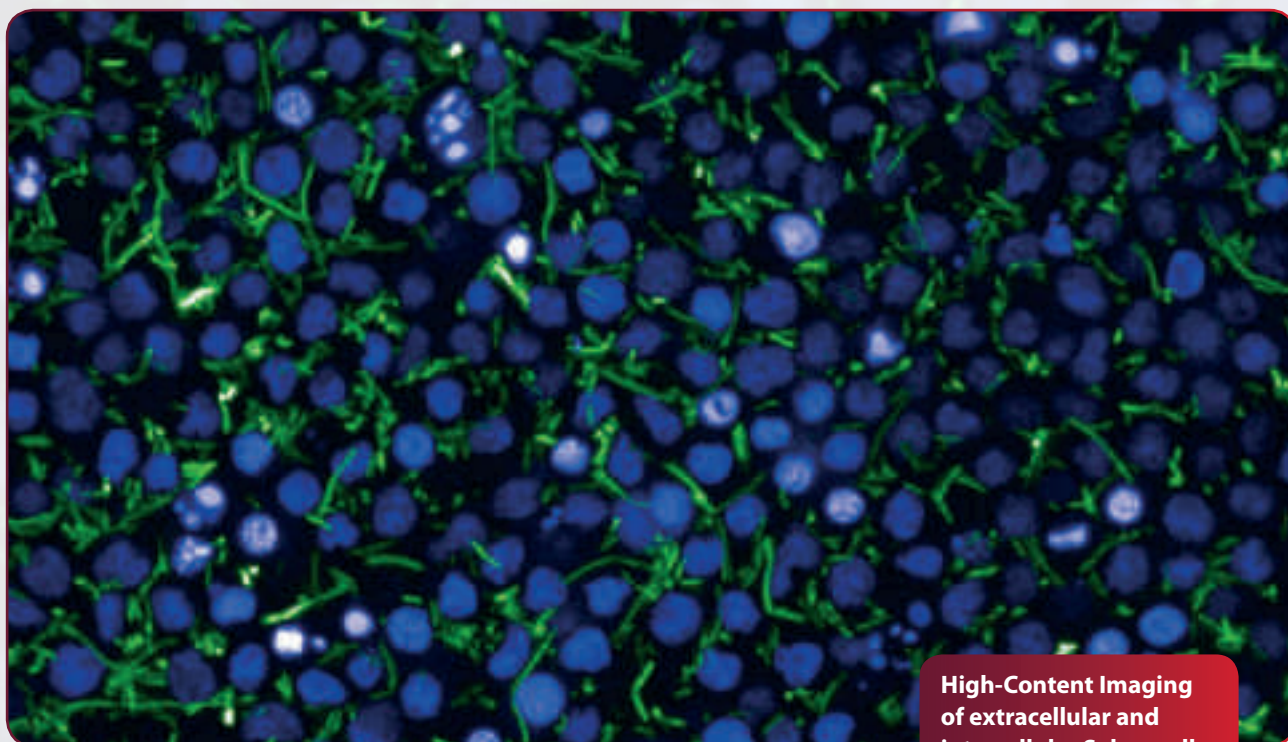
## Antibiotic use around pregnancy

The Centre for Maternal and Newborn Health (CMNH) at LSTM has assessed the use of antibiotics before and after pregnancy. Cross sectional studies in four countries (India, Pakistan, Kenya and Malawi) have assessed maternal morbidity and have shown that up to 1 in 5 women who attended for routine antenatal or postnatal care had taken antibiotics during or after pregnancy without a confirmed diagnosis of infection (18.5%, sample size 11,410 women).

Similarly assessment of the incidence of sepsis in health care facilities across seven countries in sub-Saharan Africa (Ghana, Nigeria, Sierra Leone, Kenya, Malawi, Tanzania and Zimbabwe) and two in Asia (Pakistan and Bangladesh) identified a case fatality rate of 5.3% (236 maternal deaths among 4,448 cases of sepsis identified per year) in 830 health care facilities designated to provide emergency obstetric care.

The UN process indicators for maternal health provide a standard for case fatality rate of 1%.

The evidence suggests that antibiotics are often overused (e.g. by women who do not have confirmed infection) during or after pregnancy. In most health care facilities there is a lack of laboratory capacity to conduct blood cultures and empirical intra venous antibiotic regimes are used. With a



High-Content Imaging  
of extracellular and  
intracellular *Salmonella*  
Typhi (Ty21a)



case fatality rate of over 5% for antenatal or postnatal sepsis it is likely that these regimes at a minimum need to be reviewed. Further research is needed to establish whether failure to respond to IV antibiotics is because of drug resistance and/or to what extent the misuse of antibiotics contributes to resistance.

### Effect of human behaviour

Current work at LSTM has documented how a policy of inpatient treatment for recurrent episodes of TB requiring injection therapy is so costly to patients that this acts as a barrier to patients starting and completing the 8 month treatment courses. As a consequence, the Department of Clinical Sciences has piloted community-based injection therapy and demonstrated good adherence to treatment and large reductions in costs to households and the health system.

### Public Health and Policy

Members of the Department of International Public Health have been involved in intervention studies of adherence support to patients starting antiretroviral therapy, including a large trial conducted in Tanzania and Zambia which was published in *The Lancet*.

Following the refurbishment of the National TB Reference Laboratory in Malawi, the Department of Clinical Sciences supported the completion of the a national survey for MDR-TB, documenting, for the first time, current rates of MDR-TB and highlighting the need for changes in the Malawian MDR-TB treatment regimen. Similarly the Department supported the first ever national survey of tuberculosis and MDR-TB in Nigeria, which led to a major expansion in the provision of treatment for MDR-TB in the country. The Department is responsible for the health economic evaluation of new, shortened regimens for MDR-TB in the STREAM Trial. In addition it also developed a mathematical model which informs country-level decision-makers about the implementation and scale-up of molecular diagnostics for the detection and management of MDR-TB. Work includes trials of the introduction of new diagnostics in South Africa, Russia, Ethiopia, Nigeria and Brazil.

LSTM works with the WHO to update guidelines on insecticide resistance monitoring and on the evaluation of new products designed to be more effective against insecticide resistant populations. It also develops and implements new tools including Insecticide Quantification Kits, Disease Data Management Systems and Serious Gaming into national disease control programmes for malaria and leishmaniasis.



A woman holding her health card in Bangladesh

Professor Hilary  
Ranson - Head of  
Vector Biology



# Department of Vector Biology

The Department delivers research that is responsive to challenges in controlling insect borne diseases. Some of the new tools that have been developed for monitoring and evaluation of control programmes are being highlighted here.

## Diagnostics to improve the use of insecticides in vector control

Vector control using indoor residual spraying (IRS) with insecticides is the primary intervention used in the Visceral Leishmaniasis (VL) elimination programme. Field kits designed by Dr Hanafy Ismail to monitor DDT used for IRS have moved into the manufacturing phase and have been trialed by Dr Mike Coleman's group in Bihar State, India, to assess the efficacy of the spray programme. The results uncovered widespread under-dosing of insecticides by the elimination programme, as well as extensive insecticide resistance to the currently used insecticide, DDT. These data were used by the National Vector Borne Disease Control Programme in India to support a switch in the insecticide class used in IRS to a pyrethroid insecticide. We have received renewed funding from the BMGF to monitor the impact of this switch on the elimination programme.

Development of molecular diagnostics for insecticide resistance mechanisms and cryptic species identification is an area of long standing research expertise for the Department. DNA markers are increasingly utilised in prospective human disease diagnosis but have yet to make a similar impact in vector control programmes, despite a growing arsenal of diagnostics, including new metabolic resistance markers, from our research into *Anopheles funestus* and *An. gambiae*. New NIAID- and Wellcome Trust-funded programmes aim to boost the impact of DNA diagnostics for insecticide resistance in the major African malaria vectors by optimising both existing marker systems and novel marker identification pipelines using whole genome sequencing. Africa-wide polymorphism databases for *An. gambiae* from the Wellcome Trust 1000 genomes consortium, with which departmental staff is closely involved, are also providing a rich source of novel candidates identified from associated genomic signals of selection.



Quality control of DDT  
IRS in India using kits  
developed by LSTM



The department is also discovering and implementing resistance markers in sandflies, *P. argentipes*, to support the drive toward visceral leishmaniasis elimination in the Indian subcontinent. With dengue rates increasing globally, and problematic levels of insecticide resistance, research is also ongoing to identify and apply novel resistance diagnostics for *Aedes aegypti*.

### **Developing transmission models for NTDs**

A collaboration between Professor Steve Torr, Dr Lisa Reimer and the University of Warwick through the Neglected Tropical Disease modeling consortium, is developing transmission models for lymphatic filariasis and Gambian human African trypanosomiasis (HAT), incorporating robust biological data to inform the parameters of vector-parasite and vector-host relationships. The models are being used to predict the likelihood of disease elimination through various individual and combined strategies including vector control, mass drug administration, screening and treatment.

Through the COUNTDOWN consortium we are conducting research on the integration of vector-based control programmes to strengthen local health systems to deliver multiple interventions against vector-borne diseases. We are also investigating the community factors that contribute to persistent NTD transmission in order to inform local elimination strategies.

In Tanzania and Zimbabwe, we are carrying out studies of the transmission dynamics of Rhodesian HAT associated with wilderness areas of Tanzania (Serengeti National Park) and Zimbabwe (Mana Pools National Park). Through a combination of empirical studies, conducted in the laboratory and field, and development of spatially-explicit models of sleeping sickness, we are analysing how the wilderness areas act as a source of disease for people living in surrounding areas, and how this threat might be affected by climate change.

### **Uncovering why insecticide treated bed nets are so effective at malaria prevention**

New research from Dr Philip McCall and Ms Josie Parker has revealed how insecticide treated bednets (ITNs) work from the mosquitoes' view point. Together with optical engineers from the University of Warwick and entomologists from Tanzania, we have developed infrared video technology that tracks mosquitoes in flight, enabling the measurement and detailed characterisation of the behaviour of malaria mosquitoes as they try to bite humans inside a bed net in rural Africa. This initial study demonstrated that an ITN functions as a highly efficient, fast-acting, human-baited insecticidal trap. ITNs do not repel mosquitoes - they deliver insecticide rapidly after only very brief contact. Surprisingly, mosquitoes detect nets during flight and decelerate before collision.

Originally funded within the AvecNet research consortium, Dr McCall's team have received a major new award from MRC to develop a larger three-dimensional system based in Tanzania. In a related study, the team are also using the tracking system to explore a number of patented novel LLIN designs in order to meet the growing challenge of insecticide resistance in malaria vectors.

### **Engaging tools for Communication in Health (ETCH)**

ETCH is a community of researchers, education specialists, population modelers, game developers and stakeholders creating games to address key challenges in health. We are currently developing a digital game to support training programmes in insecticide resistance management following an earlier pilot version. We have consulted with stakeholders to define a set of learning objectives which will be addressed through gameplay mechanics making the game engaging, while also supporting learning and problem-solving skills relevant to malaria vector control.

### **Supporting the Ebola response**

During the past year four members of the Department volunteered to aid with the Ebola crisis in West Africa. Pauline Ambrose, Geraldine Foster and Jessica Thompson were placed by Public Health England in Ebola diagnostic labs established by International Medical Corps and Goal in Sierra Leone. They worked shifts in teams of 10-14, diagnosing samples from Ebola Management Centres and surrounding communities. Teamwork and camaraderie were crucial. By August 2015, positive cases were infrequent due to contact tracing effectively minimising the spread. As Team Leader, Geraldine also worked with the local response committee to improve communication between lab and field, in order to reduce response and waiting times for positive and negative results respectively.

Having worked previously for Médecins Sans Frontières, Sophie Dunkley returned to work with them as an Epidemiologist. She worked on case surveillance, contact tracing, and data management, based at an EMC in Conakry, Guinea. The Department is very proud of their contributions to the Ebola effort. All commented that they found it a challenging but rewarding and memorable experience.

### **Return to Cameroon**

Dr Charles Wondji and his research team moved to the OCEAC research Institute in Yaoundé, Cameroon, to set up a LSTM research unit in vector biology. This initiative funded by a Wellcome Trust senior fellowship to Dr Wondji aims at bridging the gap between basic research in disease vectors and its translation into field applicable policies to improve control programmes.

## FEATURE ARTICLE:


# Malaria Transmission Reduction and Elimination Centre (MaLTREC)

MaLTREC fosters collaboration between malaria researchers distributed across LSTM's four research departments. Much of this research focusses upon efforts to develop and apply innovative approaches to reduce malaria transmission burden.

### **Research: Quantifying the efficacy of next generation of insecticide treated nets**

Recent studies have estimated that the combined use of artemisinin-based combination therapies (ACTs), long-lasting insecticide treated nets (LLINs) and indoor residual spraying (IRS) with insecticides have prevented over 650 million malaria infections in the last fifteen years. Of the 650 million infections averted, 68% is thought to be attributable to LLINs. The recent escalation of resistance to pyrethroid insecticides in African malaria vectors has added a renewed sense of urgency to the development of alternative public health insecticides.

LSTM has been contributing to this global effort via the work of the Liverpool Insecticide Testing Establishment (LITE; see separate chapter in this Annual Report) and also by generating and evaluating evidence on the efficacy of 'next generation' bednets designed to be more effective against pyrethroid resistant mosquitoes. The AvecNet programme, led by Professor Hilary Ranson, is running a clinical trial of the Olyset Duo net in Burkina Faso. This net contains a pyrethroid and a mosquito sterilising agent pyriproxifen. The hope is that resistant mosquitoes surviving exposure to the pyrethroids will be sterilised and have a shortened life span, thus both reducing the frequency of resistance alleles and the likelihood of malaria transmission; results will be available in 2016.

A photograph showing a man in a patterned shirt and a young child under a white mosquito net. The man is leaning over the net, and the child is looking up at him. The background is slightly blurred, showing more of the net and the man's arm.

**A father puts his son under a bednet in Burkina Faso**



In addition, in a collaboration with the Global Fund and Imperial College London, we have been evaluating the efficacy of nets containing pyrethroids and the synergist PBO. Results from the evaluations were used by WHO to develop a policy statement on the use of these nets to tackle pyrethroid resistance.

### Capacity development: Increasing interdisciplinary research capabilities in Malawi and Kenya

Developing the next generation of malaria researchers with interdisciplinary skills is central to both the MALTREC and LSTM mission. Notable examples of this capacity development are to be seen in Kenya and Malawi where Professor Feiko ter Kuile and Dr Anja Terlouw are leading multi-disciplinary research training initiatives. In Kisumu, Kenya a cohort of five PhD students are now working on malaria-related projects under the joint supervision of LSTM faculty from both deaneries.

Assessment of vector species composition, their abundance and seasonality, time and place of biting, resting and host preference, insecticide susceptibility status are essential for the evaluation of anti-vector interventions. However, as LLINs and IRS use increases in the drive to malaria elimination, vector populations decline or adapt their behaviours making monitoring and evaluation more challenging. Therefore it becomes necessary to conduct ever more frequent and intensive vector sampling. Conventional vector collection approaches rely upon trained staff managed centrally by academic or research institutions. To scale this model to the geographical extent and frequency of sampling that is required is deemed prohibitive in impoverished malaria endemic countries. LSTM PhD student Bernard Abong'o works with colleagues from LSTM, the Kenya Medical Research Institute (KEMRI) and the U.S. Center for Disease Control and Prevention (CDC) to design assess community-led vector sampling strategies. Working in an area of enhanced malaria control in Siaya County, western Kenya, Bernard assess whether community-based volunteers can provide reliable vector sampling which will be used as the basis of entomological assessment of intervention impact.



*Figure 1. Sampling design for community directed community surveillance in Siaya County, western Kenya. Each green box with a flag is a house belonging to a community volunteer, brown spots are georeferenced households. The pink circles define buffers around community volunteer households that may be varied to minimise overlap (Image courtesy of Allen Hightower, CDC). PhD student Bernard Abong'o processing collections back in the KEMRI labs in Kisian.*

PhD student Dr Menno Smit also works in western Kenya with Professors Ter Kuile and Ward on the IVERMAL study. In his study area the prevalence of malaria parasitaemia in children under 5 years old has fallen markedly from 70% in 1997 to approximately 40% in 2008. However since this time prevalence has remained relatively constant meaning innovative approaches are needed to continue towards elimination. Ivermectin is a broad spectrum antiparasitic drug that recently received renewed attention as the 2015 Nobel Prize in medicine was awarded to its discoverers. Ivermectin is widely used for the community control of onchocerciasis and lymphatic filariasis at a dose of 150-200 mcg/kg. Previous studies have shown that at this dose the drug has a potent, but short-lived effect of around 6-11 days on blood-feeding mosquitoes. To be a useful tool for widespread deployment in public health campaigns a prolonged anti-mosquito effect is required which will necessitate increased treatment doses. Regulatory studies have shown ivermectin is very well tolerated and safe even up to 2,000 mcg/kg. Menno and colleagues conduct dose finding studies to evaluate the transmission blocking effect of high-dose ivermectin to define the optimal dose for future use of ivermectin in combination with artemisinin-based combination therapy (ACT) for mass drug administration (MDA) for malaria in Kenya.

In Blantyre, Malawi a group of 14 candidates ranging from pre-MSc to senior Post-Doc have recently entered internship positions within the Malaria Theme at the Malawi-Liverpool Wellcome Trust Clinical Research Programme (MLW). Using funds from The Wellcome Trust/Malaria Capacity Development Consortium (MCDC) Dr Anja Terlouw has developed a creative fellowship and mentoring scheme to train the next generation of Malawian researchers. Candidates will be supported for a year to acquire the skills needed to secure funding for their next academic career step (i.e. MSc/ PhD scholarships, post-doctoral fellowships or project grants for entire research teams). Mentorship is provided by MLW/ LSTM staff and includes LSTM alumni Drs Standwell Nkoma and Themba Mzilahowa.

### Advocacy and policy change

The LSTM/MLW malaria team in Malawi have been particularly active in translating research findings into policy and practice. Drs Anja Terlouw and Eva Maria Hodel work

extensively on the Pharmaco-epidemiology of malaria. Much of their work focusses on antimalarial dose optimisation and safety in programmatic use. Data from one trial on the cardiac safety of piperazine, an artemisinin-partner drug, has been shared with the WHO malaria chemotherapy sub-group on dosage recommendations for the updated treatment guidelines published this year. With the Global Malaria Technical Strategy for Malaria for the next two decades moving from control to elimination, national transmission reduction efforts will heavily rely on tailored interventions including antimalarial treatments that are optimised for MDA in the local population.

