

# HPRU IN EMERGING AND ZOO NOTIC INFECTIONS (HPRU-EZI) & THE PANDEMIC INSTITUTE

**Ed Hill**

Civic Health Innovation Labs (CHIL), University of Liverpool

Member of JUNIPER Partnership  
(Joint Universities Pandemic & Epidemiological Research)



# About me: Ed Hill

**My role:** Tenure Track Fellow in Health Protection Data Science

**Role supporters include:**



**Research interests:** Quantitative modelling (incl. fitting to data & model selection) to study interdisciplinary problems in epidemiology and infectious disease dynamics.

**Application areas:**

Modelling for public, veterinary and plant health policy

Behavioural dynamics & social contagion

One Health problems (including zoonotic transmission)

I am a member of the **JUNIPER Partnership**, a collaborative network of researchers from across the UK who work at the interface between modelling, infectious disease control and health policy.



<https://maths.org/juniper/>

# HPRU in Emerging and Zoonotic Infections



## HPRU-3

**Director:**

**Tom Solomon**, University of Liverpool

**Co-directors:**

**Richard Vipond**  
UK Health Security  
Agency

**Jake Dunning**  
University of Oxford

**Jonathan Ball**  
Liverpool School of  
Tropical Medicine

**Emma Thomson**  
London School of Hygiene  
& Tropical Medicine

**Deputy Directors:**

**Lance Turtle**  
University of Liverpool

**Gillian Slack**  
UK Health Security  
Agency



# HPRU-EZI 3 (2025-2030): People

## Theme 1: Predict & Prevent

### Leads

Grant Hughes (LSTM)  
Jolyon Medlock (UKHSA)

### Researchers

Matthew Baylis (UoL)  
Christl Donnelly (Oxford)  
Christine Goffinet (LSTM)  
Maya Holding (UKHSA)  
Alain Kohl (LSTM)  
Jolyon Medlock (UKHSA)  
Soeren Metelmann (UKHSA)  
Emily Nixon (UoL)

### PhDs

LSTM (Hughes; 1-1)  
UKHSA (Holding; 1-2)

## Theme 2: Clinical Characterisation

### Leads

Lance Turtle (UoL)  
Tommy Rampling (UKHSA)

### Researchers

Barry Atkinson (UKHSA)  
Sylviane Defres (LSTM)  
Jake Dunning (Oxford)  
Tom Fletcher (LSTM)  
Susan Gould (LSTM)  
Cat Houlihan (UKHSA)  
Jane Osborne (UKHSA)  
Christina Petridou (UKHSA)  
Amanda Semper (UKHSA)  
Calum Semple (UoL)  
Tom Solomon (UoL)

Clinical Fellow (UoL)

### PhDs

Oxford (Dunning; 2-3)

## Theme 3: Non-Pharmaceutical Interventions

### Leads

Christl Donnelly (Oxford)  
Roberto Vivancos (UKHSA)

### Researchers

Iain Buchan (UoL)  
Brendan Collins (UoL)  
Christophe Fraser (Oxford)  
Kay O'Halloran (UoL)  
Charlotte Robin (UKHSA)  
Bhagteshwar Singh (UoL)  
Miriam Taegtmeier (LSTM)

### PhDs

Oxford (Donnelly; 3-1)  
KCL (Rubin; 3-2)  
UoL (Collins; 3-3)

## Theme 4: Medical Countermeasures

### Leads

Emily Adams (Oxford)  
Catherine Houlihan (UKHSA)

### Researchers

Miles Carroll (Oxford)  
Julian Hiscox (UoL)  
Michael Marks (LSHTM)  
Lois Murray (UKHSA)  
Kay O'Halloran (UoL)  
Ashley Otter (UKHSA)  
Georgios Pollakis (UoL)  
Tommy Rampling (UKHSA)  
Miriam Taegtmeier (LSTM)  
Emma Thomson (LSHTM)

### PhDs

LSTM (Taegtmeier; 4-2)  
UoL (Nixon; 4-3)  
LSHTM (Marks)

## Theme 5: Data, Modelling and AI

### Leads

Iain Buchan (UoL)  
Andre Charlett (UKHSA)

