

**Institution: Liverpool School of Tropical Medicine (LSTM)****1. Context and mission****Research mission**

LSTM was the first European research institute dedicated to tropical medicine but only became an independent HEI in 2014. REF2021 is LSTM's first independent REF submission; in REF2014 our staff were included in submissions from the Universities of Liverpool (UoL; UOA1) or University of Warwick (UoW; UOA2). Our links with both institutions remain very strong (as described in Unit level narratives).

LSTM creates knowledge aimed to control or eliminate diseases afflicting the world's poorest populations. We are a Global organisation with active research projects in 68 countries in 6 continents (Figure 1) and 24% of LSTM staff submitted to UOA1 and UOA2 (20 of 85) are based long-term in Low/Middle Income Countries (LMICs). Similarly, 34% of LSTM-registered PhD students are resident in LMICs (this disqualifies them from inclusion in the present REF submission).



**Figure 1: Locations of research collaborations during census period.**

All four LSTM Departments collaborate with industry and delivery partners such as Ministries of Health and national and international Non-Governmental Organizations (NGOs). LSTM's close relationship with industry is exemplified by our hosting of the only product development partnership (PDP) working on vector control (IVCC – see UOA1). Broader industry links have been further enhanced by a Strength in Places Award (£18.6M) which, by leverage of additional funding (totalling £120M), has allowed establishment of the *Infection Innovation Consortium* (iiCON – see UOA1). iiCON's collaborative effort is to develop new products that can directly reduce the burden of infectious diseases in the UK and around the world.

The strong functional links between staff in Liverpool, staff based in LMICs and research users allow effective translation of research from bench-to-implementation. The same linkages ensure that research questions relevant to LMICs are at the centre of investigation. A commitment to capacity strengthening via equitable partnerships underpins all the work of LSTM.

**Educational mission**

LSTM's current teaching portfolio comprises 10 Masters programmes, 3 professional Diplomas and a number of short professional development courses. However, with the granting of degree awarding powers (2017) and appointment of its first Dean of Education in 2018, LSTM is in the midst of an ambitious plan to expand its education portfolio. The pedagogical philosophy will focus on developing students' intellectual curiosity and provide transferable skills for lifelong learning. Learning and teaching will be a collaborative 'knowledge construction' process that

recognises the contribution of all stakeholders (academics, employers, service users and students).

Over the next 3years, LSTM plans to introduce programmes that will align with and draw on LSTM's research strengths and include an MRes, an 'MSc in Innovation and Enterprise for Global Health' and an 'MSc in Implementation Research for LMICs'. The new programmes will be student centred and delivered through a blended learning approach. These elements will be delivered by researchers (both non-medical and medical) and non-academic healthcare workers, based in Liverpool and overseas. These new programmes are expected to double the numbers of Masters student to approximately 700 and likely result in a subsequent increase in PhD numbers.

### **Size and structure**

LSTM is a small, focused, research-intensive HEI; in 2021, 601 staff were employed by LSTM on the census date, 393 of these in our 4 academic departments. All staff with *Teaching and Research* contracts (above 0.2 FTE) (79 staff) and 6 out of 143 with *Research-Only* contracts are included in our REF submission (the others having not met the REF2021 criteria of significant responsibility for research). The present UOA1 submission contains 54.1 FTE (compared to 31 FTE from LSTM in our REF2014 joint submission with UoL– 75% increase) while the UOA2 submission contains 27.7 FTE (compared with 4.2 FTE LSTM staff in our REF2014 joint submission with UoW – more than a 6-fold increase), partly driven by 28 new external academic appointments and a further 14 internal academics moving onto substantive positions during the Census Period.

## **2. Strategy**

### **Achievements against REF2014 strategy**

Examples of progress against our strategic aims, as stated in REF2014 UOA1 and UOA2 joint submissions, that span the translational pipeline, are presented below.

**'To advocate selectively'**. Development of intervention tools requires the understanding, both among funders and in Ministries of Health (MoH), that such tools are needed. TROPICAL SNAKEBITE (described in UOA1) is offered as an example of LSTM's work in this field. Snakebite has historically been perhaps the most under-researched, under-resourced high mortality (138,000 deaths annually) and high morbidity (400,000 disabilities annually) Neglected Tropical Disease (NTD). Since 2014, LSTM staff have led international meetings, documentary films, and launched the 'International Snakebite Awareness Day' to enhance the visibility of snakebite leading to the World Health Organization (WHO) formally classifying snakebite as a priority NTD in 2017. WHO has also established a 'prequalification' programme for ensuring the quality of snakebite therapeutics and a strategy (co-written by LSTM scientists) to halve the global snakebite mortality and morbidity by 2030. Impact Case Study LSTM103 sets out the work done by LSTM, within this framework, to design, develop and deliver improved antivenoms, resulting in new, cost-effective, life-saving treatments.