On a national scale Drs Nyanyiwe Mbeye, Mwayiwawo Madanitsa and Anja Terlouw have been instrumental in the formation of a series of working groups under the remit of the Malawi Ministry of Health's Malaria Task Force. These groups in Malaria in Pregnancy, Knowledge Translation, Vector control etc. will shape the National Malaria Strategy from 2017-2022. The task force is composed of malaria experts from a range of disciplines, with LSTM staff contributing to a number of the working groups. Representatives are also drawn from the development sector such as the United Nations Children's Fund (UNICEF) and the US President Malaria Initiative (PMI).

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**“ Malaria researchers at LSTM and their network of partners embrace this multi-disciplinary approach and are producing the critical high quality evidence that informs both local and international policy development... ”**

*- Dr Martin Donnelly, Professor of Evolutionary Genetics, LSTM*

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Within the operational frame work of the task force and the overall global research agenda on malaria control, elimination and eradication, concerted efforts across several health disciplines are required to optimise interventions. Malaria researchers at LSTM and their network of partners embrace this multi-disciplinary approach and are producing the critical high quality evidence that informs both local and international policy development towards the reduction and elimination of malaria associated morbidity and mortality.





Close up of a  
culicine mosquito

# Department of Clinical Sciences

Professor Luis  
Cuevas - Head of  
Clinical Sciences



**Our department is a vibrant, cohesive and collaborative department within LSTM, providing an excellent platform for research from concept and clinical trials to evidence synthesis. We aim to ultimately facilitate policy changes and health impact. Our outputs are products (drugs, diagnostics and vaccines), policies for health, skills for clinical management and places where excellent work can be conducted.**

We have welcomed a number of new staff members: Gabriela Gomes as Reader in Biomathematics to spearhead the development of models to assess vaccine efficacy and explore the role of genetic resistance on pathogen transmission, ecology, and epidemiology; Jahangir Khan, formerly at Karolinska University, Sweden, and the International Centre for Diarrhoeal Disease Research in Bangladesh, as senior lecturer to strengthen health economics research; and Jamie Rylance, as senior clinical lecturer in a shared appointment with Aintree University Hospital to build on the success of our partnerships between LSTM and the NHS. We also welcomed 15 research assistants, fellows, data managers and programme coordinators to our melting pot. A combination of old, new and young holds promise for innovation and the development of effective health interventions. Some of the highlights of the year are listed here:

## Evidence Synthesis

Liverpool's proven record of high quality synthesis of scientific evidence continues to thrive. The Centre for Evidence Synthesis published key Cochrane reviews this year and added HIV/AIDS to its portfolio. The Consortium published 53 research papers, with 83% (44) of the first authors being from Low and Middle Income Countries (LMIC) and 43% women. As a testimony of its international standing, the WHO Malaria Treatment Guidelines drew heavily on 12 Cochrane reviews supported by the centre; eight of these were led by LMIC and four by Liverpool. The Centre also played an active role in the revised WHO HIV/AIDS Guideline and is engaged with the TB Programme in India to develop guidelines for extra-pulmonary TB.

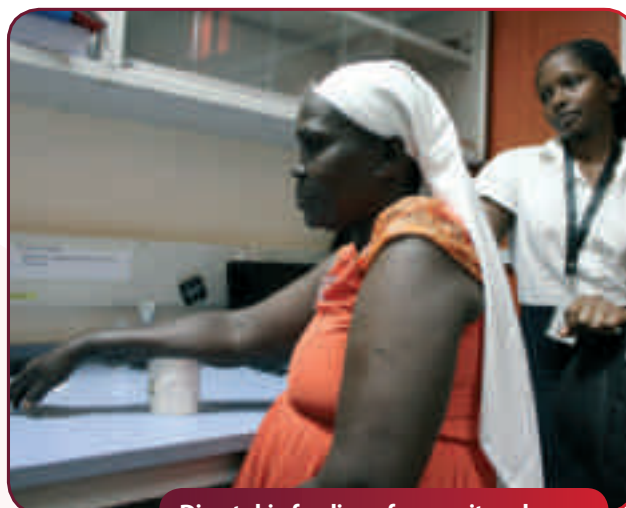
## Paediatrics and child health

Penny Phillips-Howard and team are conducting studies with Tata Institute of Social Sciences Mumbai in Chhattisgarh, Maharashtra and Tamil Nadu to develop a package of

menstrual hygiene for India's ~68 million schoolgirls. Her team partnered with Kenya's Medical Research Institute (KEMRI), US Center for Disease Control and Prevention (CDC) and SWAP Kisumu to conduct the MRC funded trial: 'Menstrual cups and unconditional cash transfer to reduce sexual and reproductive harm and school drop-out in adolescent schoolgirls in western Kenya'.

Adolescents have also witnessed major lifestyle changes in recent years and obesity and diabetes have become major health problem in emerging economies. In response LSTM is studying obesity and pre-diabetes markers in Brazilian school children, with MRC funding. Nearly one third 9-12 year old children have markers of pre-diabetes and interventions are urgently needed to address this problem.

Our group's work in malaria also continues. In western Kenya the prevalence of malaria in <5 year olds fell from 70% in 1997 to 40% in 2008, but stagnated at this level and novel approaches are needed to kick start further reductions. Ivermectin, a broad spectrum drug against parasites, is widely used for the control of onchocerciasis and lymphatic filariasis. At a dose of 150-200 mcg/kg it reduces the survival of the mosquitos, but its effect is short-lived. The drug however is well tolerated and safe at higher doses and Professor Feiko ter Kuile, in partnership with KEMRI and CDC is conducting dose-finding studies (IVERMAL) to evaluate the transmission blocking effect of 600 mcg/kg to define the optimal dose which could be used together with artemisinin-based combination therapy (ACT) for mass drug administration.



Direct skin feeding of mosquitoes by a participant in the IVERMAL study, Kenya.



The collaboration in Kenya also received a new grant from Norway's Research Council to study the impact of monthly malaria chemoprevention in the management of severe anaemia after discharge from hospital. The study will involve 2,200 children in 7 hospitals in Uganda and Kenya.

We are also developing interventions of novel therapeutic feeds to reduce intestinal inflammation in children with complicated severe acute malnutrition in Blantyre with funding from MRC, Wellcome Trust and DFID. Working with Alder Hey Children's Hospital, Professor Stephen Allen is expanding our research in gastroenterology, hepatology and nutrition and supporting the development of the hospital's global health programme.

This year has seen a revision of our teaching provision in paediatrics. Students are taken from the problems of adolescent attending ante-natal clinics, delivery, post-natal care and the management of sick and vulnerable children. Modules on hot topics in child health now take an evidence and quality improvement perspective.

**A healthy volunteer being inoculated with Pneumococcal bacteria in the nose**



### **Respiratory research, household air pollution and chronic lung disease**

Our respiratory research group continues to expand. The team, led by Dr Daniela Ferreira, secured grants for pneumococcal research from the Bill and Melinda Gates Foundation (BMGF) and the MRC and completed a vaccine efficacy trial in partnership with the Royal Liverpool and Broadgreen University Hospitals. The group launched the Experimental Human Pneumococcal Carriage (EHPC) consortium with over 30 world experts in pneumococcal research and continued its public engagement and volunteer recruitment activities. The group will also expand its work on mucosal immunity to examine how nasal immune responses correlate with those in the lung, and how these responses are affected by inhaled particulates.

Air pollution in homes caused by smoke from dirty-burning fuels for cooking, heating and lighting causes four million preventable deaths every year. Our ongoing trials, led by Dr Kevin Mortimer, saw a ministerial visit from DFID. BBC's science correspondent Victoria Gill travelled to Malawi to cover the MRC, Wellcome Trust and DFID funded Cooking And Pneumonia Study (CAPS), resulting in widespread UK and international coverage. CAPS received further grants from the Wellcome Trust and BMGF. Our projects in Malawi are yielding new insights into the burden of lung disease. Initial findings indicate that over 40% of adults around Blantyre have abnormal lung function and we are developing approaches to prevent and treat it.

Our MRC funded BREATHE-Africa Partnership, goes from strength to strength and has now held two productive Annual Meetings and trained a further 50 African doctors and scientists in lung health and household air pollution research methods.

### **Tuberculosis**

Tuberculosis (TB) disproportionately affects the poor and vulnerable, especially in developing countries, with millions of new TB cases each year. Our department continues therefore to have a strong research portfolio: from research synthesis to health systems and policies. These are described in the TB feature of this report.

**A young child participating in the Cooking And Pneumonia Study has her blood carbon monoxide and oxygen levels measured**



## FEATURE ARTICLE:

# Lung Health & TB

LSTM's research covers the full spectrum of the complex, often poverty driven, global problems around chronic lung diseases, respiratory infection and Tuberculosis (TB). It aims to reduce infection, improve prevention and optimise treatments.

The causes of these problems are complex, very often rooted in poverty, and include infections such as *Mycobacterium tuberculosis* and *Streptococcus pneumoniae*, and non-communicable conditions such as asthma and chronic obstructive pulmonary disease.

The solutions require multi-disciplinary, collaborations aimed at both prevention and management of the full spectrum of communicable and non-communicable lung conditions.

## LUNG HEALTH

### Vaccine Immunology and Translational Research

Pneumonia is the leading killer of children under 5 years of age worldwide and has a large impact in the most underserved populations. Current pneumococcal vaccines do not protect well against pneumonia so there is a need for improved vaccines. Our team has developed a model of

controlled experimental nasal carriage in humans that has been used to study immunological correlates of mucosal protection and to test the protection of new vaccines against pneumococcal carriage.

Last year was very successful for the team with nearly £4 million awarded in grants for pneumococcal research from the Bill and Melinda Gates Foundation (BMGF) and the Medical Research Council (MRC). The two grants awarded to Dr Daniela Ferreira and Professor Stephen Gordon will further develop and utilise the LSTM Experimental Human Pneumococcal Carriage (EHPC) model.

This model is the only one of its kind in the world and it can be used for vaccine development, examining pneumococcal biology, exploring mucosal immunity and host susceptibility. It involves volunteers having the pneumococcal bacteria placed directly into their nasal passage and examining their immune responses and pneumococcal biology in a controlled manner.



The Experimental Human  
Pneumococcal Carriage (EHPC) Team



The team has previously used the model to test the efficacy of a licensed pneumonia vaccine and has now successfully completed a trial in which the model was used to test the effect of a novel pneumococcal vaccine on carriage. The Phase 2a trial involving just over 90 participants tested GEN004, a protein-based vaccine candidate from Genocera Biosciences (Cambridge, USA) in partnership with the Clinical Research Unit at the Royal Liverpool University Hospital. The team will now test whether the new nasal live attenuated flu vaccine alters pneumococcal carriage. The study comes as the nasal spray vaccine, already offered in the USA, is being offered as the flu vaccine of choice for children in the UK and will be offered to all children in the next few years.

As a result of these successful trials and the resulting grants, the team has set-up the EHPC Consortium which includes over 30 UK based and international collaborators. All are world leaders in their field of pneumococcal research and work together to develop improved pneumonia vaccines.

In addition, the team won over £600,000 from the MRC Developmental Pathway Funding Scheme to conduct pre-clinical toxicology screening for a novel therapeutic agent P4 peptide. This Streptococcal peptide promotes increased bacterial killing by phagocytic cells in vitro and in vivo. Data from this project, led by Dr Ben Morton, will support an application to the Medicines and Healthcare Products Regulatory Agency (MHRA) for first in human clinical trials. Aligned to this project, Dr Morton has also won funding from the MRC Confidence in Concept scheme to refine, standardise and evaluate a near-point test of immune function to guide the administration of immune-modulatory therapies.

Household Air Pollution in low and middle income countries Air pollution in homes caused by smoke from dirty-burning fuels used for cooking, heating and lighting causes four million preventable deaths every year. LSTM efforts to tackle this problem over the last year saw a ministerial visit from DFID and BBC News Science Reporter Victoria Gill travel to Malawi to cover the MRC, Wellcome Trust and DFID funded Cooking And Pneumonia Study (CAPS) resulting in widespread coverage. CAPS related work has received further research grant funding from the Wellcome Trust and Bill and Melinda Gates Foundation (BMGF) over the last 12 months.



**New cookstove aiming to reduce Household Air Pollution**

The MRC funded BREATHE-Africa Partnership and continues to train African doctors and scientists from across the continent in research methodology related to lung health and household air pollution through the PATS MECOR programme.

Dr Kevin Mortimer and Professor Stephen Gordon presented at the American Thoracic Society Environmental Health Policy Committee Workshop at the American Thoracic Society International Conference in Denver in May 2015.



**Smoke from cooking rising from a house in Malawi**

### Chronic lung disease in sub Saharan Africa

Collaborative projects led from LSTM and MLW are yielding new insights into the burden of lung disease in sub Saharan Africa. Initial findings of The Blantyre Health Study were presented at the European Respiratory Society International Meeting in Amsterdam in September 2015. This study found that just over 40% of the adult population around Blantyre have abnormal lung function when measured using close-to-patient lung function monitors.

### Respiratory research in the UK's North West

Clinical academics from LSTM provide leadership in respiratory research for Liverpool and the NIHR North West Coast Clinical Research Network. They are actively engaged in managing a large research portfolio and supervising students and trainees on all levels of the NIHR clinical academic training scheme.

### Non-communicable diseases (NCDs)

NCDs are the leading cause of mortality and morbidity worldwide. The commonest NCDs are airways diseases (asthma and COPD) that, regardless of global location, require strategies to target lifestyle interventions and expensive lifelong therapy toward those at highest risk of adverse outcomes. Dr John Blakey's work to assess, modify, and convey an individual's risk of a future asthma attack includes a self-assessment tool in collaboration with Asthma UK, database studies including over 100,000 individuals with asthma (Respiratory Effectiveness Group, NIHR) and prospective studies in the UK and Ecuador (Wellcome Trust).

The relative numbers of healthcare professionals is falling being outstripped by population growth whilst the burden of chronic NCDs is increasing. Advances in the capability and affordability of newer information technologies and sensors could help address this problem by facilitating community management of NCDs by less expert providers, and through more efficient use of in-patient healthcare resources. LSTM is engaged in discipline-bridging research in this area, including a multi-centre study using novel indoor positioning data (Health Foundation funded) in collaboration with the Royal College of Physicians.



## Tuberculosis (TB)

The interface between Lung Health and TB disproportionately affects the poor and vulnerable, especially in developing countries. It can affect any part of the body, but in most cases it causes disabling lung damage robbing people of their livelihoods and pushing them further into poverty because of the costs of health care-seeking and treatment. This year has seen further work recognising that TB is one of several causes of chronic cough needing an integrated approach to clinical management. TB also leaves lasting lung damage even after it has been cured leading to persistent coughing. The Triage Plus work in central Malawi has used satellite mapping to document the proportion of rural adults who have a chronic cough. This is preparatory work for development of a community-supported intervention for provision of inhalers and improved access to TB services. New work at the Malawi-Liverpool-Wellcome Programme in Blantyre will see a detailed follow up of 400 TB patients who have recovered from TB to document the range of lung damage and impact on livelihoods.

**Increasing access to diagnosis and treatment**  
We have completed studies evaluating whether the provision of TB diagnostic and treatment services at village and slum level in Ethiopia and Nigeria increase the number of individuals successfully diagnosed and treated. Over 100,000 individuals per year were screened over the last 4 years. Half of the cases occurring in the community were being missed by health facilities. Patients provided treatment locally were more likely to complete treatment. These approaches disproportionately increased access of services for disadvantaged populations. Governments of Ethiopia and Nigeria have secured Global Fund support and will expand these approaches to larger populations.

## The new WHO End TB Strategy



Our work at LSTM over the past year has been aligned to the ambitious new WHO End TB Strategy. One of the new targets is that no TB patients will face catastrophic health care seeking costs by 2020. LSTM staff are members of the WHO Task Force on Measurement of Catastrophic costs, developing methodologies that will help track global progress towards this target.

“The contribution made by my colleague Professor Luis Cuevas and his group to these crucial documents is admirable. They will facilitate high quality and systematic studies and guide funding strategies to improve the diagnosis, treatment and management of childhood TB.”

-Dr Bertie Squire, Professor of Clinical Tropical Medicine, LSTM and Director CAHRD

## TB in children

TB research in children has long been neglected. The difficulties of diagnosing TB in children has led medical research to focus on adult TB to evaluate new diagnostic tests, treatment choices and clinical management. LSTM is a leading member of the expert committee on paediatric TB which published updates on research case definitions for childhood TB and a blueprint for TB research in children. These crucial documents will facilitate high quality and systematic studies and guide funding strategies to improve the diagnosis, treatment and management of childhood TB.

## TB Diagnostics

More accurate TB diagnostic tests which deliver rapid results are helping to reduce the costs incurred by patients in reaching a TB diagnosis.

We completed the first phase of evaluating multiple novel TB diagnostics funded by the European and Developing Countries Clinical Trials Partnership (EDCTP). Studies in Nigeria and Ethiopia recruited more than 2,500 patients to evaluate novel diagnostics in tandem and to assess novel approaches for the use of expensive diagnostics. A new wave of evaluations including an e-nose and Ultra, the new more sensitive version of the Xpert test, will start in 2016.



We have published further high impact articles which use integrated modelling and diagnostic evaluations to help ensure that new tests are adequately tested and used for optimum patient benefit alongside existing tests.



## Drug Resistant TB

New drug regimens for multi-drug resistant TB (MDR-TB) have the potential to reduce treatment times and improve patient outcomes. Health Economists at LSTM are leading the collection of patient and health system data as part of the STREAM drug trial in Ethiopia and South Africa to evaluate patient and health system cost impacts of these new shorter MDR-TB drug regimens. This information will be critical to any global recommendation to scale-up these regimen.

A study funded by the Wellcome Trust is underway to provide information on the extent of drug resistance and better understand the relationship between laboratory measurements of drug resistance and patient outcome is underway with clinical *Mycobacterium tuberculosis* isolates from Malawi, Nigeria, Peru, Vietnam and Moldova. This work will lead to establishing a library of well characterized isolates from a diverse range of global settings.

LSTM participates in two international consortia analyzing large collections of *Mycobacterium tuberculosis* genomes to identify novel global determinants of resistance and the host:pathogen genome interaction in susceptibility to TB disease and virulence determinants.

Through an MRC award, anti-TB drug leads have been developed with activity against MDR-TB. These lead compounds target TB through a novel mode of action. Discussions are currently underway with an industrial partner towards developing these lead molecules into clinical candidates. The project is acquiring data on how drugs kill the TB bacillus within cells which is vital for accurate modeling and prediction of dosing regimens to shorten treatment duration and mitigate against the emergence of MDR-TB.