### Researchers

Emily Adams (Oxford)  
Matt Ashton (Liverpool City Council)  
Christl Donnelly (Oxford)  
Jake Dunning (Oxford)  
Cathy Montgomery (LJMU)  
Marta Garcia-Finana (UoL)  
Edward Hill (UoL) Gary Leeming (UoL)  
Trish Mannes (UKHSA) Simon Maskell (UoL)  
Mark Green (UoL) Lois Murray (UKHSA)  
Emily Nixon (UoL) Chris Overton (UKHSA)  
Tom Solomon (UoL) Calum Semple (UoL)  
Lance Turtle (UoL) Gillian Slack (UKHSA)  
Roberto Vivancos (UKHSA) Nina Zhang (UoL)

### PhD

UoL (Buchan)

# HPRU-EZI 3 (2025-2030): Projects

## Theme 1: Predict and Prevent

### 1-1: Predict and prepare for dengue

PhD supervisors:  
Grant Hughes, LSTM  
Jolyon Medlock, UKHSA  
Matthew Baylis, UoL

### 1-2: Biosentinel surveillance

PhD supervisors:  
Maya Holding, UKHSA  
Emily Nixon, UoL  
Jolyon Medlock, UKHSA

## Theme 2: Clinical Characterisation

### 2-1: Lyme-UK

PIs: Sylviane Defres, LSTM  
Christina Petridou, UKHSA  
Amanda Semper, UKHSA

### 2-2: Arbo-UK

PIs: Lance Turtle, UoL  
Jane Osborne, UKHSA  
Tommy Rampling, UKHSA

### 2-3: Transmission study

PhD supervisors:  
Jake Dunning, UoO  
Tom Fletcher, LSTM  
Barry Atkinson, UKHSA

## Theme 3: Non-Pharmaceutical Interventions

### 3-1: Acceptability of NPIs

PhD supervisors:  
Christl Donnelly, UoO  
Iain Buchan, UoL  
Roberto Vivancos, UKHSA

### 3-2: Understanding behaviours at source of outbreaks

PhD supervisors:  
James Rubin, KCL  
Lucy Yardley, UoB  
Charlotte Robin, UKHSA

### 3-3: Economic evaluation of NPIs:

PhD supervisors:  
Roberto Vivancos, UKHSA  
Brendan Collins, UoL  
Christl Donnelly, UoO

### 5-3: Winter Respiratory Virus Pressures

PIs: Jake Dunning, UoO  
Matt Ashton, Liverpool City Council  
Lois Murray, UKHSA

## Theme 4: Medical Countermeasures

### 4-1: Next generation diagnostic tools

PIs: Emma Thomson, LSHTM  
Ashley Otter, UKHSA  
Lance Turtle, UoL

### 4-2: Vaccine access and equity

PhD supervisors:  
Miriam Taegtmeier, LSTM  
Cathy Montgomery, LJMU  
Lois Murray, UKHSA

### 4-3: Use of initial diagnostic tests

PhD supervisors:  
Emily Nixon, UoL  
Christl Donnelly, UoO  
Richard Vipond, UKHSA

### 5-4: Multimodal Surveillance Methods

PIs: Edward Hill, UoL  
Gillian Slack, UKHSA  
Emily Adams, UoO

## Theme 5: Data, Modelling & Artificial Intelligence

### 5-1: Data linkage and curation

PIs: Edward Hill, UoL  
Andre Charlett, UKHSA  
Cathy Montgomery, LJMU

### 2-4: Outbreak-UK

PIs: Calum Semple, UoL  
Catherine Houlihan, UKHSA  
Jake Dunning, UoO

### 5-2: Voice-based AI Data Capture

PIs: Gary Leeming, UoL  
Jake Dunning, UoL  
Trish Mannes, UKHSA

# Theme 1: Predict and Prevent

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## **Purpose**

- UKHSA Strategic Plan 2023-6 specifically mentions the threat from mosquito-borne diseases, driven by climate change.
- Research into interventions for control of non-native species for rapid deployment in the event of populations becoming locally established.

