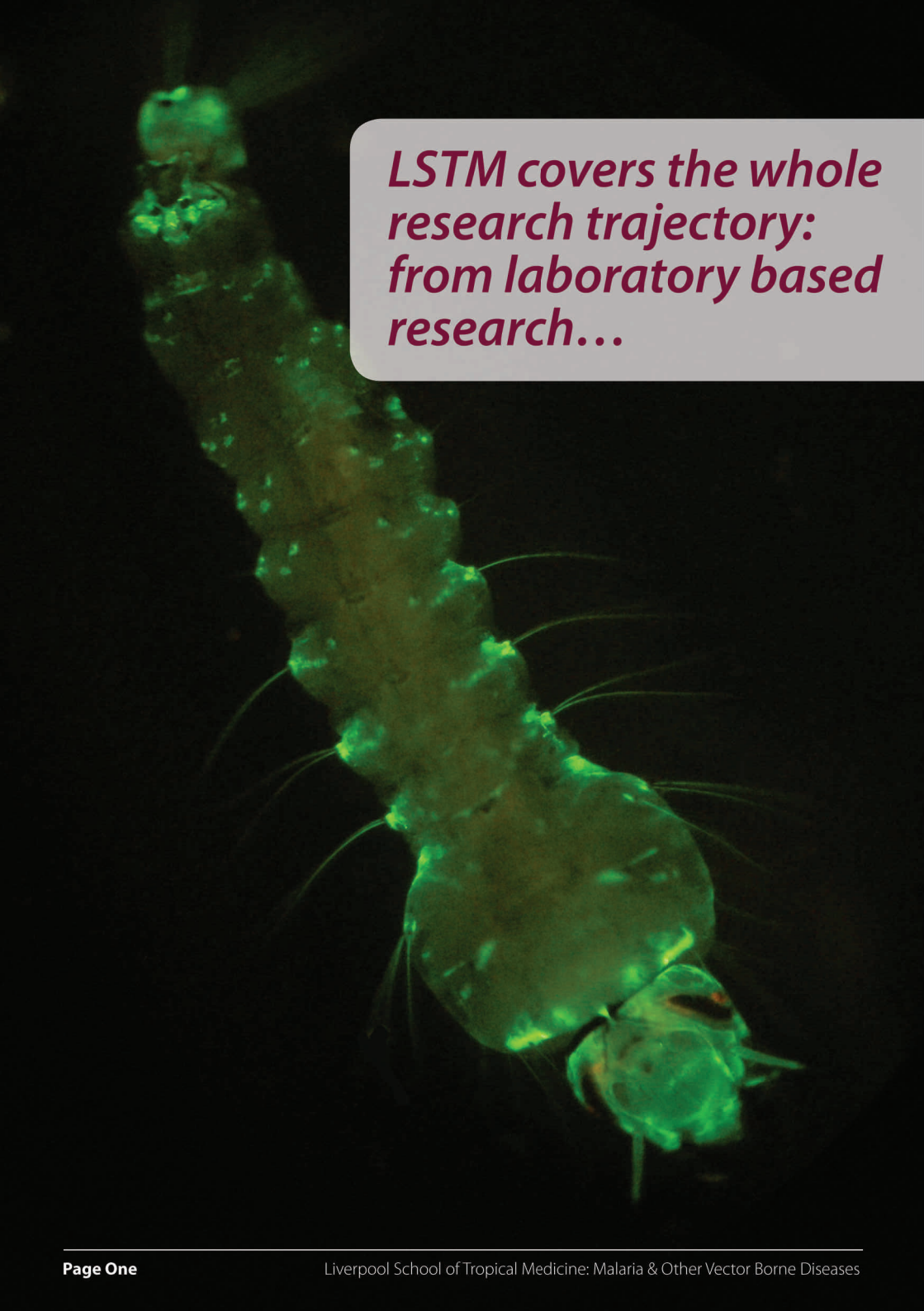




# LSTM

MALARIA & OTHER  
VECTOR BORNE DISEASES



A detailed image of a mosquito larva, also known as a pupa, glowing with a bright green fluorescence. The larva is oriented vertically, with its head at the top and its segmented body extending downwards. The head is small and rounded, with visible antennae. The body is composed of several distinct segments, each showing some internal structure. The tail end of the larva is wider and more bulbous, with several long, thin, hair-like structures extending from it. The entire larva is set against a solid black background, which makes the green glow stand out prominently.

*LSTM covers the whole research trajectory: from laboratory based research...*

# Liverpool School of Tropical Medicine and Vector Biology

Insects transmit approximately 17% of global infectious disease in humans. Malaria alone kills over half a million children each year and the incidence of other mosquito borne diseases such as dengue and Chikungunya is increasing rapidly. Six of the 17 'Neglected Tropical Diseases' listed by WHO are transmitted by an insect vector and one involves a snail intermediary host.