## Enhancing standard TB treatment

Many patients with pulmonary TB can fail treatment despite taking the drugs correctly and having bacteria apparently susceptible to those drugs. Recent work has shown that modelling the rate at which bacteria are cleared from sputum and the presence of lipids can help predict which patients are at risk of treatment failure. Further clinical pharmacology research at LSTM continues to evaluate variability in treatment responses. Recently published work from Malawi has described how careful examination of bacterial populations in the sputum of TB patients influences long-term outcomes and is being advanced by new projects directly studying anti-tuberculous antibiotic penetration and effectiveness in the lung. Specialist laboratory techniques,

developed by LSTM researchers in Malawi, will supplement this work by investigating how immune responses in the lung evolve during TB treatment.

## Contributions in the North West of England

LSTM clinicians actively contributed to the establishment and continuation of systematic cohort audit of TB treatment outcomes across the Northwest. There have been marked increases in indicators of quality of care as a result. In-depth analyses of the resultant high quality dataset on the 1,700 TB cases treated in the region every year are underway and will contribute to further improvements in patient care.

## Systematic Reviews in TB

As well as publishing several new and updated systematic reviews in TB diagnostics and interventions this year, some of which have informed WHO guidelines processes, the Cochrane Infectious Diseases Group has been engaged as methodological support in an Indian Government initiative to provide national guidelines on diagnosis and management of extrapulmonary TB; the INDEX-TB guidelines.

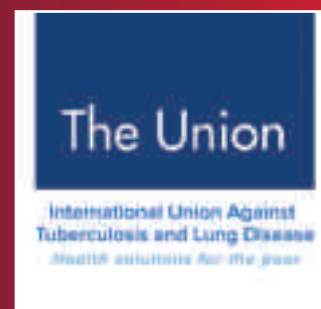
## Lung Health Conference 2016

Liverpool has been chosen to host the 47th Union World Conference on Lung Health in October 2016.

The event is the main international conference for researchers, health programme

managers, policy experts, advocates and other leaders working to address tuberculosis, lung health and other global health issues primarily affecting people living in poverty.

"The Union's decision to host its World Conference in Liverpool is seen as a recognition of our outstanding conference host city but also an acknowledgement of the leading research being conducted here in the field of TB and wider lung health", said former President of The Union and LSTM Professor of Clinical Tropical Medicine Bertie Squire.



People with suspected TB from Mabuduan Health Centre, Papua New Guinea

# Department of International Public Health

**Professor Shabbar Jaffar - Head of International Public Health**



The department focuses on multidisciplinary health research and its use in guiding health policy and practice in low and middle income countries.

In July, Dr Shabbar Jaffar, Professor of Epidemiology and Global Health, was appointed as the new Head of Department. Professor Jaffar brings skills in large-scale HIV intervention trials to complement the ongoing public health research.

## Community Health Workers

Over the past year the REACHOUT consortium has consolidated its context analysis on community health workers, having presented the findings at the Global Symposium on Health Systems Research in Cape Town in 2014 and launched a supplement that brings together the evidence base from around the world. REACHOUT is currently rolling out the first phase of a quality improvement cycle in Mozambique, Ethiopia, Indonesia, Malawi, Kenya, and Bangladesh that will evaluate changes in the supervision and oversight of close-to-community health programmes. REACHOUT continues to engage with the Health Systems Global Thematic Working Group on community health workers.



## Health systems strengthening, Gender and Equity

Our focus has been on human resources for health, fragile and conflict affected states and gender equity analysis. The research in our PERFORM project has been completed. In partnership with district health managers in Tanzania, Uganda and Ghana, we have integrated human resource and management strategies.

Through our DFID-funded ReBUILD programme, which focuses on health systems strengthening in fragile and post conflict contexts, we are conducting a joint analysis with the College of Medicine and Applied Health Sciences in Freetown, Sierra Leone, on the opportunities and challenges for health systems strengthening. This work has informed the health system recovery plans, and in particular strategies to support health workers working both during and after the Ebola crisis. The outputs, briefs and an online resource on ReBUILD's gender stream was successfully launched in October 2015 with active inputs from Tulip Mazumdar, BBC's global health correspondent.



We are building a community of health systems researchers, policy makers and practitioners working in fragile states and through our leadership of the Health Systems Global Thematic Working Group in this area with over 400 members. Our DFID funded work on Research in Gender and Ethics: Building stronger health systems (RinGs) has 10 small grants funded, an active website with multiple resources and a forthcoming special issue planned.

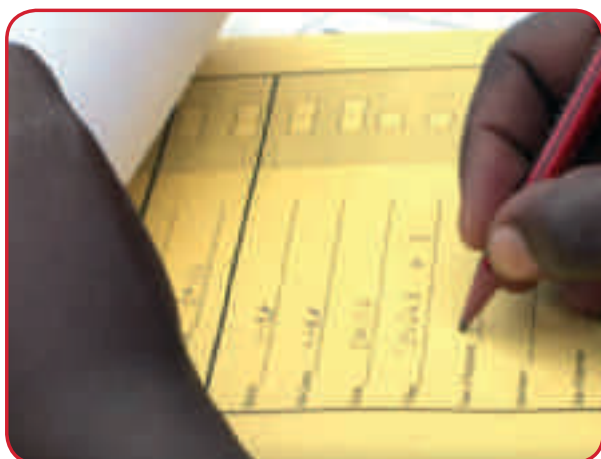
Other projects include maternal health and human resources for health (Nepal), post-abortion care (China), Community Health Workers and e-health (Ethiopia) and an MRC, Wellcome Trust, DFID-funded development grant for improving the use of neonatal health guidelines in China and Vietnam.



Our EU-funded MATIND project has completed its evaluation of major demand-side financing programmes in India for improving maternal health, and disseminated the findings at meetings in Delhi and Ahmedabad. We have conducted a qualitative process evaluation of an intervention to integrate post abortion family planning services into abortion services in hospital settings in China, under the EU-funded INPAC project.

### Monitoring, Evaluation, Training and Research

The METRe Group (Monitoring, Evaluation, Training and Research Group) is a global leader in the development and use of monitoring and evaluation techniques. During 2015 METRe concluded its 5-year USAID funded project with the NGO MSH to introduce the Lot Quality Assurance Sampling (LQAS) in Uganda and this tool is now used widely in the country for strategic health care planning and problem solving. With DFID support, METRe concluded its 3-year impact evaluation of Results Based Financing in Northern Uganda.



METRe continued its long standing relationship with the Republic of South Sudan by supporting its first national household survey since independence. This unique survey provides insight about the current status of local communities. In late 2015 METRe will support the Republic of South Sudan to conduct its first assessment of clinical care since the conflict erupted in December 2013. METRe launched new work with UNICEF to roll out the LQAS method to assess Child Health Days in sub-Saharan Africa.

### Trials and Surveys

Together with colleagues in the Department of Clinical Sciences, we are partners on a large phase III Randomised Control Trial (RCT) of different management strategies for cryptococcal meningitis in Africa (ACTA trial, led by St Georges University of London). The trial will report its findings in 2017.

Findings from our complementary REMSTART trial, which included a strategy of screening serum for cryptococcal meningitis antigen and treating positives pre-emptively with

a cheap widely available single drug treatment (fluconazole), were published in the Lancet in 2015 as a fast track paper. The department is also collaborating with Malawi Epidemiology and Interventions Research Unit of LSHTM to conduct probably the largest survey of the burden and drivers of non-communicable diseases in Africa.

### Capacity Research

The Capacity Research Unit (CRU) is at the forefront of operational research into capacity strengthening. It has developed a rigorous approach and innovative methods and tools for planning, delivering, tracking and evaluating capacity strengthening initiatives, which have been demonstrated to work in a variety of contexts and programmes.

With the Royal Society and DFID, the Unit is continuing to support UK-African research consortia to identify and implement strategies to develop the universities' research environments and improve doctoral programmes. Through a new contract with GlaxoSmithKline, CRU will facilitate the development of African institutions' capacity to conduct research on non-communicable diseases.

For the Malaria Capacity Development Consortium, CRU has been strengthening the research management systems of four African universities. A holistic assessment of the universities' research support systems has been conducted against an evidence-based benchmark, which partner institutions are now using to implement solutions to identified capacity gaps.

### Centre for Maternal & Newborn Health (CMNH)

CMNH has established itself as an internationally recognized Centre of Excellence. In creating effective links with international partners it aims to promote the health of women and newborns in low-income countries through high quality research, teaching and technical assistance.

CMNH currently counts on a multidisciplinary team of more than 100 staff and supports research programmes in 13 countries in Asia and Africa with a portfolio of £32million. See for more information the Feature article on Maternal & Newborn Health.

# Maternal & Newborn Health

Progress has been made with regard to increasing the coverage of maternal and newborn health interventions over the past two decades. There is increasing recognition that further improvement in maternal and newborn health outcomes will depend on the ability to address inequity in availability of care as well as to improve the quality of that care. Improving the quality of facility-based healthcare services and making quality an integral component of scaling-up of interventions that are known to be effective will require a renewed global focus.

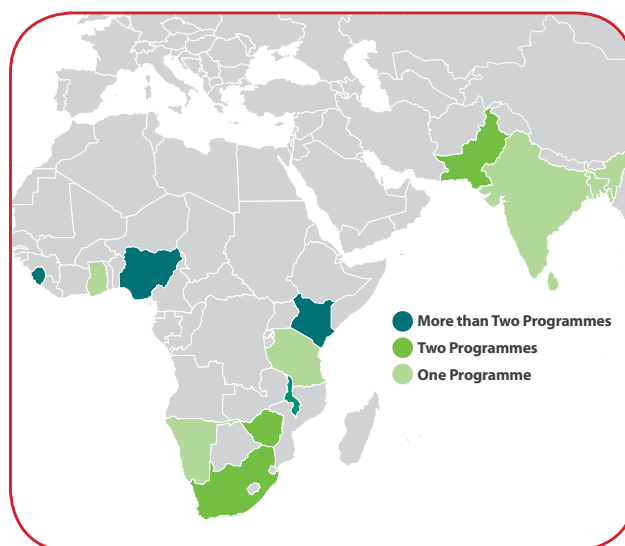
LSTM's Centre for Maternal and Newborn Health (CMNH), led by Professor Nynke van den Broek, has established itself as an internationally recognized Centre of Excellence. In creating effective links with international partners, CMNH aims to promote the health of women and newborns in low-income countries through high quality research, teaching and technical assistance.

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**The CMNH is a WHO Collaborating Centre for Research and Training on Maternal and Newborn Health and in May 2015 CMNH was declared the winner in the Women's Health Category of the 2015 prestigious British Medical Journal (BMJ) awards, for its work on Emergency Obstetric Care in Africa and Asia.**

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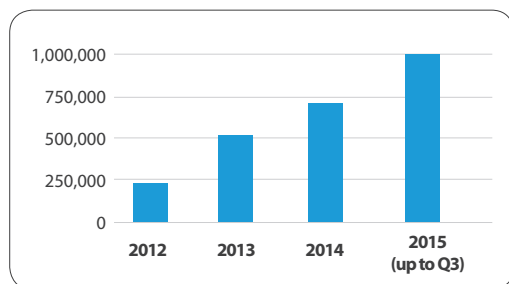
The CMNH currently counts on a multidisciplinary team of more than 100 staff and supports research programmes in 13 countries in Asia and Africa with a portfolio of £32million.



The centre has designed, developed and implemented a variety of innovative maternal and newborn health interventions and programmes that 'catalyse' increased availability and improved quality of care available at health facility level in middle and low-income settings. It uses a rigorous evaluation methodology to document effectiveness of complex interventions and programmes, facilitating the translation of evidence into practice.



## Improved availability and quality of healthcare for 1 million mothers by 2017



## Availability of Care

The majority of maternal deaths and deaths of babies within 24 hours of birth can be avoided if women and newborns receive the appropriate interventions from a skilled health worker, and with adequate equipment, drugs and medicines. However, globally an estimated 45 million women give birth each year without skilled care. To address this gap, countries need to increase the number of skilled birth attendants and should also build the capacity of existing health workers so that they perform better.

### The Making it Happen Programme (MiH)

A comprehensive innovative 5-level M&E framework to evaluate the effectiveness of training in Emergency Obstetric and early Newborn Care (EmONC) was developed by CMNH. This is used to evaluate the impact of the MiH interventions in 11 African and Asian countries (Sierra Leone, Ghana, Nigeria, Malawi, Tanzania, Kenya, the Republic of South Africa, Bangladesh, India, Pakistan). Data was collected at baseline and then at 3-monthly intervals, up to 12 months post intervention. Results from health care facilities were 80% or more of maternity care providers have been trained were included in the analysis.



The results at 6 months post intervention were

- a decrease in Still Birth Rate and direct obstetric case fatality rate of 4.9% and 27.6% respectively.
- a 67% reduction in postpartum haemorrhage and 36.6% reduction in admissions to NCBU for birth asphyxia.
- 54.5% and 35.5% more health care facilities could provide all the basic emergency obstetric care (BEmOC) and comprehensive EmOC signal functions respectively.

For the second year running, the DFID Annual Review 2014 scored the overall MiH programme as: A+, meaning its outputs exceeded expectations.

**The MiH interventions contributed to improved availability of emergency obstetric and newborn care at facilities, a reduction in the number of women with obstetric complications, maternal case fatality rate, stillbirth rate and admissions for birth asphyxia.**



- Professor Nynke van den Broek, Head of CMNH

## Impact of Ebola on maternal & newborn health in Sierra Leone

Research carried out by CMNH found that despite adequate numbers of maternal health workers showing up to work, it was the patients who stayed away at their own peril for fear of catching Ebola. The study, commissioned by international development charity VSO, has shown the devastating impact of Ebola on Sierra Leone's pregnant women and newborn children.

Data was collected from 81 key informants and 76 health care facilities across the country which provide emergency obstetric and newborn care.

Key findings from the research showed:

- 30% increase in maternal deaths.
- 24% increase in newborn deaths.

## Quality of Care

CMNH is providing a new focus on quality of Skilled Birth Attendance, Emergency Obstetric and Newborn Care using a health systems approach and ensuring that care packages are of good quality, delivered along the continuum of care at facility level as well as between different levels of the health system, meet the health needs of women and babies and are 'women and baby-friendly'. Robust research methodology and systematic evaluation is used to generate new evidence for what works where and how. Lessons learnt are disseminated widely and effective dialogue and clear messages facilitate the translation of these into policy.



To support sustainable improvements in selected target countries, CMNH is

- Identifying the 'bottle necks' to providing Quality of Care
- Reviewing national guidelines and protocols
- Introducing a Quality Improvement process at health facility level
- Taking a health systems approach
- Evaluation and Operations Research to assess 'what works where and how'

### **Assessment of quality of care indicators on maternal and newborn care at facility level**

In order to ensure care offered to mothers and babies across the globe is of sufficiently high quality, developing and maintaining quality standards is necessary. These standards need to be measurable and therefore indicators to assess the quality of care play a critical role in the process. After consultation with a wide range of international stakeholders and experts in quality improvement and measurement of quality of care, a core set of indicators was proposed at global level to improve measurement of quality of care at facility level.

CMNH was tasked by WHO with assessing the applicability of the indicators proposed to measure quality in maternal and newborn care and to provide data for the 2015 global Countdown report. Data for the analysis was collected through facility assessment surveys across nine African and Asian countries and an additional evaluations in Sierra Leone (altogether 1,039 facilities). CMNH was tasked to suggest additional information required to measure the indicators in real-life settings and to develop methodological recommendations for testing application of the proposed indicators.

## **Neonatal Health**

An estimated 2.9 million neonatal deaths occur each year. The majority of these happen in developing countries. Three main causes account for the majority of deaths: prematurity (34%), intra-partum related conditions (25%) and infections (including pneumonia and sepsis, 22%). Respiratory Distress Syndrome (RDS) is common to the main causes of neonatal mortality. Respiratory support to manage RDS is provided by Continuous Positive Airway Pressure (CPAP) or mechanical ventilation and is needed to decrease the newborn mortality and morbidity rates.

CMNH is conducting research to:

- Assess the use of CPAP in health care facilities
- Estimate the number of newborns admitted with severe respiratory distress who would benefit from CPAP and measure the RDS case fatality rate.
- Examine practicalities of using CPAP in terms of diagnostic capacity, quality of its use (compliance with standards for CPAP use) and the views of the parents and healthcare professionals.

## **Maternal Morbidity**

CMNH advocates that the identification and measurement of maternal morbidity in a standardised, comparable and robust method will ultimately help to contribute to reducing maternal deaths. A better understanding of the burden of ill health during and after pregnancy will further help to inform and refine care packages to improve maternal health outcomes in low resource settings. CMNH has been working on the development of a standardised definition, the construction of identification criteria for maternal morbidity, the design of a comprehensive assessment tool, and piloting and data collection using this tool in four countries (India, Kenya, Malawi and Pakistan) in order to obtain estimates of maternal morbidity in these settings.

CMNH has developed and used this new tool to develop a maternal morbidity 'score' as a key maternal health indicator that can be used as a new composite outcome measure that can be of use to evaluate maternal health programmes in low and middle income countries. A multi-country study was completed in October 2015 to assess Maternal Morbidity of over 11,000 women during and after pregnancy and findings will be used to develop this Maternal Morbidity Score.

### **Students & Publications**

CMNH currently hosts 10 PhD students researching a wide variety of topics such as using patient reported outcome measures to assess quality of care; effectiveness of emergency obstetric training; the role of Community Health Workers in maternal and newborn health and a social return on investment study on EmONC training.

The centre published a total of 15 peer reviewed papers in the last year.

### **Evaluation of the Maternal , Neonatal and Child Health Week (MNCHW) in Nigeria**

The purpose of this mixed-methods independent evaluation is to assess to what extent the maternal, neonatal and child health week (MNCHW) has contributed to improved maternal, newborn and child health outcomes in Nigeria, and to explain how change was achieved. The evidence provided through the evaluation will inform decisions on how to improve and sustain MNCHW across Nigeria post 2015. The evaluation will provide an independent assessment of the MNCHWs against the following criteria: relevance, impact, effectiveness, efficiency and sustainability (including partnership). A theory based approach, specifically a contribution analysis using the Theory of Change approach will be performed. The evaluation will cover the period 2010-2014.



**Evaluation of 'Improving Maternal & newborn health in Nkhotakota district, Malawi' project**

The evaluation provides an in-depth understanding of the differences that the project has made in care seeking behaviours and in the quality and availability of maternal and newborn health (MNH) services. At inception, CMNH provided technical assistance and quality assurance in the design of the project monitoring systems and tools, and in the collection and analysis of project monitoring data. CMNH assessed both the implementation process (analysing the project), the key measurable outputs of the activities and the plausible effect of the project activities on key maternal and newborn outcomes.