## **Initial projects**

1-1: Predict and prepare for dengue introduction to the UK

1-2: Biosentinel surveillance for emerging zoonotic disease assessment and modelling

## **Outputs & impact**

- Mitigate the negative consequences of the introduction of these emerging pathogens, including health and economic impacts.
- Training of students/staff will increase UKHSA's capacity to respond to such threats.

# Theme 2: Clinical Characterisation

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## Purpose

- Prospective cohort studies for emerging and zoonotic infections to characterise the disease, understand outcome risk factors and develop medical countermeasures.
- Study pathogen transmission in healthcare settings, critical to controlling nosocomial spread.

2-1: Lyme-UK study

2-2: Arbo-UK study

2-3: Nosocomial transmission of emerging pathogens

2-4: Outbreak-UK study

## Initial projects

## Outputs & impact

- Characterisation of clinical features of major threats (Lyme, arthropod-borne & outbreak diseases) & understanding of nosocomial transmission to inform policy.
- Provision of samples for developing medical countermeasures

# Theme 3: Non-Pharmaceutical Interventions

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## Purpose

- Help inform evidence-based decision-making on the use of NPIs.
- Examining the ethics, acceptability, and feasibility of research on NPIs.

## Initial projects

- 3-1: Social and ethical acceptability of next-generation digital & research approaches to NPIs
- 3-2: Understanding behaviours at source of outbreaks
- 3-3: Economic evaluation of NPIs

## Outputs & impact

- Identify cost-effectiveness and ‘tipping point’ where health benefits outweigh economic or equity-related losses.
- Guide development of sleeper protocols to conduct trials to evaluate further NPIs in epidemics and pandemics.



# Theme 4: Medical Countermeasures

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## Purpose

- Development of diagnostics tests, supporting evaluation of potential treatments and better use of vaccines.
- Modelling work to help decisions about where to deploy interventions early in an outbreak, when there is limited availability.

4-1: Developing next generation diagnostic tools

## Initial projects

4-2: Vaccine access and equity

4-3: Use of initial diagnostic tests

## Outputs & impact

- Help UKHSA protect the nation from health security threats in Europe that are likely to arrive soon in the UK, including dengue and hazard group 4 pathogens, such as CCHF.
- Address health disparities and mistrust to ensure that vaccines are used more widely.

# Theme 5: Data, Modelling & AI

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## **Purpose**

- Provide the underpinning skills and expertise in data systems, modelling and AI to support projects across the whole HPRU.
- Narrow the gap between data and action to prevent and control emerging and zoonotic infections.

*5-1: Data Linkage and Curation*

## **Initial projects**

5-2: Voice-based AI Data Capture

5-3: Winter Respiratory Virus Pressures Exemplar Plan

*5-4: Multimodal Surveillance methods*

## **Outputs & impact**

- Commons of health protection data science resources & public support for data sharing.
- Inter-disciplinary validation of data science and AI advances for emerging infection surveillance.



Tackling emerging infections and future pandemic threats

Founding Partners:



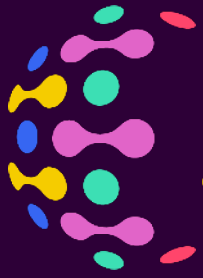


# Building a global footprint

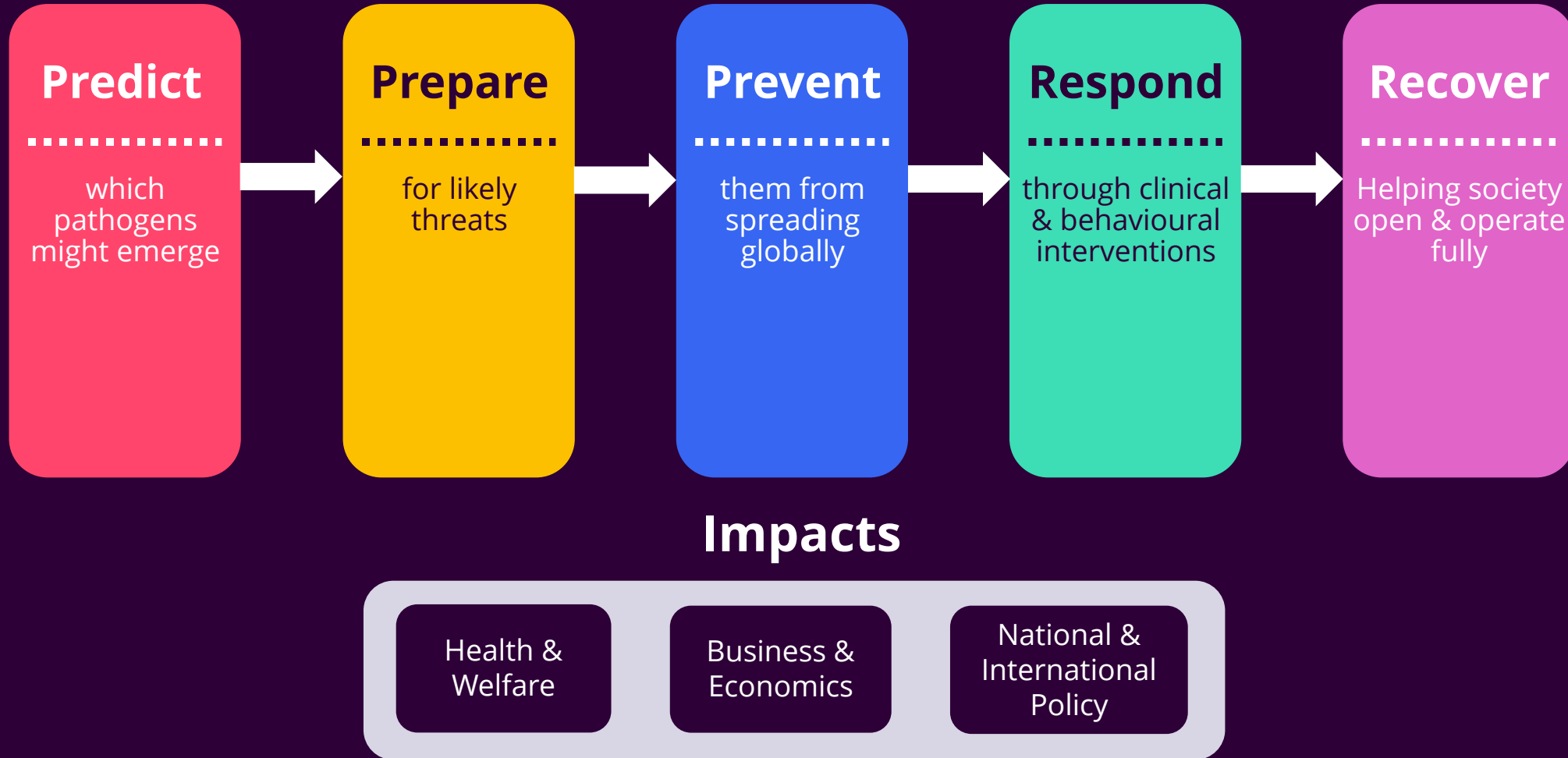
The Pandemic Institute is part of international and national networks for pandemic preparedness

*“...The Pandemic Institute is it **at the heart of a global network of partners.** COVID-19 has demonstrated the need for global partnerships and the value of their ability to rapidly assimilate research across a global network and **to respond rapidly anywhere across the world...**”*





# Science Strategy: End to End Approach



# Predict

With large data sources, including our own ENHanCED Infectious Diseases (EID2) database, which integrate pathogens, vectors hosts and locations, we are using machine learning to predict which pathogens might emerge.



**Divide-and-conquer: machine-learning integrates mammalian and viral traits with network features to predict virus-mammal associations.**

*Maya Wardeh, et al Nature Comms 2021*

# Prepare

To prepare for likely threats we are detecting which pathogens are found in animals and could make the jump to humans. By identifying them early we can put measures in place to reduce risk.