**'To undertake research that supports product development pipelines'** Multiple examples are provided in our UOA1 narrative and we present just two examples here. (a) DRUG DEVELOPMENT FOR NTDs. *Wolbachia* is a bacterial endosymbiont of filarial worms and a target for drug therapy. The Anti-*Wolbachia* (AWOL) Consortium has established a preclinical platform to assess candidate cures for filariasis. Resulting drug candidates include: the AbbVie molecule ABBV-4083 (which has reached clinical Phase-II and is the subject of an 'investigational new drug' submission to the US FDA) and the Eisai molecule AWZ1066 (toxicology profiling completed and first-in human testing will start August 2021). In addition, AWOL work on doxycycline has led to WHO approval of this treatment for treatment of filarial diseases. (b) DRUG DEVELOPMENT FOR MALARIA. Industry-standard pathways are followed (in formal product-development-partnerships with the *Medicines for Malaria Venture* (MMV)) extending from pre-clinical discovery to clinical stages of development. One such collaboration

has resulted in the synthetic tetroxane E209 which is being assessed for clinical development. LSTM's successes in such T1 translational research were the basis for a recent STRENGTH IN PLACES FUND AWARD (iiCON), described in unit narratives.

**'To develop *Monitoring and Evaluation* methodologies and systems to measure Impact'**

Examples of activity can be found in UOA1 and UOA2 including (a) An evidence-based intervention package for OBSTETRIC EMERGENCIES (EmOC) was developed by LSTM staff who demonstrated its effectiveness. LSTM then led '*Making It Happen*' (MiH), a 7year (2009-2016) multicounty implementation programme to improve the availability and quality of EmOC. (b) REACHOUT which has assessed and developed the role of close-to-community providers of health care in managing major illnesses in Africa and Asia. (c) AMETHIST is currently exploring whether a sex work programme, tailored for Africa, can raise uptake and adherence to HIV prevention and treatment among female sex workers

**'To operate as a Centre of Excellence for Evidence-based Research Synthesis across a range of disciplines'** (described in UOA2). Public health policy makers in LMICs can face challenges when presented with a wide range of, often conflicting, evidence and draw on evidence synthesis methods to support decision making. LSTM houses the *Centre for Evidence Synthesis in Global Health*, a WHO Collaborating centre, which conducts systematic reviews and has published evidence in areas including COVID-19 interventions, hand washing for prevention of diarrhoea, malaria diagnosis and treatments and contact tracing strategies in TB.

**'To assist Disease Endemic Country partners to optimise intervention strategies and implementation'** (described in UOA2). Examples include: (a) REDRESS is using a person-centred approach to evaluate, develop, and adapt health systems interventions for the management of stigmatizing skins diseases in Africa. (b) LIGHT aims to transform gendered pathways to health for those with tuberculosis in urban, HIV-prevalent settings and to stop the spread of TB. (c) The MENSTRUAL HEALTH CONSORTIUM is addressing the menstrual health needs of girls in rural Kenyan schools contributing to national policy, global discourse and strategy and training guidelines.

**'To provide leadership in defining methodologies to monitor and evaluate the effectiveness of external and internal Capacity Strengthening programmes'**. The Centre for Capacity Research (CCR, described in UOA2) works to strengthen the ability of individuals, institutions, and systems to generate the knowledge needed to address a population's health and development needs. CCR collaborates with leading funding/implementing partners (including DFID/FCDO, the Royal Society, the Wellcome Trust, the UK Collaborative on Development Sciences, WHO and UKRI) who use CCR's evidence to underpin major UK research capacity strengthening investments.

## **Forward strategy**

### ***Changes in our research culture***

LSTM is a signatory to the:

- Vitae Concordat to Support the Career Development of Researchers and its implementation is extending our vibrant youthful research culture because the organization is now influenced by participation of Early Career Researchers (ECRs) in decision-making to a greater degree than before;
- San Francisco Declaration on Researcher Assessment (DORA) where our 'action plan' to improve compliance is now at an advanced stage. Scientific outputs are judged on their *originality*, *rigor* and *significance* and we have set out our approach to judging wider research contributions. Academic research performance expectations are now explicit, and widely disseminated;
- UUK Consortium on Research Integrity where our 'action plan' (which sees us move to a pro-active approach to standards in the laboratory, in research on human subjects and in systematic review-based research) is now at an advanced stage;

- Technicians Commitment which is increasing the visibility and improving career structures for our technicians;
- Knowledge Exchange Concordat which is equipping staff and students with skills to thrive in an open research environment.