The Liverpool School of Tropical Medicine (LSTM) has a long track record of pioneering research in vector biology. The transmission of malaria by mosquitoes was established by Ronald Ross, a British doctor working in India who became LSTM's first lecturer in 1898. He was awarded the Nobel Prize for Medicine for his discovery in 1902. LSTM's work in Sierra Leone also led to the discovery that river blindness is transmitted by blackflies.

Today LSTM hosts the largest concentration of medical entomologists in the UK with a research profile that spans from functional genomics of disease vectors to clinical trials; implementation research and the development of tools for monitoring and evaluation of disease transmission. In addition to our well-equipped research laboratories, we have access to state of the art genomics and proteomics facilities via our excellent collaborations with the Sanger Institute and University of Liverpool. Our insectary suite consists of 14 environmentally controlled rooms. These contain the largest tsetse fly colony in the UK and a wide range of different mosquito species; two category 3 insectaries; two insecticide testing laboratories and two free flying rooms for studies on insect behaviour.

LSTM has major field projects which evaluate, implement and monitor vector control activities in Africa and Asia. LSTM works closely with a range of partners to ensure our research and

educational programmes are responsive to the needs of disease endemic countries.

Strengthening capacity in vector biology is a major component of LSTM's work. As an example, 11 of the 14 Wellcome Trust Public Health and Tropical Medicine Fellowships in vector biology are sponsored by faculty within LSTM's Vector Biology Department. LSTM also runs short courses and MSc programmes on the biology and control of disease vectors.

LSTM leads several international vector control consortia and hosts the Liverpool Insecticide Testing Establishment (LITE), which provides GLP standard evaluation of new insect control tools and maintains one of the largest collection of fully characterised insecticide resistant mosquito populations in the world.

LSTM's excellent links with innovators; policy makers and implementers ensure that advances in approaches to reduce the transmission of vector borne diseases are translated into improvement in the health of those most at risk.



**Professor Janet Hemingway**  
Director LSTM

# LSTM's research programmes in Vectors & Vector Borne Diseases

## ► Mosquitoes

### **Aedes**

- Dengue fever
- Chikungunya

### **Anopheles**

- Lymphatic filariasis
- Malaria

### **Culex**

- Japanese encephalitis
- Lymphatic filariasis
- West Nile fever

## ► Sandflies

- Visceral leishmaniasis
- Cutaneous leishmaniasis

## ► Ticks

- Crimean-Congo haemorrhagic fever

## ► Tsetse flies

- Human and Animal African trypanosomiasis (sleeping sickness)

## ► Blackflies

- Onchocerciasis (river blindness)

## ► Aquatic snails

- Biomphalaria (Intestinal schistosomiasis)
- Bulinus (Urogenital schistosomiasis)
- Lymnaea (Fascioliasis)



A photograph of a rocky riverbank. In the upper left, a person stands on a large rock. The river flows through the center, with sunlight reflecting off the water. In the foreground, a blue flag is attached to a black frame, positioned on a rock. The scene is surrounded by tall grasses and other vegetation.

*...to field application...*



# LSTM and Vector Borne Diseases: Expertise across different disease systems

## Malaria

With wide reaching expertise from basic research to field implementation, LSTM is pioneering research on mosquito behaviour; insecticide resistance; population genomics and monitoring and evaluation tools.

## Filariasis

LSTM hosts the Global Alliance to Eliminate Lymphatic Filariasis (GAELF). Vector control is pivotal to the elimination strategy and LSTM's research on the behaviour, physiology and ecology of the vectors is underpinning these efforts.

## Schistosomiasis

LSTM is applying DNA barcoding technology to understand the epidemiology of schistosomiasis transmission in East Africa.

## Cutaneous Leishmaniasis

LSTM is introducing novel diagnostic methods, evaluating current disease treatment protocols and assessing novel strategies to control cutaneous leishmaniasis in Saudi Arabia.

## Dengue

LSTM projects are investigating insecticide resistance and behaviour around human homes; dengue outbreak surveillance and response and improving the effectiveness of novel control interventions.

## Trypanosomiasis

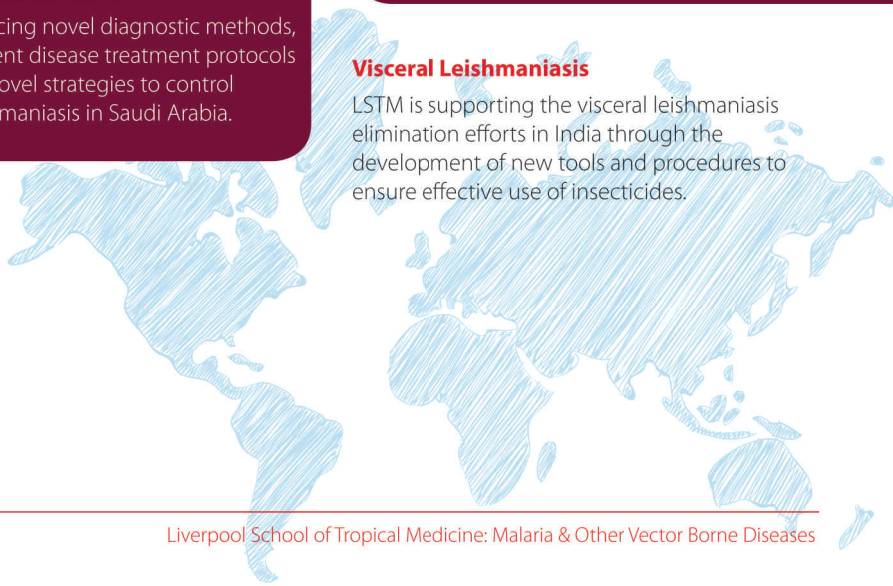
Research at LSTM is focussed on improving methods of tsetse control. LSTM leads large scale field projects in five countries to evaluate the impact of tiny targets on sleeping sickness transmission.