**Evaluation of the Health Transition Fund (HTF) in Zimbabwe**

Designed in line with the evaluation criteria endorsed by the OECD-Development Assistance Committee, our mixed methods evaluation utilizes both quantitative and qualitative data. The analysis of existing reports and secondary data available through HMIS and national surveys is complemented by the design and implementation of regular, comprehensive health facility assessments. Health facility assessments, representative at national level, are scheduled to be conducted for three consecutive years, and form part of the evaluation to track progress in availability and quality of MNH interventions in the country. Key informant interviews are also administered at various levels of the health system, to obtain the views of key actors and to explore the main barriers and facilitators to change.



# LSTM's Strategic Partnerships

## Malawi-Liverpool-Wellcome Trust (MLW)

The Malawi-Liverpool-Wellcome Trust Clinical Research Programme celebrates its 20th anniversary this year. This internationally renowned health research partnership is a collaboration between LSTM, the University of Liverpool and the University of Malawi's College of Medicine with major support from the Wellcome Trust. MLW's four overlapping research themes reflect the health needs of Malawi and the wider region covering: malaria; HIV; TB; non-communicable diseases; and microbes immunity and vaccines.

After eight years as MLW Director, Professor Robert Heyderman has made way for incoming Director Professor Stephen Gordon. Former Head of LSTM's Department of Clinical Sciences, Professor Gordon began his new role on 1 July 2015.

### • Malaria

Cerebral malaria accounts for a significant proportion of malaria mortality and is a key area of collaboration between LSTM, MLW and international collaborators. LSTM's Dean of Biological Sciences, Professor Alister Craig supervises MLW researchers to develop an understanding of adhesion-based pathology in malaria and thereby the development of novel therapeutics.

Malawi's National Malaria Taskforce are developing the National Malaria Research Agenda 2017 – 2021 and held their first meeting in Lilongwe in July. The meeting brought together researchers from MLW, the Malaria Alert Centre, the University of Malawi's College of Medicine, Blantyre Malaria Projects and LSTM.

**“A strong five-year research agenda and a vibrant research community that can address the priority questions, will give policy makers the information that can help Malawi achieve its goal to substantially reduce malaria over the coming years.”**

*- Dr Anja Terlouw, Clinical Lecturer LSTM & Honorary Senior Lecturer College of Medicine, Malawi*



### • TB

MLW researchers have also been investigating why people taking effective antiretroviral treatment (ART) are still susceptible to developing tuberculosis (TB). They found that immune cells respond to the presence of TB-causing bacteria or that its proteins do not work properly in HIV-infected adults who have taken ART for less than four years. The findings show the need for strategies to augment ART to improve lung immune cell function and reduce the incidence of TB.

### • HIV

A \$23m UNAIDS partnership is accelerating access to HIV self-testing (HIVST). The project will form an evidence base to inform policy and programming decisions at both global and national levels. In Malawi, Zambia, and Zimbabwe, the project team is piloting HIV self-testing models among different populations, distributing nearly 750,000 self-test kits over the two years of the study.

The UNAIDS Self-Testing Africa (STAR) project in Malawi will test strategies using community-based distributors to give out self-tests to general populations in the community. MLW will be working with the London School of Hygiene and Tropical Medicine to conduct studies on accuracy, choices, costing, linkage and the social implications of HIVST in communities. A smaller sub-study on key populations, including female sex workers, will take place in Blantyre.

## BREATHE Partnership



The BREATHE Africa partnership (Biomass Reduction and Environmental Air Towards Health Effects), led by LSTM, draws together experts and investigators in major air pollution trials to harmonise specific aspects of trial methodology, optimise associated mechanistic work, including testing for new biomarkers not funded in current trials, and engages African researchers and trainees in existing and new studies by offering mentored research training projects. Jointly funded by the MRC and DFID (under the MRC/DFID Concordat agreement), BREATHE Africa also trains African doctors and scientists in lung health and household air pollution research methods through the PATS/MECOR programme.





### Wellcome Trust Liverpool Glasgow Centre for Global Health Research (WTCGHR)

MLW is supported by WTCGHR, one of five Wellcome Trust Centres for Global Health Research. LSTM Dean of Clinical Sciences and International Public Health, Professor David Laloo, is Director of the Centre that also delivers the Wellcome Trust Clinical PhD Programme, a flagship scheme supporting the most promising

medically qualified clinicians wanting to undertake rigorous research training.

### KEMRI/CDC in Kenya

A collaboration between the Kenya Medical Research Institute (KEMRI) and the US Centers for Disease Control and Prevention (CDC) in Kisumu, western Kenya, is strengthened by staff from LSTM's Department of Clinical Sciences, including Professor Feiko ter Kuile, who leads the malaria research collaboration.

The KEMRI/CDC collaboration is part of the Malaria in Pregnancy (MiP) consortium. Led by Professor Feiko ter Kuile it has been investigating whether dihydroartemisinin-piperaquine may be effective at preventing malaria in pregnant women in areas of drug resistance.

### The Global Alliance to Eliminate Lymphatic Filariasis (GAELF)

GAELF brings together a diverse group of public-private health partners to support the Global Programme to Eliminate Lymphatic Filariasis (GPELF) by mobilising political, financial and technical resources. GAELF's secretariat has been hosted by LSTM since 2004 and was incorporated into LSTM Neglected Tropical Diseases in early 2015.



GAELF's 8th biennial meeting was held in Addis Ababa, Ethiopia, in conjunction with the 20th session of the African Programme for Onchocerciasis Control Joint Action Forum, an operational research session addressing questions relating to both lymphatic filariasis and onchocerciasis. The meetings were attended by 250 delegates from 46 countries and provided an ideal opportunity for interaction and collaboration between countries and partners.

### LSTM and the University of Warwick

LSTM's Director, Professor Janet Hemingway, was among three eminent UK scientists being



honoured by the University of Warwick (UoW) when she was conferred as Honorary Doctor of Science in January 2015. The partnership between LSTM and UoW's School of Medicine and Life Sciences began in 2012 and draws upon complementary areas of expertise, providing an excellent opportunity for talented researchers to make significant contributions to the international health agenda.

Central to the partnership is the study of the science, policy and economics of applied health research and delivery. Coordinated by LSTM, the Collaboration for Applied Health Research and Delivery (CAHRD) brings together individuals and disciplines across the full range of applied health research encompassing operational, implementation, and health systems research.

The NTD Modelling Consortium is coordinated by UoW and acts as a point of contact to commission modelling to address questions concerning the elimination and control of NTDs. Mathematical modelling plays an increasing role in public health planning and decision-making (such as determining cost-effectiveness of drugs and vaccines), but for NTDs such as approached previously have been rarely used.

In recognition of the partnership, LSTM made a joint submission with UoW for public health to the UK's Research Excellence Framework (REF) 2014.

### Lancaster University

Strong cross-cutting links with Lancaster University (LU) have already generated collaborative projects with all of LSTM's departments and along the entire translational research pipeline continuum. A Translational and Quantitative Skills Doctoral Training Programme in Global Health is the latest area of collaboration for LSTM and LU. Supported by a grant from the Medical Research Council's Doctoral Training Programme (MRC DTP), LSTM and LU will train the next generation of scientists in translational and quantitative research with a focus on Global Health.



### University of Liverpool

Although the formal affiliation with the University of Liverpool



(UoL) ended during in July 2013 when LSTM obtained higher education institutions status, the academic collaboration to deliver world class education and research continues to thrive as illustrated in numerous research initiatives such as MLW; WTCGHR; CIDG; LIV-TB to name a few.

In response to the 2014-15 Ebola outbreak, Liverpool was awarded a Health Protection Research Unit in Emerging and Zoonotic Infections. The partnership between LSTM and UoL works closely with researchers at Public Health England on the biology of Ebola virus.

Scientists from the UoL's Institute of Infection and Disease Control and LSTM have shown that evolution can be highly predictable under certain circumstances, especially in terms of how animals become resistant to dangerous toxins. In a paper published in the journal PNAS in September 2015, researchers examined the response of a variety of insects, reptiles, amphibians and mammals to a natural selection pressure in the form of cardiac glycosides – toxins produced by certain plants and toads for defence against predators.

LSTM made joint submissions with UoL for clinical medicine to REF 2014. On the education front,

LSTM's postgraduate degrees and most of the diplomas continue to be awarded by UoL until LSTM has obtained degree awarding powers.

### ACT Consortium



Artemisinin-based combination therapies (ACTs) are the first-line treatment for malaria in Africa and Asia. The ACT Consortium, brings together 24 global academic and public health partners, including LSTM,

who work in 10 countries to examine the effectiveness of ACTs over time, the cost-effectiveness of delivery strategies, acceptability, safety, and how to improve ACT use by prescribers and patients.

The Consortium's research focuses on four main themes: improved access to malarial drugs for the poorest communities; targeting the use of the drugs to ensure they are available to those who need them; improving safety by identifying common adverse effects of drugs; recommending improvements to the systems to ensure the quality of drugs.

LSTM's Professor Laloo, a member of the ACT Consortium Steering Committee and the Safety Working Group Lead, provides resources for researchers seeking user-friendly methods for evaluation of antimalarial safety.



### Stop TB Partnership

Although TB is treatable with a six-month course of antibiotics, it still kills 1.5 million people each year. Founded in 2001, the Partnership's mission is to serve every person who is vulnerable to TB and ensure that high-quality treatment is available to all who need it. Together Stop TB's 1300 partners are a collective force that is transforming the fight against TB in more than 100 countries.

At LSTM, TB research spans the whole spectrum of this complex problem, taking a practical approach with partners in developing countries to find the best solutions that can be effectively applied in these settings. LSTM's Professor of Clinical Tropical Medicine, Bertie Squire, is Secretary to the Partnership's TB & Poverty Sub-group, a sub-group of the DOTS Expansion Working Group. This is a network of individuals and organisations who focus on ensuring that the specific needs of poor and vulnerable populations are addressed in the delivery of TB services.

The Partnership is working towards the target of eliminating TB as a global public health problem by 2050.

### Mersey Maritime

The Mersey Maritime network represents the interests of the Ports and Maritime Sector on Merseyside. LSTM became a member in 2015, enabling further development of maritime business opportunities, initially occupational health; pre- and post-travel screening services; training and education. Chief Executive Officer of Mersey Maritime Chris Shirling-Rooke welcomed LSTM saying: "We are delighted that such a renowned institution as LSTM has joined Mersey Maritime. Its global scientific reputation is second-to-none and with its unique maritime heritage and ambitious growth programme I am confident LSTM will be a major asset to the network as well as benefiting from the business opportunities we offer."



**MERSEY  
MARITIME**  
— MEMBER —



## FEATURE ARTICLE:

Applied **health**

To improve prevention and treatment of many diseases, new products and interventions require knowledge of their effective implementation and an understanding of their impact through constant monitoring and evaluation.

LSTM's emphasis on product development alongside translational and policy research with special focus on health systems and capacity strengthening resonates strongly with institutions; governments and their ministries; funding bodies and partner organisations across the globe.

Applied Health Research at LSTM includes a strong focus on taking interventions from regulatory approval through to field implementation.

This encompasses the activities that help develop practical solutions to health needs and rights. It incorporates the spectrum of research that delivers policy-relevant evidence and includes operational, implementation, and health systems research.

**CAHRD**

Led by Professor Bertie Squire, with Dr Kevin Mortimer as recently appointed deputy director, this Collaboration brings together individuals and disciplines, across the full range of applied health research encompassing operational, implementation, and health systems research.

Following its launch Consultation in the 2014 CAHRD Consultation the outcomes of the four identified workstreams (lung health; maternal and newborn health; NTDs; health systems) are scheduled to be published in BMC Proceedings at the end of 2015. This follows a number of key publications in peer-reviewed literature.

CAHRD has been instrumental in the set-up of the BMGF funded NTD Modelling Consortium, which promotes mathematical modelling Neglected Tropical Diseases as it works best through cross cutting collaborations with epidemiologists, policy makers and field experts. It also played

a role in the renewal of the partnership between LSTM and the REACH Trust (Research for Equity and Community Health Trust). REACH Trust conducts international and national recognised multidisciplinary research that promotes access to health services, particularly for the poorest and most vulnerable. REACH Trust conducts research that generates knowledge on understanding the interface between the national and international socio-economic development and communicable disease, especially malaria, tuberculosis and HIV/AIDS.

The Collaboration was also involved in the successful application, together with Lancaster University, to the MRC Doctoral Training Partnership PHD programme, which enables LSTM to recruit up to 7 PhD students annually. The scheme pairs novel multidisciplinary PhD research with the next generation of leaders in health and biomedical provision.

CAHRD also promotes the creation of a health economist group to provide economic evidence for social policy, environment health and public health policy, and clinical guidance.

The next Consultation is scheduled for 2016, hosted by the University of Warwick.

**Evidence Synthesis**

Systematic reviews of reliable research evidence are a requirement for evidence informed policy and practice. They are also required prior to embarking on new research, to build on the existing research base, and avoid duplication and wasting money and resources.



What new drugs need to be approved for the WHO Essential Medicine List for middle and low income countries? This was one contribution of the Centre for Evidence Synthesis to global policies, as its director, Professor Paul Garner, acted as rapporteur of the Essential Medicines Committee in June 2015. Members of the centre contributed to generating the evidence base, the decision making and the writing of the Malaria Treatment Guidelines as well as being part of the HIV/AIDS Operational Guidelines Group.

The Centre also helped WHO evaluate National Guidelines development and implementation in Estonia, and worked with the Government of India in forming national guidelines for extra pulmonary TB. Within the Centre, the Cochrane Infectious Disease Group is helping with executive policy issues for editors and examines value for money investment of the UK National Institute of Health Research Funding to Cochrane.

The Centre is committed to capacity development of LSTM staff in evidence synthesis, and have run training workshops in medical writing and qualitative research synthesis. It also provided training in systematic reviews at Cornell University Summer School, and for the TB Union in India.

A substantive number of new and updated Cochrane reviews in malaria and neglected tropical diseases have been published, some of which have generated considerable debate, particularly around the effectiveness of deworming. A systematic review of animal studies around the new MVA85A TB vaccine indicated the researchers delayed publication of poor survival in monkeys with the new vaccine until after a trial testing the same vaccine children in South Africa had started, raising questions about selective publication.

The Cochrane Group has now taken on responsibility for HIV/AIDS reviews, which provides a platform for work in the coming decade.

### **Health Systems Development**

LSTM is working on issues around health staff performance management; international migration of health professionals; decentralisation and human resource management; reducing geographical mal-distribution of health personnel; the role of HR in policy development and strategies to strengthen the integration of community health workers into the formal health system.

### **Gender and Health**

The Gender and Health Group is a multi-disciplinary group with expertise in gender equity and health research. Its research on gender equity and sexual and reproductive health and rights includes work on maternal health, post abortion care, gender based violence, gendered vulnerability and resilience to HIV and research uptake strategies; work on equity and tuberculosis includes assessing community based approaches to bring services closer to communities to enhance access.

Group members have extensive experience of gender and equity analysis in areas such as national level policy development, clinical research and practice, and health systems development in collaboration with partners in Africa, Asia and Latin America.

### **Capacity Strengthening**

Strengthening health research capacity in low- and middle-income countries (LMIC) is a recognized way to advance health and development. However, systematic evidence on the effectiveness of different approaches remains limited, as their complexity and diversity make monitoring and evaluation (M&E) difficult.

The Capacity Research Unit (CRU), led by Professor Imelda Bates, is renowned for its operational research into capacity strengthening. It has developed a rigorous approach and innovative methods and tools for planning, delivering, tracking and evaluating capacity strengthening initiatives, which have been demonstrated to work in a variety of contexts and programmes.

The EU-funded T-REC programme has had a significant impact on blood transfusion research across Africa culminating in a pan-Africa meeting of researchers and senior blood services managers. This meeting resulted in a list of research priorities for African blood services which will help to focus funding and projects towards the most important topics. Through PhD projects the programme has also generated new knowledge about the economics of infection screening, rationalising syphilis testing and changing HIV patterns and has uncovered new ways to motivate blood donors in Africa.

CRU continues to support, with Royal Society and DFID funding, UK-African research consortia to identify and implement strategies to develop the universities' research environment and improve doctoral programmes.

For the Malaria Capacity Development Consortium, CRU has identified strengths and weaknesses in the research





management systems of four African universities which has helped them target their resources more effectively to implement solutions to identified capacity gaps.

CRU has also set up a cross departmental laboratory capacity strengthening group to focus on activities in this area, building on previous experience in malaria, tuberculosis and Neglected Tropical Disease (NTD) laboratory strengthening.

### Health Programme Monitoring and Evaluation

The Monitoring and Evaluation Technical Assistance and Research unit (METRe), led by Professor Joe Valadez, focuses on the use and training of innovative and up-to-date data collection and analysis tools which can be used to guide and strengthen health programmes, and to formulate evidence based policy.

During 2015 METRe concluded its 5-year USAID funded project with MSH to institutionalize the Lot Quality Assurance Sampling (LQAS) method in Uganda. It did so in approximately 78 of 112 districts. LQAS is now used by most of these 78 districts for strategic planning and problem solving. Its unique virtual data base has linked, across time and space, LQAS databases collected from 2003 to the present and has now been used in 6 publications.

With DFID support, METRe concluded its 3-year impact evaluation of Results Based Financing (RBF) in Northern Uganda. It presented its results to a joint conference of DFID, World Bank, UNICEF, and the Government of Uganda (GoU). METRe's results are now being used to inform the World Bank's Global Financing Facility and RBF policy of the GoU.

METRe supported the Republic of South Sudan with its first national household survey. Using the LQAS method, it was successfully carried out in 9 of 10 states at county level. NGOs were particularly helpful in collecting information in areas of high conflict.

METRe launched new work with UNICEF to roll out the LQAS method to assess Child Health Days in Niger, Benin and Madagascar. METRe also commences a new programme with the Bill and Melinda Gates Foundation (BMGF) to establish monitoring and evaluations systems for the BMGF Maternal, Newborn and Child Health programmes in Bihar, India. In this project METRe's statisticians are advancing cutting edge research to blend survey data with recurrent information to strengthen local level estimation.

### Health Economics

As part of CAHRD LSTM conducts research on effectiveness, efficiency & equity impact of health interventions from community to hospital level. This is to provide economic evidence for social policy, environment health and public health policy, and clinical guidance, including inequalities in the international health field and health technology assessment field.

LSTM Health Economics, led by Professor Luis Niessen, has been developing steadily since 2013, while setting up collaborations

across the departments and with selected key partner institutions, especially in Bangladesh, Kenya, Malawi, Ghana and Cameroon. These collaborations lead to funding opportunities, involvement in ongoing LSTM projects, and joint and stand-alone courses. Two years after the start a critical mass of health economics activities at LSTM is emerging. The ongoing stream of scientific publications focusses on the financial and equity impact of major diseases on households, healthcare systems and value-for-money options to combat those diseases in an efficient and equitable way.