LSTM will shortly appoint a Dean of Research Culture and Integrity to ensure these commitments are embedded in policy and practice.

Our research data management policy recognises the long term value of research data and is designed to aid researchers in maximising the public visibility and thereby facilitating the reuse of data, minimising the risk of data loss, and ensuring compliance with funders' policies. All researchers undertake mandatory training in Data Protection and Research Integrity. LSTM's Centre for Data acts as a central resource for support in data management.

Safeguarding of research participants, communities with whom we work, and vulnerable children and adults is taken very seriously at LSTM. A dedicated safeguarding officer conducts workshops for staff and students and is the key point of contact for any concerns and a Strategic Safeguarding Oversight Committee meets bi-monthly to monitor the organisation's progress against our organisational safeguarding action plan.

### ***Open Access (OA)***

LSTM OA-compliance is high: UOA1 - 100% and UOA2 - 98.5%. The Library allocates funds for article processing charges that enable articles to be OA on the publishers' own websites. We are entering into an increasing number of agreements with publishers, which offer cost effective routes to fully OA publishing. The Library manages LSTM's institutional repository, an online OA archive of all LSTM publications.

### ***Public and community engagement***

LSTM is committed to engaging the public about its world-class research, locally, nationally, and internationally. LSTM seeks to listen to the public, and other key stakeholders, both in the UK and in LMICs, and to discuss the challenges faced by communities to set the agenda for its research. LSTM staff have been working very actively with local communities during the COVID-19 pandemic. For example, 27 staff have collectively contributed to 98 Radio Merseyside programmes in the past year to provide updates and explanations during the pandemic.

### ***Promoting interdisciplinarity***

Interdisciplinarity is facilitated by 9 cross-cutting Research Centres, externally funded interdisciplinary awards, and cross departmental appointments, all of which are described in Unit-level statements.

### ***International partnerships***

LSTM's major externally funded research programmes are set out in UOA1 and UOA2. Most of these are in close collaboration with established independent research organisations in LMICs. In addition, the work of LSTM staff in both UOAs sometimes requires long-term presence overseas and examples of locations of these staff include:

- The Malawi-Liverpool-Wellcome Programme (MLW). MLW employs 648 staff and is the long-term base of 10 LSTM academics (all of whom are included in Unit level submissions). MLW undertakes clinical-laboratory study of human diseases, vector biology, public health research, epidemiology, and health-behaviour research. MLW is currently building Malawi's first specialist postgraduate medical training centre (the 'CREATOR building') financed by Wellcome, LSTM and the UoL.
- KEMRI-CDC in western Kenya. This health and demographic surveillance system provide a platform for population-based studies. LSTM staff are working on malaria, HIV, rapid diagnostic tests, paediatric gut health and reproductive health.
- The Centre for Research in Infectious Diseases (CRID), Cameroon. Research activities focus on vector control including of malaria, arbovirus diseases and sleeping sickness using genetics, genomics, and ecological approaches.

- The Centre for Sexual Health and HIV/AIDS Research (CeSHHAR), Zimbabwe. CeSHHAR conducts implementation research related to HIV and sexual and reproductive health, including evaluation of several national programmes, and runs Zimbabwe's national program for sex workers.

### ***Achieving research impact***

All of LSTM's research, whether single-discipline or interdisciplinary, aims to achieve impact for the world's poorest people through translation and implementation. To facilitate this, LSTM systematically collects impact data annually, collates this information and celebrates case studies in the school-wide seminar series. Although no incentive is necessary to encourage development of impact in LSTM, outstanding Impact Case Studies are presented annually to the Board of Trustees.

### ***Knowledge Exchange***

Over the past two decades Liverpool City Region (LCR) has undergone an economic renaissance and now has a diversifying economy that facilitates innovation and future economic growth, and LSTM is a core partner. The BEIS '**Science & Innovation Audit**' from LCR lists 'infection research' as one of its 3 strategic areas for growth and LSTM has worked within this framework to benefit the health of the UK through local partnerships. LSTM is a member of both the *Health & Life Science Board* of the LCR and the local 'Academic Health Science System' *Liverpool Health Partners*. LCR, Cheshire and Warrington have the largest concentration of infectious diseases research in the UK as illustrated by the speed and efficiency by which the region mobilised resources to address the COVID-19 crisis with active research programmes in diagnostics, therapeutics, and vaccines. **Diagnostic technologies** at LSTM have been rapidly adapted to address COVID-19 and LSTM has become a test bed for new technology development with multiple commercial and academic partners. LSTM's *Hazard Grade-3* facilities, essential for the handling of COVID-19, have supported studies into novel **therapeutic interventions**. This has brought together a Liverpool consortium of some 40 scientists who have established a COVID-19 pre-clinical pipeline to identify, prioritise and validate candidate molecules suitable for clinical Phase I and Phase II studies.