## Arboviruses

Arbovirology research includes studies on the pathogenesis of Crimean Congo Haemorrhagic Fever; vector competence of British mosquitoes for arboviruses and the epidemiology of Tick Borne Relapsing fever in East-Africa.

## Visceral Leishmaniasis

LSTM is supporting the visceral leishmaniasis elimination efforts in India through the development of new tools and procedures to ensure effective use of insecticides.





*...to technology development...*



# LSTM and Vector Borne Diseases: cross-sector expertise

## Product Evaluation

From professional laboratory screening services provided by LITE to evaluation under operational settings in the field: LSTM supports the development and evaluation of new vector control products across the entire pipeline.

## Policy and Guidelines

With a mission to improve research uptake, LSTM regularly contributes to guidelines and global policies on control of vector borne diseases including malaria surveillance; management of insecticide resistance and control strategies for dengue; trypanosomiasis and visceral leishmaniasis.

## Technical Assistance

LSTM has a long track record in providing long term technical advice and support in the design, implementation, monitoring and evaluation of national and regional control programmes against vector borne diseases including malaria, trypanosomiasis and filariasis.

## Applied Health Research

Entomologists, anthropologists and economists are working together to improve the cost effectiveness and ease of use of new methods of vector control. LSTM is also developing and implementing disease data management systems to monitor interventions and evaluate impact.

## Diagnostics

LSTM is translating basic research into molecular diagnostic tools for monitoring resistance and the development of insecticide quantification kits for insecticide monitoring.

## Capacity Strengthening

In addition to training and mentoring of vector biologists via short visits, MSc programmes and PhDs, LSTM leads training programmes for environmental health technicians in the UK Ministry of Defence and contributes in vector control quality assurance workshops and provides on the ground training in diagnostic tools.

## Genomics and genome modification

LSTM developed technologies allow for manipulation of gene expression in specific body parts of vectors facilitating studies on insect immunity and basic vector biology. Population genomics approaches are being applied to address challenges in vector control.

## Containment facilities

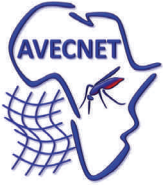
LSTM has facilities for culturing category 3 pathogens and for infecting vectors with these pathogens. This coupled with LSTM's expertise in vector biology, parasitology and clinical medicine makes it an ideal environment for vector competence studies.





***...to implementation and evaluation of vector control programmes...***

## Cross sector initiatives hosted by LSTM



AvecNet is developing and evaluating new tools to sustain malaria control in an era when insecticide resistance is reducing the efficacy of many existing interventions.  
[www.avecnet.eu](http://www.avecnet.eu)

### COUNTDOWN

Calling time on Neglected Tropical Diseases

COUNTDOWN investigates cost-effective, scale up and sustainable solutions, necessary to control and eliminate the seven most common Neglected Tropical Diseases by 2020.  
[www.countdownnntds.org](http://www.countdownnntds.org)



LITE provides a product evaluation service for insect control products for a variety of industry clients and academic partners.  
[www.lite-testing-facility.com](http://www.lite-testing-facility.com)

### MALTREC

The Malaria Transmission Reduction and Elimination Centre fosters collaboration between researchers with malaria interests from across LSTM.

### Tiny Targets

LSTM has been leading the development and evaluation of Tiny Targets to prevent sleeping sickness transmission. Around 50,000 of these tsetse traps are being deployed across 5,000 km<sup>2</sup> with promising initial results.



IVCC is a not-for-profit public-private partnership. Its mission is to save lives, protect health and increase prosperity in areas where disease transmitted by insects is endemic.  
[www.ivcc.com](http://www.ivcc.com)



FPSU supports NTD activities in 12 countries. It provides technical assistance to identify and prioritise interventions that will eliminate lymphatic filariasis (LF) and reduce the burden of LF and other neglected tropical diseases.



The Effective Health Care Research Consortium (EHCRC) focuses on evidence by preparing and updating Cochrane Reviews about the effects of healthcare relevant to low-income and middle-income countries. LSTM hosts the Cochrane Infectious Disease Group.  
[www.evidence4health.org](http://www.evidence4health.org) &  
[www.cidg.cochrane.org](http://www.cidg.cochrane.org)



*...resulting in research uptake benefiting people worldwide.*





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