The health economics activities involve a diversity of areas related to both infectious and chronic diseases, such as the major neglected tropical diseases, malaria, diabetes, cardiovascular disease, lung health and cancers. Cross-cutting themes focus on catastrophic expenditures, poverty-impact of diseases, economic benefits of control programmes, cost-effectiveness of new intervention programmes as well as their effects on access and impact inequalities.

Highlights in the past two years were high-impact studies on the chronic disease epidemics in low-income countries as well as related intervention studies. Several studies were completed on the occurrence of malaria and household impact as well as the socio-economic impact of the control of neglected diseases.

**“ LSTM Health Economics will contribute to LSTM's mission to combat the impact of major diseases globally through the development of appropriate and affordable technologies in a demonstrated efficient and equitable way. ”**

*-Dr Louis Niessen, Professor in Health Economics, LSTM*

### Data Management and Modelling

LSTM researchers are working to improve cost effectiveness and ease of use of new methods of vector control as well as coordinating efforts on NTD modelling to inform policy.

LSTM is also implementing the Disease Data Management System (DDMS) to monitor and evaluate vector borne disease programmes. The DDMS has modules to support case surveillance, disease outbreak, entomological monitoring, intervention planning and intervention monitoring as well as a form generator to build customized modules.



**A 'tiny target' placed along a river in Chad. It attracts tsetse flies and is impregnated with insecticide. LSTM and national control programmes deploy tiny targets to protect locals against sleeping sickness**



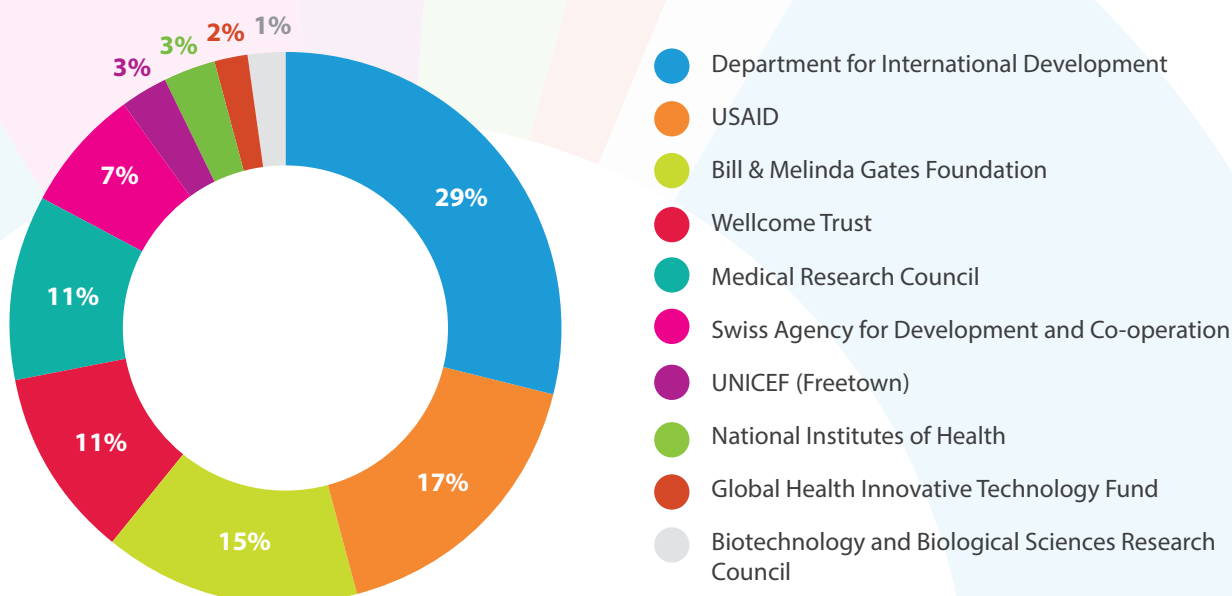


# LSTM's top research funders

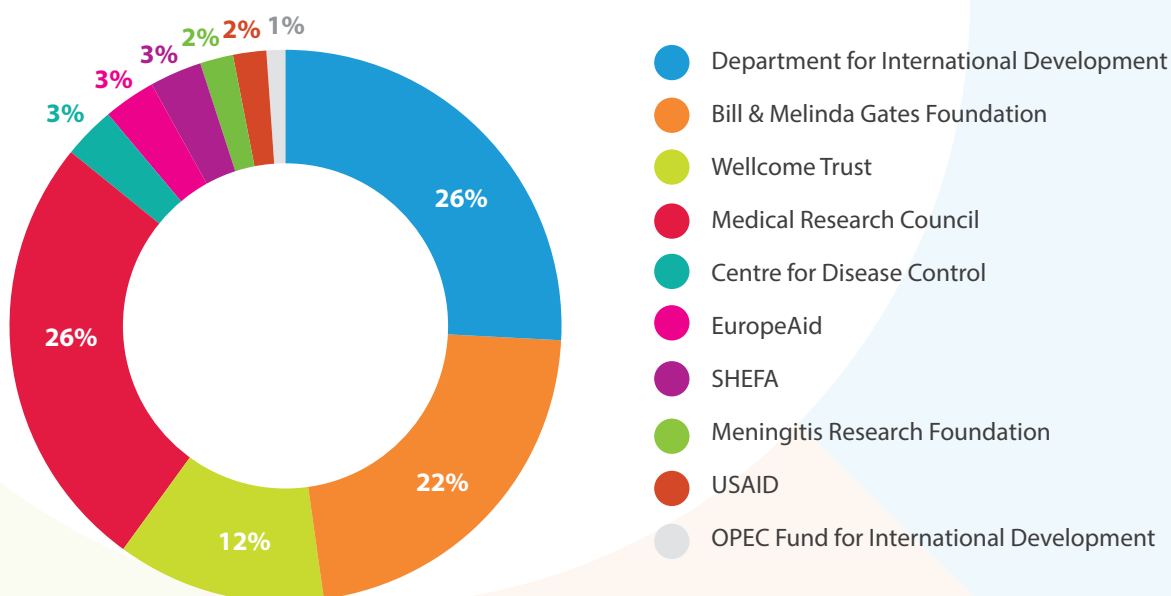
The tables below show the top funders in terms of total contract value for LSTM for the financial year 2013/14 and 2014/15.

The comparison of the two last financial years shows that the top funders largely remained the same: DFID, Bill & Melinda Gates Foundation, Wellcome Trust, and Medical Research Council. There are however changes in the top research funders in 6th-10th position.

## Top 10 research funders (by total contract value) 2013-14



## Top 10 research funders (by total contract value) 2014-15



<sup>1</sup>Top funders by total contract value, not number of applications awarded.



# Research Committee 2014 - 2015

LSTM's Research Committee is responsible for developing the detailed strategic plans for research development linked to LSTM's overall strategic plan. It recommends to LSTM's management the deployment of resources to enhance LSTM's research effort.

## Research Excellence Framework (REF)



LSTM appeared on the REF2014 rankings under its own name for the first time following the designation as higher education institution in July 2013. LSTM provided joint submissions with the University of Liverpool (clinical medicine) and University of Warwick (public health).

LSTM scored exceptionally well on the 'Times Higher Education' ranking of institutions on impact by taking place 6 out of 128 and almost all of the LSTM impact case studies submitted were considered to be internationally excellent or outstanding. Overall LSTM scored 24th place out of 128 assessed higher education institutions.

LSTM outputs were judged to be 70 to 75% internationally excellent or outstanding. LSTM's REF2014 exercise was

coordinated by Professor Alister Craig who has now handed over to Professor Hilary Ranson who will coordinate the next submission scheduled for 2020, when LSTM will make a standalone submission.

## Support to Multidisciplinary Workstreams



**Professor Alister  
Craig**

Research Committee achievements in 2014-15 include support to the above mentioned REF process as well as an agreement on strategies to support open access publications. The identification of funder champions to share research intelligence and best practice across the funding landscape for 11 key funders has been completed and the launch of a cross department, cross deanery mentoring scheme (in collaboration with the Athena SWAN committees) has taken place.

Multidisciplinary speed dating to support discussion across disciplines and encourage partnerships continues to enjoy high attendance rates and strategic links with the Intention to Submit Committee, which has reviewed 232 research grant applications, and disbursement and administration of LSTM internal funding opportunities have been set up.

## Internal Restructuring

LSTM's central support functions of Finance, Research Support and Governance underwent a restructuring in spring 2015 with the specific intention to strengthen the research support function. The newly formed Unit of Research and Business Professional Services (RBPS) was established on 1st May 2015 covering pre award, post award and research information services, with Helen McCormack appointed as Head of the Unit.

One of the key functions of RBPS is the support to Research Committee. A plan for improvement has been established which will be implemented over the coming months to ensure close working relationships between RBPS and research committee are further developed.

As a result of the newly formed RBPS, the Research Implementation Plan has undergone a detailed re-engineering to align the document to the Strategic Framework, which operationalises the Strategic Plan.

# Clinical Partnerships

As clinical research, health services delivery and training continues to grow LSTM's expertise is increasingly called upon by the NHS and international partners to improve the health of UK patients and the world's poorest communities.

## Lung health & TB research

Chronic lung diseases, respiratory infection and tuberculosis (TB) affect people in the UK and worldwide. It is therefore important for LSTM and the NHS to work in partnership to develop new diagnostics and treatments for respiratory medicine.



LSTM works with the Royal Liverpool University Hospital, the University Hospital Aintree and the Liverpool Heart and Chest Hospital and in association with

Liverpool Health Partners and NIHR Clinical Research Network: North West Coast. This collaborative research targets the best methods of reducing susceptibility to infections such as TB and pneumococcal disease and non-communicable conditions such as asthma and chronic obstructive pulmonary disease.

## Pneumonia

The Experimental Human Pneumococcal Carriage (EHPC) collaboration is recruiting volunteers for a study examining the effect of a new nasal spray flu vaccination on the carriage of pneumococcal bacteria in the nose. The collaboration between LSTM and the Royal Liverpool Hospital has attracted a grant of £2.3m from the UK's Medical Research Council which will see the EHPC model utilised for vaccine development, understanding pneumococcal biology, looking at host susceptibility and measuring mucosal immunity.

## Innovations in Medical Care

Limited resources within the NHS have led to a pressing need to understand the actual activity patterns of hospital staff in order to see if safety and efficiency can be improved. Staff and patient activity needs to be studied in the context of interactions with people, equipment and the built environment. LSTM senior clinical lecturer Dr John Blakey and collaborators at the University of Nottingham are endeavouring to understand the relationship between activity and location in hospitals. Health Foundation and charitable awards support this research in hospitals in Liverpool, Blackpool and

Nottingham feeding directly into a Royal College of Physicians' toolkit and the national safe staffing programme.



Asthma attacks are a significant source of mortality and morbidity. There is currently no validated assessment tool to describe a person's individual risk of future attack. Dr Blakey and colleagues produced the Asthma UK "Triple A Test" for

risk assessment (>40,000 completions on-line this year). This work has been advanced by a study of over 118,000 individuals with asthma presented at the European Respiratory Society meeting. Related work with LSTM PhD student Cristina Ardura-Garcia has extended this research to children in low-middle income settings with presentations at the American Thoracic Society, World Allergy Organization and the Association for the Advancement of Artificial Intelligence (AAAI) Conference 2015.

## Improvements in Access to TB Care and Treatment

Tuberculosis (TB) is a contagious and often severe airborne disease caused by a bacterial infection. Three million of the annually estimated 8.6 million cases of TB are missed by healthcare services.

LSTM has developed and tested approaches to bring diagnosis and treatment for TB closer to the community. Researchers from LSTM and the University of Warwick have found that same-day diagnosis and close-to-community approaches lead to improvements in access to TB care and treatment, and reductions in costs incurred during care-seeking by poor patients in Malawi, Nigeria, Yemen, Ethiopia, Nepal and elsewhere.

Professors Sally Theobald and Luis Cuevas led the research which has directly influenced policy and local TB control programmes practice. The National TB Programme in Malawi is engaging informal providers to recognise disease and refer



patients as part of national policy. The Nigerian National TB and Leprosy Control programme is exploring whether the Global Fund could provide financial support to include community-based approaches within its programme. The Ethiopian Regional and National Health services are expanding a community-based approach from three million to seven million people as part of the regional and national Health Extension Programme. LSTM's work engaging community health workers has been described as a 'pathfinder for TB' by WHO.

The prestigious 2014 Kochon Prize for innovative tuberculosis projects has been won by REACH Ethiopia for their innovative work in finding and reaching people with TB. The REACH project in Ethiopia received funding from the Global Fund and within one year doubled the number of TB patients diagnosed and successfully treated. LSTM, a partner in REACH Ethiopia, has focused on smear transport and the expansion of TB services in 19 underserved districts.

Dr Mohammed Yassin designed and initiated the community-based TB control programme in Ethiopia which improved access to services. Dr Yassin's valuable contribution to the project was recognised in April 2015 when he became Senior TB Advisor for the Global Fund. Dr Yassin was a research student at LSTM supervised by Professor Cuevas, a fellow co-founder of REACH Ethiopia.

### Paediatrics

Together with the new Alder Hey Children's Hospital in Liverpool, LSTM contributes to several NIHR Children Clinical Research Network portfolio studies and developing studies in coeliac and Crohn's disease. Support is also given to the expansion of the global child health programme at Alder Hey.



**Public Health  
England**

### Health Protection

LSTM clinicians continue to support the improvement of the nation's health by providing specialist advice to Public Health England (PHE), the government body responsible for protecting the nation's health and wellbeing, and reducing health inequalities. LSTM made a major contribution to the UK response to the Ebola outbreak in West Africa.

The Tropical and Infectious Disease Unit (TIDU) at the Royal Liverpool University Hospital is one of just three British hospitals designated to take patients with Ebola if the national specialist unit in London is full. LSTM professor David Laloo was on the Chief Medical Officer's scientific Advisory Group which

reported to the UK government. Dr Nick Beeching, LSTM senior lecturer and honorary consultant at the Royal Liverpool University Hospital, provided clinical advice for medical professionals managing travellers returning to the UK with fever through the PHE Imported Fever Service. Dr Beeching also co-authored the BMJ Best Practice series on Ebola Virus Infection which provides a comprehensive interactive reference for clinicians interested in all aspects of the presentation, diagnosis and management of people with Ebola.



**Professor David  
Laloo**



Well Travelled Clinics, an LSTM subsidiary, undertook the health assessment of a large proportion of the British NHS staff who volunteered for the UK-Med mission to West Africa and is one of the few centres responsible for monitoring the health of volunteers when they return to the UK.

### NaTHNaC

The National Travel Health Network and Centre (NaTHNaC), commissioned by PHE, continued to protect the health of British travellers, by providing the latest information and advice to the public and the travel industry. As co-founder, LSTM has been working with other network partners including the Hospital for Tropical Diseases and LSHTM, both in London.



### Health Protection Research Unit (HPRU)

The National Institutes of Health Research HPRU, based in Liverpool, brings together leading researchers from the University of Liverpool, LSTM and PHE. The HPRU works to increase PHE's ability to tackle current and future threats, thus informing policy, enhancing decision making, strengthening services and facilitating responses.

HPRU hosted the Vector-Borne Diseases in the UK Biennial Conference in 2014. The conference looked at how the UK may be vulnerable to the importation of overseas diseases and to potential new diseases. Endemic mosquito-borne diseases have not been a real problem in the UK since the disappearance of malaria several decades ago but emerging mosquito-borne viral diseases in Europe are an ever-growing threat. LSTM's Professor Hilary Ranson outlined at the conference the dangers of insecticide resistance and the need to accelerate the availability of new vector control tools.

# Department of Education & Training

Dr Sue Assinder  
- Director of  
Education



LSTM has for many years delivered masters' and postgraduate research degrees under a franchise agreement with the University of Liverpool. This year we achieved several important milestones on the road to independent delivery of our education and training portfolio.

In January 2015 we submitted an application to the University to be granted the status of an accredited institution. This was approved by the University after a detailed examination of LSTM's systems and processes for assuring high quality teaching and meetings with staff and students at an accreditation visit in March. The University commended in particular LSTM's engagement with its students and responsiveness to their feedback.

“ The teaching and lecturers have been fantastic, amazing depth of knowledge and huge amounts of clinical insight to impart...

Fantastic experience and really glad I came.

- Diploma in Tropical Medicine & Hygiene student,  
February 2015



Being an accredited institution will give us greater independence to develop and approve new programmes and will also allow us to receive direct government funding

for teaching. However, the gold standard for any higher education institution is to be able to award degrees in its own name and this is the next goal for LSTM. In July, we submitted to the Privy Council an application for powers to award both taught and research degrees. This was considered by the Quality Assurance Agency (QAA), and we were delighted when the QAA determined that LSTM had made a prima facie case for the application to proceed to detailed scrutiny. Over the next year we will have a number of engagements with a scrutiny panel of senior academics appointed by the QAA, who will meet with staff and students and observe teaching-related meetings. We expect the outcome of the scrutiny in early 2017.

## The Student Information System – A Single Source of Truth

In order to prepare for its accredited status, LSTM has invested much time over the last year installing a new Student Information System (SIS) to manage the student life cycle. An on-line application system was launched in September 2014 and was followed over the year with roll-out of processes for managing student registration and assessment and programme approval. The SIS now integrates all student and programme information and serves as a 'single source of truth' that feeds information to all of the other systems involved in



MSc students on a field exercise collecting snails to study trematodes



the student experience, including the library, LSTM's website and the virtual learning environment. This has achieved our aim of giving LSTM students a seamless learning experience, wherever they are in the world.

### **The Virtual Learning Environment – The Future is Bright**

Enhancing the student experience and success through the use of technology is fundamental to education at LSTM. This year the Technology Enhanced Learning (TEL) Unit has been busy implementing a suite of new technologies to enhance and support teaching and learning. We have taken time and consideration to ensure that these technologies are fully integrated in order to create a high quality, unified, online learning environment for our students.

**“ I think LSTM is an amazing place to build your future career in tropical-medical-related field. It is teemed with ultramodern facilities and brilliant resource persons to assist students. ”**

*- MSc Biology & Control of Parasites & Disease Vectors/MSc Molecular Biology of Parasites & Disease Vectors alumni survey, 2015*

At the heart of the student learning experience is a new Virtual Learning Environment, “Brightspace by Desire 2 Learn”, which supports over 15 million users worldwide. Brightspace contains a number of innovative student-centred tools such as: Binder, an app enabling students to manage their learning resources; Wiggio, a tool intended to support group work and an ePortfolio system that allows students to keep a record of their learning journey. Each of these tools is designed to enable students to manage their own learning more effectively. These tools are accessible using any computing device including tablets and smartphones even in low bandwidth settings so that LSTM students can continue to learn regardless of device or location, a crucial factor as we look towards developing our distance and blended learning education portfolio. We are also rolling out a lecture capture tool Panopto into our teaching rooms, which allows easy creation and distribution of video-based learning content.