LSTM's largest PDP collaborator has been the **Innovative Vector Control Consortium (IVCC)** which is the only PDP working in vector control anywhere in the world. Established in 2005 (through a grant from the Gates Foundation), IVCC works with stakeholders to facilitate the development of novel interventions and brings together partners from industry, the public sector and academia. Interactions with industry are further supported through the MRC Confidence in Concept programme which has involved over 46 different industry partners in the 7 years since establishment.

### ***Ongoing aims***

LSTM is currently working to its 2017-2023 Strategic Plan. The major research activities planned for the next 6 years will continue in line with that plan, particularly concentrating on translational research, that addresses global infection priorities and is focused on health impact in the poorest areas of the world.

Activities will include:

- Building on the success of our work in COVID-19 to increase our investment in emerging infectious diseases
- Strengthening the laboratory base in Liverpool and overseas to address therapeutic and diagnostic challenges related to infectious diseases
- Developing greater capacity to undertake interdisciplinary work on health systems
- Developing closer relationships with industry through our translational platforms and iiCON
- Working more closely within the Liverpool region to apply LSTM's global expertise to some of the problems affecting our local population
- Developing stronger partnerships with organizations in the countries of Asia and Africa where we work with a continued focus on equity and breaking the cycle of ill health and poverty

- Supporting the development of young career researchers and attracting new talent to LSTM, including employment of larger numbers of researchers in LMICs.
- Strengthening the profile of LSTM with external stakeholders as part of the initiatives to celebrate LSTM's 125<sup>th</sup> anniversary in 2023

### **Sustainability**

**Leadership.** The Director, Deputy Director and Deans of Biological Sciences and Clinical Science & International Public Health are all research active and submitted to either UOA1 or UOA2, as are all four Heads of Department. Since REF2014 LSTM has created Deputies to Heads of Department thereby strengthening succession planning.

**New appointments since REF2014.** The rise in numbers of staff submitted to UOA1 and UOA2 include 28 external academic appointments made since January 2014. These new appointments have enabled expansion in of research topics and we now have increased breadth and depth across the translational pipeline from bench to implementation.

**Equitable engagement with the global south.** This remains one of LSTM's core values and strategic goals and is key to the long-term sustainability of our work. LSTM has approved an increasing number of joint and honorary appointments and secondments between LSTM and partner organisations in LMICs as part of this global engagement.

**Sustainability and Environmental Impact.** Environmental, Social and Governance issues are at the forefront of all that we do. Staff led Environmental Working Groups propose measures to reduce the environmental impact of our different activities (e.g. laboratory work, international travel) and their recommendations are consolidated into an action plan that is monitored by the Sustainability and Environment Committee. Due diligence carried out on our research partners and suppliers considers social and governance aspects as part of partnering considerations and are linked to ongoing capacity building activities.

## **3. People**

### **Staffing strategy and staff development**

**Career pathways for part-time and fixed-term staff.** Since 2019, and responding to a call from staff, a concerted effort has been made to reduce the use of fixed-term contracts for 'R-only' staff by engagement with line managers (to identify upcoming vacancies) and with staff (to explore their career plans). Staff eligible for redeployment are prioritised for consideration for roles ahead of other applicants. A working group has been established to improve the career and development of researchers; senior managers, HR professionals and ECRs are working together to co-create and implement an action plan that recognises and rewards the contributions of grant funded researchers and highlights and celebrates alternative career pathways within and out of academia. Requests for flexible working are welcome and, learning from the changes in working practices necessitated by COVID-19, we are adapting our approach to flexible and ad-hoc agile working, giving our colleagues greater opportunity to vary their hours of work and location to balance their responsibilities at work and home on a day-to-day basis.