**“ This was a brilliant course and very well organized. It exceeded my expectations ”**

*- Diploma in Tropical Nursing student, 2015*

During the evaluation of this new infrastructure, one student on the Professional Diploma in Tropical Nursing stated it was “the best use of technology in education they have ever experienced”. We are excited to have this technological infrastructure underpinning student learning and look forward to fully embedding this into everyday practice during the year ahead.

### **Education – Inspire to Make a Difference**

LSTM aims to inspire its students to make a difference to their own lives and to the lives of others.

Several graduates from the Diploma in Tropical Medicine and Hygiene and the clinically-based MSc programmes volunteered to work, alongside LSTM staff, as part of the front-line response to the Ebola crisis in Sierra Leone.

Applicants can apply to LSTM for financial assistance with their fees. In 2014-16, LSTM awarded £74,000 in scholarship funds to students who would not otherwise have been able to pursue their studies. LSTM also helps students to obtain funding from external sources by advertising opportunities and acting as a sponsor for applications to external funders.

Each year, LSTM provides the graduates from the humanitarian studies MSc programmes with financial support to organise a one-day national conference. This offers the opportunity for students from across the UK to present their scholarly work to the humanitarian community and to network with others working in the field. The 2014 conference focussed on the challenges and practicalities of humanitarian aid and the 2015 event will be on the very topical theme of ‘Health and Human Rights in Humanitarian Settings’.



# Students and Courses

**TOTAL  
TAUGHT  
STUDENTS** **561**



**OTHER  
SHORT  
COURSES**

**TOTAL 181**



**RESEARCH STUDENTS 2014-15**



**TOTAL 113**

**HEU  
(UK & EU)**

**40**

**Overseas**

**73**

## MSCS:

**MSc in Tropical &  
Infectious Diseases**

**TOTAL 10**

**HEU  
(UK & EU) 4**

**OVERSEAS 6**

**MSc in Tropical  
Paediatrics**

**TOTAL 5**

**HEU  
(UK & EU) 2**

**OVERSEAS 3**

**MSc in Biology & Control of  
Parasites & Disease Vectors**

**TOTAL 11**

**HEU  
(UK & EU) 9**

**OVERSEAS 2**

**MSc in Molecular Biology of  
Parasites & Disease Vectors**

**TOTAL 5**

**HEU  
(UK & EU) 1**

**OVERSEAS 4**

**MSc in International  
Public Health**

**TOTAL 21**

**HEU  
(UK & EU) 10**

**OVERSEAS 11**

**MSc in Humanitarian  
Studies**

**TOTAL 11**

**HEU  
(UK & EU) 11**

## PROFESSIONAL DIPLOMAS:

**Diploma in  
Humanitarian Assistance**

**TOTAL 6**

**HEU  
(UK & EU) 4**

**OVERSEAS 2**

**Diploma in  
Reproductive Health**

**TOTAL 14**

**HEU  
(UK & EU) 1**

**OVERSEAS 13**

**Diploma in Tropical  
Nursing**

**TOTAL 126**

**HEU  
(UK & EU) 47**

**OVERSEAS 79**

**Diploma in  
Tropical Medicine  
& Hygiene**

**TOTAL 170**

**HEU  
(UK & EU) 146**

**OVERSEAS 24**



# International Education and Knowledge Exchange Initiatives



**Mr Michael  
Lurie - Director  
of International  
Education &  
Knowledge**

The creation of a function for International Education and Knowledge Exchange Initiatives is testament to LSTM's commitment to further develop its portfolio of educational programmes to advance its global footprint through innovative and dynamic initiatives in the area of teaching and learning.

LSTM's recent advances in student information systems, learning technology platforms as well as the momentum in the process for Degree Awarding Powers over the past year will be key drivers to supporting this agenda.

Key activities have focused around setting the strategic direction of travel for International Education and Knowledge Exchange Initiatives and ensuring that these have a clear focus. Moreover, it is all about creating awareness and momentum with internal and external stakeholders on LSTM's formidable portfolio of educational programmes and seeing how we can leverage our research led global profile to areas of teaching.

The international priorities that have been developed over the past year are underpinned by 4 focus areas:

- Pipeline: Setting up an institutional pipeline of collaborative activity and identifying opportunities for engagement with potential partners.
- Infrastructure: Establishing a framework for partnership development supported by policies and procedures to ensure compliance and governance of collaborative initiatives in line with all academic related approval processes.
- Partnerships: Building on existing relationships whilst engaging with key stakeholders in government, industry and the wider higher education community both in the UK and abroad as part of offering bespoke and innovative programmes.
- Promotion: Promoting the 'LSTM Story' through the eyes of our students and staff and conveying the impact of our activity across the globe.

**“Engagement in this emerging area of focus has been extremely positive and enthusiastic from colleagues within LSTM as well as external partners. It's clear that we have the support and the developing infrastructure in place to look at translating opportunities into tangible initiatives that can be implemented over the coming year and beyond.”**

*- Michael Lurie, Director of International Education and Knowledge Exchange Initiatives*

One of these initiatives is scoping the opportunity to work with a world leading NGO to provide a Master's programme that is geared to preparing teams for senior field roles in the area of humanitarian activity. Another initiative aims to develop an undergraduate and integrated Masters pathway specifically targeting potential students and future researchers in the wider Merseyside region. In addition online courses that showcase LSTM's subject areas are being developed to deliver content in innovative models that widen the educational access and reach.

These initiatives all aim to increase student numbers onto LSTM programmes and diversify its student base via active and targeted marketing and student engagement initiatives. The programme delivery can be done in face to face settings or through online delivery. Partnerships with multiple stakeholders such as government agencies, industry and NGOs are continuously being explored.

# Well Travelled Clinics

Well Travelled Clinics improvement in turnover continued again this year with income up by over 3.2% on the previous year across our two branches. This increase in income was due to the dramatic rise in occupational health related work over the course of the year.



Dr Philippa Tubb -  
WTC Managing Director

Well Travelled Clinic played a significant role in the preparation of healthcare workers being deployed to the Ebola Crisis in Sierra Leone and coordinated the pre and post deployment health screening of 236 NHS volunteers who were deployed via UKMED, the humanitarian organisation working on behalf of DFID, to deploy British aid workers recruited from the NHS to international humanitarian emergencies.

As part of this process, a large number of these volunteers were seen through our main clinic in Liverpool, but we also had to run some off-site clinics in order to ensure the rapid deployment of these NHS teams, straight from their pre-deployment training programmes.

We have also established a number of new occupational health services this year and are now carrying out Maritime and Coastguard Agency (MCA) medicals for seafarers and also Oil and Gas medicals for off-shore industries. During the year ahead we hope to further develop occupational health services for the shipping and offshore sectors through our links with the Mersey Maritime Group.

WTC Chester is a part-time branch, operating for three days per week. During 2015, we opened the branch for an additional day per week for six months of the year during our peak times. This proved successful and we are going to repeat this again in 2015/16, with a view to opening up permanently for four days per week from summer 2016.





# Liverpool Insect Testing Establishment (LITE)



Helen Williams -  
Head of LITE

Liverpool Insect Testing Establishment (LITE) was established four years ago by the Department of Vector Biology. Under Helen Williams' management the facility has grown considerably and now employs a further seven fixed term staff, with plans for further expansion in the next few years.

LITE is accelerating the search for new public health insecticides in partnership with the Public Private Partnership IVCC. These are urgently needed as more and more disease-transmitting insects are developing resistance to existing insecticides. LITE provides an efficient service to industrial partners to screen new chemicals against using a variety of biological assays.

Our unique selling point is the range of fully characterised, insecticide resistant and susceptible mosquito strains that we maintain at LSTM, all of which are characterised phenotypically and genotyped for known insecticide resistance mechanisms. With support from our extensive network of overseas collaborators, and the scientific expertise in insecticide resistance within the Vector Biology Department, we continually review and update our colonies to reflect the evolution of resistance in the field. In addition to offering assays on live mosquitoes we also provide chemical testing services of insecticide treated materials and have developed a range of in vitro assays to test chemicals for cross resistance to existing insecticides.

During the past 12 months we have strengthened our quality processes and procedures within the facility and earlier this year we completed a successful audit by the WHO Pesticide Evaluation Scheme (WHOPES) which hopefully will result in LITE becoming a WHO Collaborating Centre.

Further developments planned for 2016 include formally adopting Good Laboratory Practice (GLP) with the ultimate aim of GLP compliance inspection by the Medicines and Healthcare Products Regulatory Agency



(MHRA) in the next 18 months. This will enable LITE to expand services on offer and the range of clients, aiding us to achieve our long term vision of a fully self-funded, sustainable centre of excellence for evaluating products to control insect disease vectors. A new building hosting, amongst others, six new insectaries, a range of insecticide testing facilities and rooms for behavioural studies is foreseen to open in mid-2017.

LITE has contributed to the outreach activities of LSTM with the deployment of two members of staff to Sierra Leone to Support for Ebola Testing Laboratories in country, for 5 week periods each during the year 2014-2015.



Setting up Polymerase Chain Reaction gels for  
genotyping of mosquito colonies

# Estates

## Liverpool Life Sciences Accelerator

Liverpool's future as home to a world class life science hub has taken a huge step forward with the announcement of a new £24.8m Liverpool Life Sciences Accelerator (LLSA) building. The five storey laboratory-based development will enable innovative research into antibiotic resistance. LLSA has been developed in partnership between LSTM and the Royal Liverpool and Broadgreen University Hospitals NHS Trust (RLBUHT).



'Render of the Accelerator building

LLSA will provide 70,000 square feet of state-of-the-art laboratory space and offices. LSTM will occupy the top two floors of the building dedicated to resistance mitigation

research, which is essential in the global fight against the growing threat of antibiotic resistance. A further two floors will be available for commercial laboratories and office facilities for Small & Medium-sized Enterprises (SMEs) involved in life sciences, particularly those developing products that will improve patient care and treatment outcomes.

LSTM facilities will include containment level three (CL3) laboratory facilities, insectaries and testing laboratories.

**“ With a proven track record of industry partnership and ground breaking lifesaving research, the Accelerator will allow us to further boost Liverpool's reputation as a world renowned centre of expertise. The collaboration with the Royal and SMEs will benefit global health by taking research and innovation from the lab to where it is needed most and will encourage further investment in Liverpool. ”**

*- Professor Janet Hemingway, Director LSTM*

The project will have a positive impact on high value job creation. With construction having commenced in November 2015 the building is due to open in the summer of 2017.

## Wolfson Building

The Wolfson Building was opened by LSTM's Patron, HRH Princess Royal in December 2014. The Centre for Maternal and Newborn Health (CMNH), the Filarial Programmes Support Unit (FPSU), IVCC and the Governance and Contracts team are now well established in the £7.3m building.





**Malawi-Liverpool-Wellcome Trust Clinical Research Programme (MLW)**

MLW is a collaboration between LSTM, the University of Liverpool and the University of Malawi's College of Medicine, with major support from the Wellcome Trust. MLW conducts biomedical research on high burden health problems and through high quality training, strives to strengthen the research capacity of doctors and scientists, developing the research leaders of the future. Thanks to £1.1m of funding from the Wellcome Trust, MLW has been able to undertake a programme of building and refurbishment works.

The refurbishment of MLW laboratory facilities is due to be completed in December 2015. The upgrade will introduce new facilities adding a CL3 laboratory, dark room and space for the Freezer Archive. In addition to providing better separation of functions e.g. research from routine service work, the remodelled space is needed to attain Good Clinical Laboratory Practice (GCLP) compliance and eventual accreditation to support a range of scientific activities including clinical trials.

A modular CL3 laboratory manufactured and pre-commissioned in South Africa, has been installed and re-commissioned on the Malawi College of Medicine (CoM) site in October 2015. Functional high-performance CL3 laboratories are rare in Africa, this new facility will extend the range of research studies that can be carried out at MLW; allow MLW and CoM to participate in regional and international networks, for example TB vaccine and Clinical Trials Consortia, and TB Diagnostic Discovery; support the development of techniques required for phase 2/3 clinical trials; extended surveillance of TB epidemiology and drug resistance and support the evaluation of new diagnostics.

A new two storey stores building was opened in April 2015 delivering much needed additional storage required to support the research undertaken both on the main MLW campus, satellite research stations and field work. The new facility is supported by a £324,000 grant from the Wellcome Trust and will increase the efficiency of programme delivery.

# Far East Prisoners of War (FEPOW), LSTM's longest running collaboration

The 70th anniversary of VJ day also marked the 70th anniversary of LSTM's relationship with former Far East Prisoners of War (FEPOW) and their families, making this LSTM's longest running project. An anniversary that has been marked by a renewed interest, thanks to a fascinating new book by LSTM Honorary Fellow Meg Parkes and Emeritus Professor Geoff Gill, entitled *Captive Memories*, published in May 2015.

Before the men returned to the UK, LSTM's former Dean, Professor Brian Maegraith, addressed a large group of their families in Blackpool in early September 1945, answering questions about the kind of tropical diseases and infections that they might return with. This was the start of a unique scientific and medical collaboration. Over time LSTM became the primary centre responsible for carrying out the Tropical Disease Investigations on 2,072 ex-FEPOW. During the 1970s Professor Gill became one of the doctors treating the men for a disease called Strongyloidiasis, which would afflict many of them for the rest of their lives. It is this treatment and Professor Gill's research that has helped to improve medical knowledge of the diagnosis and treatment of some tropical diseases.

Meg Parkes began her social history project recording interviews with ex-FEPOW as well as some of their wives and widows in 2007, the culmination of which forms the core of *Captive Memories*. The book charts the history of these

survivors remembered six decades after their release. It is a touching and personal account of their captivity, survival and the struggles, both physical and psychological, faced on their release. The book launch at the Liverpool Medical Institution was attended by ex-FEPOW and their families along with international visitors who are part of the Researching FEPOW History Group. Since then a series of reading and book signings have ensured that a reprint of the book will be required, less than a year after its release.

Following the book launch, Meg and Geoff co-chaired the 5th International FEPOW History Research Conference in Liverpool in June 2015. 'Far East Captivity & the Aftermath Explored: 70 Years On', was attended by three FEPOW veterans and three former child internees, together with delegates representing many FEPOW families as well as academics and historians.

There was an international line-up of speakers covering military history and the medical aspects of building the jungle railways of Thailand and Sumatra. Among the speakers was author Frank Cottrell-Boyce, the scriptwriter of the film *The Railway Man*, based on the book of the same name by ex-FEPOW Eric Lomax. A presentation given by Professor Gill at the conference examined LSTM's treatment of ex-FEPOW and how what had been learned from those men had informed modern medical practice in relation to tropical and military medicine. The conference has some substantial national media coverage. As part of the national commemoration of VJ Day in London, Meg Parkes took part in the live coverage, broadcast on BBC One, talking to broadcaster Kirsty Young about her experiences as the child of a FEPOW, alongside other family members and surviving ex-FEPOW themselves.

[www.captivememories.org.uk](http://www.captivememories.org.uk)





# CAPTIVE MEMORIES

MEG  
PARKES

GEOFF  
GILL

STARVATION DISEASE SURVIVAL

Far East POWs

& Liverpool School of Tropical Medicine

# Public engagement

## Public Engagement (PE) strategy for LSTM

The appointment of the PE Manager is the start of LSTM's progression towards developing a formal strategy and building upon previous public engagement successes at LSTM.

A Public Engagement Working Group has been formed to assess LSTM's current PE activities. These discussions will inform the development of the PE strategy, with support from the PE Committee consisting of senior academics across LSTM.

### Public engagement activities to Inform

#### Exhibitions

LSTM's major PE success came from the 5 month Sssnakes Alive exhibition at the World Museum Liverpool, which attracted over 250,000 visitors. To continue on the back of this success, a number of LSTM's researchers have submitted proposals to showcase our work to the public throughout 2016. Increasingly, LSTM's researchers are ring-fencing funds from research grant applications to contribute to raising the profile of LSTM's work to the public. Several applications have been submitted to donors and awaiting decision.

#### Community Talks

A number of talks to community groups has taken place this past academic year, for example a talk by Ms Terry Kana of LSTM's Centre of Maternal & Newborn Health to Alma Mata Liverpool, a local network of health practitioners. In addition, Dr Eva Maria Hodel gave a talk on the ADJusT program, investigating antimalarial treatments, to the Rotary District 1285 Annual Conference.

#### Captive Memories

The release of *Captive Memories*, a book by LSTM's Honorary Fellow Meg Parkes and Emeritus Professor Geoff Gill, coincided with talks to the public about the history of LSTM's involvement with the Far Eastern Prisoners Of War (FEPOW) at the Liverpool Medical Institute, the Artists Club in Liverpool, Waterstones in Liverpool One and Lingham's bookshop in Heswall.

### Public engagement activities to Inspire

#### LSTM STEM Ambassadors Team

LSTM's newly-formed STEM Ambassadors Team (Dr Gemma Molyneux, Dr Paul Bedingfield, Ms Rachel Clare, Dr Hayley Tyrer, and Dr Elli Wright) is in the process of developing a coordinated strategy for engaging and inspiring young people about the STEM subjects (science, technology, engineering, and mathematics) in schools in the North West region. To support the team, MerseySTEM have provided two ambassador training sessions for 40 of LSTM's staff and students.

#### Student Blogs

To introduce our new cohort of students to novel methods of communication, three of our 2015 DTM&H students have been successfully blogging about their experiences on the course.

### Public engagement activities to Involve

#### Public Involvement

The public have come face to face with scientists and health practitioners in Lung Health and TB through the recruitment of volunteers, from community groups and the universities in Liverpool, for their study looking at the effect of the new nasal spray flu vaccination on the carriage of pneumococcal bacteria in the nose. This practical application of science will enrich lives by inspiring, informing and involving the public.





Hand drawn mosquito illustrations by LSTM entomology lecturer Dr A.M. Evans (1929) used for teaching and public information sessions



# LSTM in the media

Throughout the past academic year many LSTM experts provided interviews and editorials on a wide range of subjects across regional, national, international and specialist media.

## Commenting on Medical Developments

LSTM staff members have been regularly invited by various media to give their advice and analyses on the medical issue of the day. This included Dr Nick Beeching and Professor David Lalloo, who spoke about the development of vaccines for Ebola and malaria respectively and LSTM's Director, Professor Janet Hemingway, who spoke about the international response required to combat the problem of anti-microbial resistance. In addition Dr David Weetman offered reassurances to Sky News about the capability of UK based mosquitoes spreading tropical disease; Professor David Molyneux contextualised the issue of neglected tropical diseases for Thompson Reuters; Professor Paul Garner advising the Guardian and other media following the publication of an updated Cochrane Review which reassessed the value offered by universal deworming programmes in relation to school attendance and Dr Derek Sloan talked to CNN about the pathology of Dengue virus.

## CAPS

LSTM has featured a number of times on BBC One's Breakfast programme including the Cooking and Pneumonia Study (CAPS) in Malawi. This involved a film crew accompanying the team from Liverpool out to Malawi to film the distribution of the stoves and interview the PI, Dr Kevin Mortimer. The coverage also featured on BBC News, BBC World News, BBC World Service, local radio and online.

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**With an international audience of viewers, listeners and online readers in excess of 300 million a week, the work of LSTM has been showcased across the world.**

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## Malaria

This April saw the Financial Times' Malaria supplement, which examined the current situation of the disease worldwide by looking at the challenges posed by the growing problems of the disease's development of drug resistance and the mosquito's growing resistance to insecticide. LSTM was featured throughout the supplement with Professor Janet Hemingway commenting about the race to develop new public health insecticides while Dr Philip McCall and PhD student Kobie Hyacinthe Toé spoke about innovations to make current control tools more effective.

## Alistair Reid Venom Research Unit

The Alistair Reid Venom Research Unit has maintained a high media profile throughout the last 12 months, appearing on several different programmes and offering expert advice to different publications. BBC's science video journalist Victoria Gill visited the Unit at the end of 2014 and the resulting film was shown on BBC's Breakfast, across the BBC News Channel and on the World Service. This was followed by a similar look, by Thomson Reuters, at the work to develop a new universal antivenom for sub-Saharan Africa which is being funded by the MRC. The interview footage was distributed by the foundation and picked up by over 70 outlets, featuring heavily on TV, radio and in print across Africa, America, Asia and Europe. Head of the Unit Dr Robert Harrison and Dr Nick Casewell were interviewed in September by the BBC's Global Health Correspondent Tulip Mazumdar about the shortage in antivenom for Africa.

## FEPOW & Captive Memories

The new book published by Emeritus Professor Geoff Gill and Honorary Research Fellow Meg Parkes, *Captive Memories* about LSTM's clinical and social history with returning Far East prisoners of war (FEPOW) caught the imagination of the media. It was featured extensively across local, regional and national media, with the authors being interviewed by the BBC Radio 4 Today Programme and for BBC Breakfast, and with Meg Parkes being interviewed on BBC One's live coverage of the VJ day celebrations in London and by 19 regional BBC Radio stations. A number of regional newspapers covered the publication of the book and LSTM's relationship with the men by interviewing the authors along with surviving FEPOW living in their regions.



A photograph showing a woman, Tulip Mazumbar, in a laboratory setting, gesturing while speaking to a man. A camera operator is visible on the left, holding a professional video camera. The background shows laboratory equipment and a whiteboard.

**BBC Global Health correspondent Tulip Mazumbar  
at the Alister Reid Venom Research Unit**

### **BBC Health Check**

LSTM has continued to be called upon by the BBC World Service flagship TV and radio health programme, Health Check. With an international audience of viewers, listeners and online readers in excess of 300 million a week, the work of LSTM has been showcased across the world. There was a film and online article about “Tiny Targets”, which have been developed to combat human sleeping sickness in Uganda which featured Drs David Hope and Richard Selby along with Professor Mike Lehane.

Professor Imelda Bates was interviewed about an enterprising study from a Canadian scientist assessing the value of adding a small iron “fish” into families’ cookpots in Cambodia to reduce instances of anaemia, while Dr Philip McCall was interviewed

for the radio programme about how mosquitoes interact with bednets and the new 2D tracking device that has been developed to further understand this behaviour.

Dr Nick Casewell appeared in the studio demonstrating the devastating impact that snake venom can have on human blood.

Across the year LSTM has generated 21 press releases and over 180 news stories, excluding journal publications and releases generated by other organisations about the many partnerships in which scientists and researchers from LSTM are involved. Numerous interviews have been facilitated with publications, broadcast and online platforms resulting in thousands of mentions around the world, highlighting the life-saving work carried out by LSTM in global health, both at home and abroad.

# Fundraising

LSTM would like to thank all of our donors whose support has helped to develop our infrastructure and our ability to support the most promising international students.

## Wolfson Building

The Wolfson Building brings together the Innovative Vector Control Consortium administrative and management team, the Filarial Programmes Support Unit, the Centre for Maternal and Newborn Health, the COUNTDOWN consortium and LSTM subsidiary Well Travelled Clinics. Opened in December 2014 by LSTM Patron HRH The Princess Royal, the £7.3m project is funded by the Wolfson Foundation, the European Regional Development Fund Programme 2007-2013 and the Regional Growth Fund.



## Scholarship Support

Over the academic year 2014-2015, LSTM received charitable grants and donations worth £65,000 to support scholarships for LSTM students. Supporters have ranged from individuals to companies, who have all seen the benefit of investing in education. Opportunities exist for supporters to sponsor students from specific countries or studying on particular education programmes.

## Sexual and Reproductive Health

According to 2014 figures, an estimated three million babies die within one month birth.

The Diploma in Sexual and Reproductive Health in Low Resource Areas helps to save the lives of mothers and newborn babies by developing the skills of doctors, midwives and other health professionals.

The Oglesby Charitable Trust has been a long-standing supporter of the Diploma and for the 2015 course, has sponsored students from Kenya, Tanzania and Bangladesh.



## Endowments

Endowments can take the form of money or financial assets that are donated to academic institutions and once invested can provide an annual income. In the face of major government cuts in capital and revenue grants and restrictions on traditional sources of charitable funding, building LSTM's endowment funds is important for our future growth and development. Making a donation to LSTM's Endowment Fund will help maintain our independence and our capacity to offer scholarships to the most talented international students, who represent the future of global health.

## Humanitarian Assistance

Grants and donations totalling £12,000 have been received in support of the development of LSTM's Humanitarian Response Register, which will bring together humanitarian volunteers with NGOs offering opportunities to work in response to humanitarian emergencies.

If you would like to make a donation to LSTM or join the mailing list for the bi-annual fundraising e-newsletter, please contact Development Officer, Billy Dean: by email at [billy.dean@lstmed.ac.uk](mailto:billy.dean@lstmed.ac.uk) by phone +44 (0)151 705 3272 or visit [www.lstmed.ac.uk/fundraising](http://www.lstmed.ac.uk/fundraising) for more information on leaving LSTM a gift in your will, corporate support and the latest fundraising appeals.

A full list of donors during this reporting period can be found in LSTM's Financial Statements for 2014-15.



# Social mission

LSTM's values shape its working practices and the furthering of a vision to save lives in resource poor countries through research, education and capacity building, recognising the relationship that LSTM has with its staff, students and stakeholders.



**Christine Greenway**  
- Director of Human  
Resources

Human resources is a critical component of any organisation, particularly when the work is done in over 70 countries worldwide and needs to meet the growing strategic and operational needs of the organisation. To keep pace with LSTM's vision the HR team has expanded and restructured to offer a greater range of services and support. Complementing this commitment, staff across the organisation are providing a better environment for students, staff and LSTM stakeholders.

## Recruitment and Staff Development

In recruitment and selection HR is widening its methodologies to attract and interest new talent pools, building on our reputation as an employer within Liverpool, the UK and internationally. The ability to recruit is linked to valuing and developing staff, who are ultimately our greatest asset.



Based on the recommendations coming from staff surveys and consultations, carried out

on a regular basis at LSTM, we have introduced a Mentoring Scheme to build upon the work of previous informal mentoring processes. The scheme matches research assistants, post-doc researchers and lecturer with more senior research staff to encourage mentee – mentor relationships across different departments. Already the scheme is encouraging participants to reach their full potential as self-reliant, self-confident and independent scientific researchers.

## Advancing Gender Equality



The Athena SWAN Charter encourages and recognises the commitment to advancing the careers of women in science, technology, engineering, maths and medicine (STEM) as well as arts, humanities, social sciences, business and law (AHSSBL) employment in higher education

and research. One of only 132 Charter members, LSTM has achieved the Bronze Level Award and is aiming to move to application for the Silver Award with the Faculty groups which are now working towards their Bronze Level Award.

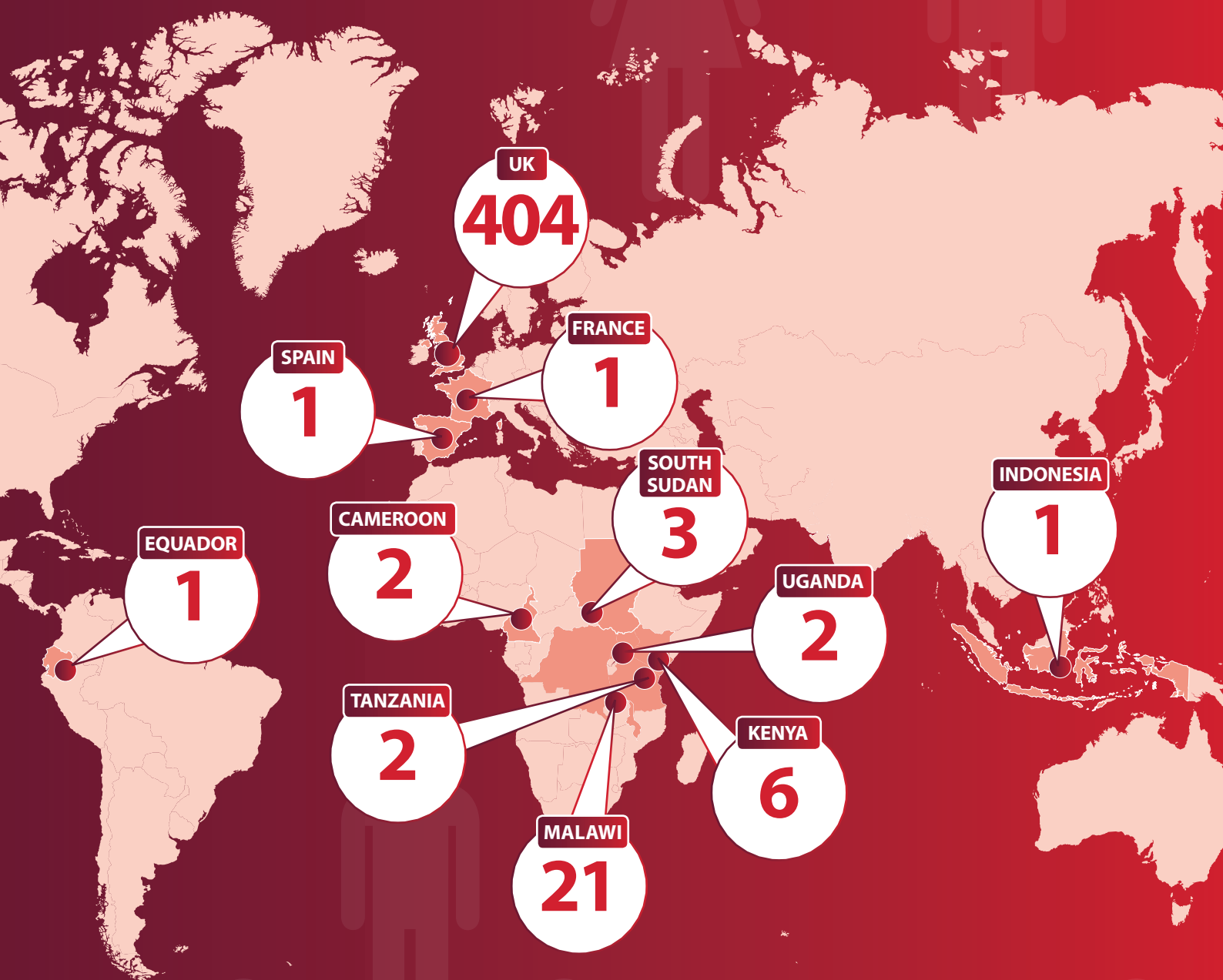
There are many facets to this area of our work which involves putting realistic and creative action plans in place. LSTM's Gender and Health Group, established in 1995, is a multi-disciplinary group at the forefront of work on gender and health, applying gender analysis and planning in their various areas of expertise. A practise that translates across all areas of LSTM's operations.

## A Diverse and Family Friendly Workplace

LSTM is proud to be a multi-cultural community that aims to provide a welcoming institutional environment which affirms the positive contributions of all its members. By embracing diversity LSTM hopes to promote and achieve a more rewarding environment. Giving staff, students and visitors a place to express their religious faith has long been a commitment from LSTM which provides a room for multi-faith prayer and meditation.

As a family-friendly employer and teaching institution, providing a supportive environment for employees, students and visitors, LSTM supports family friendly working practices, such as flexible working, and improved shared maternity/paternity arrangements.

# Staff overview



**404**

Staff members  
based at LSTM  
incl. one offsite  
in the UK

**40**

Staff members  
working  
overseas on a  
LSTM contract  
(as of 1 September 2015)



# List of honorary appointments 2014 – 2015

Name	Title	Department
Professor J Gyapong	Honorary Research Fellow	Parasitology
Dr L Savioli	Honorary Research Fellow	Parasitology
Dr Seif Al-Abri	Honorary Research Fellow	Clinical Sciences
Dr Victor Mwapasa	Honorary Research Fellow	International Public Health & Clinical Sciences
Catherine Johnstone	Honorary Research Fellow	International Public Health & Clinical Sciences
Dr M Beadsworth	Honorary Fellow	International Public Health & Clinical Sciences
Professor P Cooper	Honorary Research Fellow	Clinical Sciences
Chris Moxon	Honorary Research Fellow	Clinical Sciences/Parasitology
Christopher Parry	Honorary Research Fellow	International Public Health
Emily Adams	Honorary Fellow	Parasitology
Margaret Parkes	Honorary Research Fellow	Clinical Sciences
Jesus Salcedo-Sora	Honorary Research Fellow	Parasitology
Robert Parker	Honorary Research Fellow	International Public Health & Clinical Sciences
Karen Steingart	Honorary Research Fellow	International Public Health
Stephane Paulus	Honorary Teaching Fellow	Education
Thomas Edward Fletcher	Honorary Research Fellow	International Public Health & Clinical Sciences
Andrew Riordan	Honorary Teaching Fellow	Education
Jason Janish Madan	Honorary Research Fellow	Parasitology
Dr Jamie Rylance	Honorary Research Fellow	Clinical Sciences
Dr MacPherson	Honorary Research Fellow	Clinical Sciences
Dr O Uthman	Honorary Research Fellow	International Public Health
Dr T D Hollingsworth	Honorary Research Fellow	IPH & Clinical Sciences
Dr A Lenhart	Honorary Research Fellow	Vector Biology
Dr Janet Price	Honorary Research Fellow	International Public Health
Dr Peter Frank Heywood	Honorary Affiliate	Clinical Sciences
Professor Geoffrey Gill	Honorary Professor	Clinical Sciences
Professor Richard Lilford	Honorary Professor	Clinical Sciences
Hassan Burhan	Honorary Research Fellow	Clinical Sciences
Dr Guy Barnish	Honorary Teaching Fellow	Education
Wendi Bailey	Honorary Lecturer	Education
Dr Marie Stolbrink	Honorary Academic Clinical Fellow	Clinical Sciences
Dr Olivia Tulloch	Honorary Research Associate	International Public Health
Dr Stacy Todd	Honorary Research Fellow	Clinical Sciences
Dr Angela Allen	Honorary Research Fellow	Parasitology
Prof Axel Kroger	Honorary Teaching Fellow	Education
Dr Henrik Ullum	Honorary Teaching Fellow	International Public Health
Christopher M Parry	Honorary Research Fellow	Clinical Sciences
Dr Prathap Tharyan	Honorary Research Fellow	Clinical Sciences
Professor David Hornby	Honorary Research Fellow	Parasitology
Rachel Isba	Honorary Research Fellow	Clinical Sciences
Dr Helen Smith	Honorary Research Fellow	Clinical Sciences
Helen Hill	Honorary Research Associate	Clinical Sciences
Rosanna Ghinai	Honorary Research Associate	International Health

# Governance

**Effective governance contributes substantially to LSTM by underpinning the institutional success on which international reputation is based; providing assurance to the government, the funding bodies and stakeholders including the Higher Education Funding Council for England (HEFCE) about institutional integrity and sustainability; and providing leadership through effective governance.**

LSTM demonstrates compliance with the Higher Education Code of Governance by following the seven key principles:

- The Board of Trustees is unambiguously and collectively accountable for institutional activities, taking all final decisions on matters of fundamental concern within its remit.
- The Board of Trustees protects institutional reputation by being assured that clear regulations, policies and procedures that adhere to legislative and regulatory requirements are in place, ethical in nature, and followed.
- The Board of Trustees receives institutional sustainability by working with the Executive to set the institutional mission and strategy. In addition, it needs to be assured that appropriate steps are being taken to deliver them and that there are effective systems of control and risk management.
- The Board of Trustees receives assurance that academic governance is effective by working with the Management Committee as specified in its governing instruments.
- The Board of Trustees works with the Executive to be assured that effective control and due diligence take place in relation to institutionally significant external activities.
- The Board of Trustees promotes equality and diversity throughout the institution, including in relation to its own operation.

- The Board of Trustees ensures that governance structures and processes are fit for purpose by referencing them against recognised standards of good practice.

The oversight provided by the Board of Trustees ensures that LSTM responds to these requirements and the numerous challenges facing it in this highly competitive research, education and capacity strengthening sector, to maintain its world-leading position.

As LSTM's relationship with HEFCE continues to mature, a planned HEFCE Assurance Review was undertaken at LSTM in July 2015. The aim of the review was to examine how LSTM exercises accountability for the public funding which it receives. The results of this review were very positive, giving credence to the adequacy of governance within LSTM and the progress made since the designation of HEI status.

There has been much focus this year on developing assurance that LSTM has in place an effective framework to manage the quality of learning and teaching and to maintain academic standards. Since our objective is to acquire degree awarding powers, the upcoming period of scrutiny will further establish the Board's effectiveness in this regard.

LSTM congratulated Trustee Sir Nigel Thrift who was knighted for his services to higher education in the 2015 New Year's Honours List. This year LSTM also thanked outgoing members Dr Ann Hoskins, Professor Malcolm Jackson and Dr Nick Banatvala for their valued contribution to the Board of Trustees and welcomed new members Dr Julian Lob-Levyt and Dr Jenny Amery.

Also the Rt. Hon. Stephen O'Brien MP stepped down from the Board at LSTM and was received as a LSTM Vice President. The Board congratulated him on his appointment to the position of Under-Secretary-General for Humanitarian Affairs at the UN. Finally, LSTM recognises the contribution and achievements of all members of the Board of Trustees and Vice-Presidents in their respective fields, through the dedication that they bring to their duties.