**Supporting staff wellbeing.** Our Dignity at Work policy describes our commitment to maintaining a prevailing culture of fairness and mutual respect. LSTM has an online reporting platform, *Freedom to Speak Up*, where people can raise issues relating to safeguarding, staff and student conduct (including allegations relating to research integrity and DORA) and wellbeing. 2019-20 has seen the creation of two staff-led networks; the LGBTQ+ Network and BAME Staff Network. Events of May 2020 highlighted ongoing inequality across the globe: LSTM was challenged by staff on adequacy of its focus on internal race equality. A Race Equality Action Panel has been established to consult, develop and implement an action plan. This will feed into the new 2021-2024 Equality Diversity and Inclusion Strategy, strengthening our commitment to becoming an actively anti-racist Institution.

**Early Career Researchers (ECRs).** 21% of submitted staff FTE in REF2021 are defined as ECRs. Support for ECRs is described in Unit level statements and includes:

- MRC Skills Development Fellowship Programme in Translational and Quantitative Skills for Global Health (4 Awards) which aims to develop a cadre of talented researchers who demonstrate leadership in translational research and can work across the traditional phases of translational research.
- The Wellcome Trust Institutional Translational Partnership Award (iTPA) which will allow LSTM to overcome barriers experienced by staff that limit their ability to progress translational research.
- Internally funded schemes including the *Director's Catalyst Fund* (21 Awards) and seed funding to support innovation and proof-of-concept.
- Career Track which underwrites salary support for promising researchers and provides mentorship, and reduced teaching and administrative expectations, to help them transition to substantive positions; 14 ECRs have successfully completed the career track scheme in the current census period and 13 of these have subsequently been promoted.
- Seminars and training workshops in areas such as grant writing and publication strategy and a supportive system of peer review of grants and publications pre submission

**Support for overseas based staff.** 45 of total staff (7.5%) are based overseas in Botswana, Cameroon, Kenya, Malawi, Nepal, Uganda and Zimbabwe – despite the geography, overseas-based people serve remotely on LSTM committees. We support these staff by maintaining high-specification research environments, by facilitating integration with UK-based colleagues and by provision of overseas allowances.

**Research students.** Research students are fully integrated into research groups. An annual postgraduate symposium provides an opportunity for all students to present their work. Students undertake an appraisal of their professional and personal training needs upon registration and annually thereafter using the 'Development Needs Analysis' (DNA) tool and engage with training opportunities via the PGR Skills Development Programme, MSc modules, and external courses to bridge their knowledge gaps. The DNA and Skills Development Programme are both built around the four primary domains of the VITAE Researcher Development Framework, and training sessions are tailored to be suitable for participants to join on-site as well as off-site. LSTM consistently achieves approval scores from student participants of above 80% in the Postgraduate Research Experience Survey (PRES) in relation to Professional Development and Research Skills.

**Equality and diversity.** Our Inclusion, Diversity & Engagement Manager is leading on initiatives to increase inclusivity across all areas of LSTM and is working closely with staff networks to implement and monitor 'bottom up' approaches. All new policies undergo Equality Impact Assessments and staff undertake mandatory training in diversity and inclusion.

LSTM has greater number of female than male staff in all grades except NHS and Professorial and Corporate Leaders (31% female) and yet only 36% of REF submitted staff are female. In 2020 we had a 11.1% median hourly pay gap in favour of men. We are investigating reasons for this gap (for example undertaking a pay audit introducing a talent management approach to succession planning) and have set a target to reduce the GPG to 5.5% by 2026.

81% of staff who declared their ethnicity identify as white (72% of Professorial and Corporate Leaders) and 59% of our REF submitted staff are white. We have an inverse ethnicity pay gap with median hourly pay rates being lower for white staff than any other ethnic group (difference ranges from <1% to <16%).

#### 4. Income, infrastructure and facilities

The number of staff employed by LSTM has increased by 47% over the census period. This has been accommodated by investment in two new buildings (the *Wolfson Building* and *Liverpool Life Sciences Accelerator Building*). Our research office has overseen a 95% increase in our research income over the census period, facilitated by providing academics with updates on funding opportunities, training workshops and support on budget preparations. Research Committee coordinates the award of our multiple internal funding schemes and also oversees the peer review process for external funding applications with restricted numbers of applicants/institute. We support collaborations via our very successful 'speed networking' events and by providing funding for workshops with potential external partners early in the bid writing process.

Our laboratory scientists work in shared well-equipped open plan facilities, which have recently benefited from a £1.3M investment to upgrade equipment. All equipment is shared between research groups to remove barriers to new principal investigators and ensuring equitable access regardless of group size or seniority. The provision of specialist laboratories such as Hazard Grade 3 microbiology, parasitology and insectary suites, and a Human Challenge Facility attracts investment and collaboration from local SME, pharmaceutical and agrochemical industries and with NHS Trusts.