LSTM's Board of Trustees in June 2015



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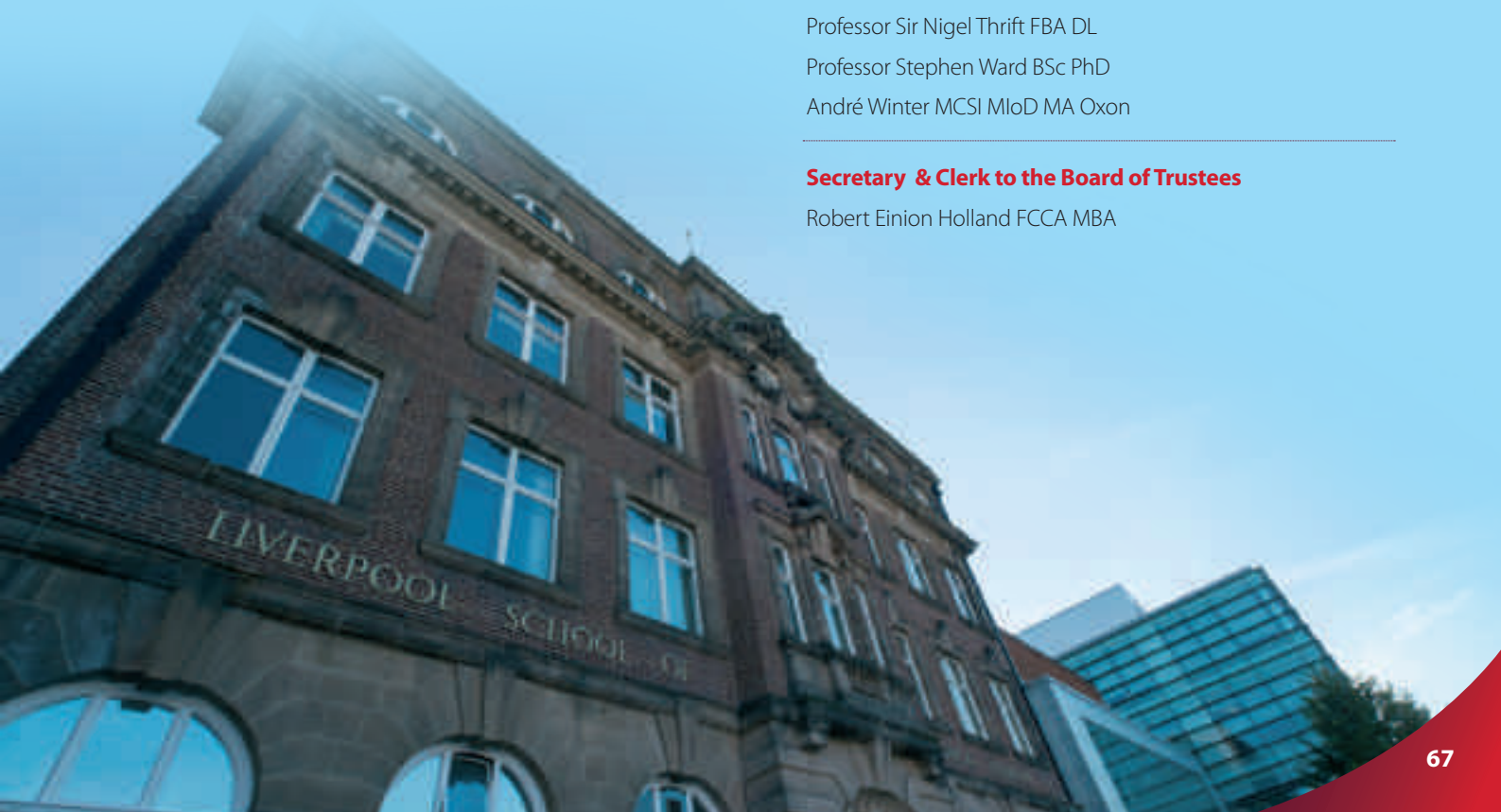
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Robert Einion Holland FCCA MBA



# Lectures and Seminars

## LSTM awards 100th Mary Kingsley Medal

LSTM awarded the 100th Mary Kingsley Medal to Dr Kevin Marsh, Professor in Tropical Medicine at the University of Oxford, for his contribution to the field of Tropical Medicine.

Before the award ceremony Professor Marsh delivered a lecture entitled: 'The global picture of malaria; is the glass half full or half empty?' His lecture looked at the burden of malaria through recent decades, with cases falling in many places in Africa and large gains in child survival.



**Professor Marsh receiving the Kingsley Medal from LSTM Director, Professor Janet Hemingway**

The medal is named after Mary Kingsley, a self-educated writer; traveller and personal friend of LSTM founders Jones and Holt. Her campaigning contributed to a greater focus on the improvement of health across Africa. In honour of her achievements and passion, the Mary Kingsley Medal was instituted by John Holt in 1903 and was issued for the first time in 1905 to Sir Patrick Manson, by many seen as the founding father of the field of Tropical Medicine.

## 2015 LSTM Leverhulme Lecture

Dr Anarfi Asamoah-Baah, Deputy Director General of the World Health Organization, delivered the prestigious LSTM Leverhulme Lecture on 11 January 2015. His Lecture entitled 'Public Health Challenges in the post-2015 era' was introduced by LSTM's Chairman, James Ross OBE. It was delivered to a large audience, many of whom had taken part in the all-day event host by LSTM which brought together experts in Neglected Tropical Diseases from around the world.

Dr Asamoah-Baah, an alumnus of LSTM, talked about the many advances in global health and explained how different

the challenges for public health will be in the coming years, highlighted the growing problem of anti-microbial resistance. Following the lecture Dr Asamoah-Baah took a number of questions from the audience and was presented with the Leverhulme Medal by LSTM's Director, Professor Janet Hemingway CBE.

LSTM is proud to be one of a select number of institutions given the honour of hosting a prestigious Leverhulme Lecture Series. The lecture was established by LSTM's Professor David Molyneux and Viscount Leverhulme, thanks to the generous support from Lord Leverhulme's Charitable Trust in 1997.

## LSTM Plenary Lecture Series

LSTM awarded two Chairs in the past academic year. Dr Faragher became Professor in Medical Statistics and Dr Sally Theobald became Professor in Social Sciences & International Health.

Professor Brian Faragher gave his plenary lecture entitled: 'An Assessment of the whole piece from a small random sample' in October 2015 was attended by staff as well as an invited audience of his family and previous colleagues. Professor Theobald's plenary lecture is scheduled for November 2015. The Plenary Lecture Series gives newly appointed professors the opportunity to reflect upon their career and highlight the area of research that they have rose to prominence within.

## LSTM Seminars

LSTM has hosted 33 seminars since July 2014. Presented by prominent external visitors, as well as LSTM staff and students, the seminars provided those at LSTM and beyond with fresh perspectives on current research aimed at saving lives in resource poor countries.

Central to this is the LSTM Seminar Series, which sees speakers from institutions from all over the world coming to LSTM to present research in progress and in many cases foster collaborative working relationships.





# Awards and Honours



**LSTM Reader Dr Mark Paine received the Carnegie-Wits Alumni Diaspora Award in November 2014, for his work in strengthening links between LSTM's department of Vector Biology and the Wits Research Institute for Malaria. The award is given to leading health sciences**

**alumni of Witwatersrand University (Johannesburg) to promote research collaboration and networking.**

Dr Andrea Collins has received the British Lung Foundation Early Career Investigator of the Year award at the winter 2014 meeting of the British Thoracic Society. Dr Collins received the award for her work on the Experimental Human Pneumococcal Carriage study involving LSTM's Department of Clinical Sciences and the NHS.

**LSTM MSc students Matthew Cliffe, Justin Kumala and Katherine Gleave took first, second and third place prizes for their talks given at the Royal Society of Tropical Medicine and Hygiene conference, held in London during December 2014.**

Dr Tom Fletcher, WT Research Fellow, received an MBE in the New Year Honours in recognition of his compassion, clinical skill and commitment to helping the people of Sierra Leone and Guinea during the Ebola outbreak.

**LSTM Director, Professor Janet Hemingway, has been awarded an Honorary Fellowship from the Royal Colleges of Physicians of the United Kingdom. She also received an Honorary DSc degree from the University of Warwick in January 2015.**

Professor Stephen Gordon has been honoured by the American Thoracic Society (ATS) as he became the recipient of the 2015 World Lung Health Award in January of the same year.

**Students from LSTM won all six awards in the poster and oral presentation categories at the British Society of Parasitology Spring Conference, held in Liverpool in April 2015. The winners included PhD student Josephine Parker taking first prize for her oral presentation entitled Shooting swoops: video-tracking Anopheles gambiae flight around insecticide treated bed nets. She also won the student-**



**voted best talk at 2015's Royal Entomological Society's Postgraduate Forum in February.**

LSTM's Centre for Maternal and Newborn Health's Emergency (Essential) Obstetric Training won in the Women's Health Team Category of the 2015 BMJ awards held in May.



LSTM and Royal Liverpool & Broadgreen University Hospital's Respiratory Research Team received The Chief Executive's Award at the recent Make a Difference Awards held in Liverpool in July 2015. The awards celebrate the contribution that employees, as both individuals and teams, have made to the NHS.

**The Royal Embassy of Saudi Arabia in London presented LSTM PhD student Ashwaq Alnazawi with an award during a celebration of the national day of the Kingdom of Saudi Arabia in September 2015. Ms Alnazawi received the award from Prince Mohammed bin Nawaf, Saudi Ambassador to the UK, for her work on insecticide resistance in the mosquito vectors of dengue in Saudi Arabia.**



Dr Mary McCauley of LSTM's Centre for Maternal and Newborn Health, has been presented with a Global Health Globe from the Royal College of Obstetricians and Gynaecologists (RCOG) as the winner of the RCOG Global Health Strategy photography competition.

**Midwives Jaki Lambert and Terry Kana from LSTM's Centre for Maternal and Newborn Health have won International Fellowship Awards from the Royal College of Midwives and Wellbeing of Women. The aim of the award is to enable midwives to further develop research interests in midwifery, maternity services, pregnancy, childbirth and women's health from an international perspective.**

Mr. Ayubo Kampango, a Wellcome Trust MSc fellow in the Vector Biology Department, was awarded the inaugural Jorge Barreto prize in his home country Mozambique. The prize will be awarded every two years to the best young, prolific scientist from across the range of health-related disciplines, as judged by a committee of Mozambican and international scientists.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE—MEMOIR XI

FIRST REPORT  
OF THE  
TRYPANOSOMIASIS EXPEDITION  
TO SENEGAMBIA  
(1902)

OF THE  
LIVERPOOL SCHOOL OF TROPICAL MEDICINE  
AND MEDICAL PARASITOLOGY

BY  
J. EVERETT DUTTON, M.B., B.Ch., VICT.  
WALTER HYDE FELLOW, THE UNIVERSITY, LIVERPOOL  
AND  
JOHN L. TODD, B.A., M.D., C.M., MCGILL

WITH NOTES BY H. E. ANNETT, M.D., D.P.H.  
AND AN  
APPENDIX BY F. V. THEOBALD, M.A.

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## Publications

The Online Archive brings together LSTM's published research outputs into one central repository, ensuring that they are made available worldwide.

The Online Archive can be accessed via: [www.archive.lstmed.ac.uk](http://www.archive.lstmed.ac.uk)





# 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](http://www.avecnet.eu)



## **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](http://www.performconsortium.com)



## **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](http://www.a-wol.net)



## **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](http://www.reachoutconsortium.org)



## **COUNTDOWN**

COUNTDOWN is a research consortium dedicated to investigating cost-effective, scale-up and sustainable solutions, necessary to control and eliminate the seven most common NTDs by 2020

Funded by: UK Department for International Development  
[www.countdownonntds.org](http://www.countdownonntds.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](http://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://www.evidence4health.org) and  
[www.cidg.cochrane.org](http://www.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](http://www.t-rec.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](http://www.mip-consortium.org)

# In Memoriam



**Herbert M. Gilles, Emeritus Dean and Professor in Tropical Medicine (1921 – 2015)**

LSTM's longest serving Vice-President and former Dean, Professor Herbert Gilles was an exceptional figure in the world of tropical medicine.

In 1949, Professor Gilles was a House Physician on the Tropical Ward of the Liverpool Royal Infirmary, while studying for the Diploma in Tropical Medicine at LSTM. During this time he struck up a friendship that would influence LSTM and the course of tropical medicine as well as his own career.

As he explained at the time, "I was approached by the Dean of LSTM, Professor Maegraith, to take up the position of Lecturer at Large, which I readily accepted and which lasted from 1960 to 1965." The role took him to Nigeria, where he formed a department of preventative medicine at Ibadan University. Returning to LSTM in 1965, he was offered a Senior Lecturer position by Maegraith, before taking the Warrington Yorke Chair in Parasitology.

His commitment to carry on the work of Maegraith was evident: "I worked very closely with him and when he retired I took over his work in Thailand." He retired in 1986, having spent the previous five years as Dean of LSTM. The then Director of LSTM, Emeritus Professor David Molyneux said in response to Professor Gilles death that 'I was privileged to have been able to count on Herbert Gilles as a colleague and friend for so many years in the School. He was the most celebrated tropical physicians of his

generation and throughout his life was committed to Liverpool. Always approachable, gentle and modest he offered the wisest of counsels. He was deeply respected throughout the world and the Schools greatest ambassador, his expertise was without peer. He will be greatly missed but he leaves an enduring legacy. Our sincere condolences to his beloved family.'

Since retirement, Professor Gilles has continued to teach in Ireland, Italy and Malta and helping postgraduates who are seeking further training overseas. He was awarded the CMG for his outstanding work overseas in 2005 and in 2008 he was appointed Companion of the Most Exalted Order of the White Elephant by the King of Thailand for his involvement with the faculty of Tropical Medicine at Mahidol University in Bangkok. Professor Herbert Gilles has contributed significantly in his field, publishing over 150 papers in scientific journals besides writing a number of books, including 'a Short Textbook of Public Health Medicine for the Tropics', first published in 1973, still used today by medical students.

Since his retirement he remained involved with LSTM as vice-President and had a keen interest in the FEPOW project. In 1994 he was recipient of LSTM's highest award, the Mary Kingsley Medal.

Director of LSTM, Professor Janet Hemingway, said 'Professor Gilles has been an extra-ordinary tropical medical physician, and a great friend and long-standing colleague to many of us. We will miss his wit, his endearing enthusiasm and his ability to engage students and staff at all levels.'



**Professor Bill Macdonald, Emeritus Dean and Professor in Medical Entomology (1927 – 2015)**

Born in Glasgow 1927, his university education began in the last year of the Second World War, and he subsequently graduated from The University of Glasgow with a BSc (Honours) in Zoology in 1948.

After a brief period with the Colonial Office in Europe, he took up a post as Entomologist in the East Africa Fisheries Research Organization, moving to Uganda with his new wife Margaret in 1950, living and working on the shores of Lake Victoria until 1953.

Leaving Africa, between 1953 and 1960 he worked in the Institute for Medical Research in Kuala Lumpur, returning to the UK when Malaysia became independent. It was during his time at the Institute that Bill began his research on the yellow fever mosquito *Aedes aegypti*.

Joining LSTM in 1960, his research focused on the genetic factors that enable some species of mosquitoes to carry and transmit the filarial parasites that cause lymphatic filariasis, resulting in elephantiasis of the limbs. These were landmark studies, considering the technical approaches available in an era

before the use of molecular genetics.

Between 1966 and 1975 Bill continued in his post as Senior Lecturer at LSTM making numerous visits to South-East Asia working on the mosquitoes carrying the arboviruses that infect man and in 1972, he was awarded the Chalmers Medal of the Royal Society of Tropical Medicine and Hygiene.

In 1975 he moved to the London School of Hygiene and Tropical Medicine, where he became Professor of Medical Entomology between 1977 and 1980 after which he returned to LSTM to take up the newly founded Selwyn-Lloyd Chair of Medical Entomology, before becoming Deputy Dean in 1981 and then Dean of LSTM in 1983.

His colleague, LSTM's Emeritus Professor Harold Townson said: "Bill left an extensive curriculum vitae, documenting not only the posts that he held during his career but also his visits and consultancies in countries ranging from Sarawak, the Philippines, Thailand and Borneo, to India, Kenya, Indonesia, Libya, Sudan and Brazil. His publications stretched from field studies in Peninsula Malaysia to some of the most important studies on the genetic factors determining the capacity of mosquitoes to transmit the parasites causing lymphatic filariasis. He will be dearly missed by his numerous friends and colleagues both in the UK and throughout the tropics"



# LSTM Pioneers: Warrington Yorke (1883 – 1943)


LSTM was among the first institutions in the world to recognise the importance of studying and understanding the phenomenon of drug resistance

One of the pioneers in this field was Professor Warrington Yorke who in 1914 took LSTM's first Walter Myers Chair of Parasitology. In that same year he led LSTM's 32nd and final expedition to Sierra Leone to study sleeping sickness. In 1921 Yorke conducted the first clinical trial of suramin against the disease followed by the first chemotherapy work in 1927.

This was followed in 1929 by the first in vitro cultivation of drug resistant blood parasites of African trypanosomes in order to understand the mode of action of new drugs. This led him to be elected as a fellow of the Royal Society in 1932.

In 1941 Yorke demonstrated acquired resistance in a malaria parasite (*Plasmodium knowlesi*) to an antimalarial drug.

Resistance research continues today across LSTM and the LSTM Research Centre for Drugs and Diagnostics is developing and delivering novel diagnostics and therapies against a range of drug resistant pathogens.

A black and white portrait of Professor Warrington Yorke, a man with glasses, wearing a suit and tie, looking slightly to the left.

*Professor Warrington Yorke. M.D.*



## Public Benefit Statement

The charity trustees of the Liverpool School of Tropical Medicine are its Board of Trustees who have had due regard to the Charity Commission's guidance on Public Benefit and particularly to its supplementary public benefit guidance on purpose, which primarily for LSTM is the advancement of education and research and advancing health/saving lives.

This statement has been included in compliance with the formal reporting requirement introduced by HEFCE as the principal regulator of English Higher Education Institutions. Although primarily concerned with teaching, learning, research, knowledge transfer and the development of the potential of its students, both for their own sake and to serve the needs of society and the economy; LSTM also plays a major role in shaping a democratic, sustainable and inclusive society by striving its research having impact on policies and implementing practices.

These distinct purposes inevitably impact on its governance structures and practices, including in the need to engage both staff and students in the governance of their institution and a clear recognition of the importance of public benefit.

Public benefit reporting is also an increasingly important aspect of LSTM's transparency and accountability and this helps the staff, students and the wider public appreciate what activities LSTM delivers in return for both public funding and tax exemptions. A representative record of those activities are published throughout this Annual Report.