# Prevent

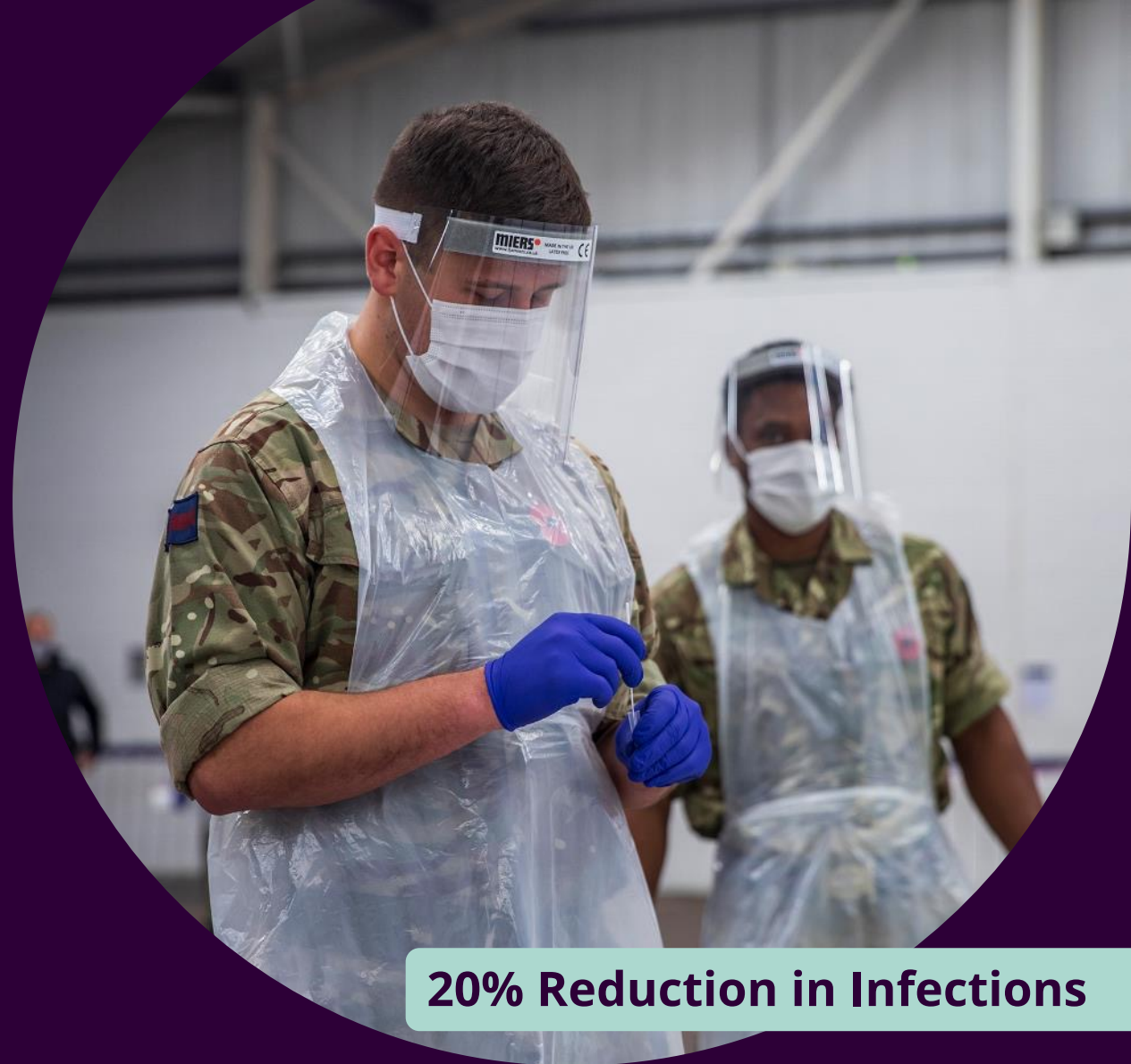
To prevent emerging infections spreading globally we need diagnostic tests, drug therapies and vaccines to be ready within 100 days of a new disease emergence. This 100 days mission is backed by the G7 Governments.





# Respond

As lead organization for the national ISARIC study, we have the team in place across the UK, to lead the early clinical research response to emerging infections.

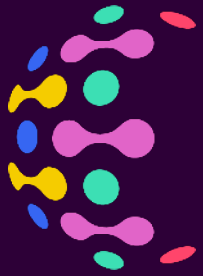


**20% Reduction in Infections**

# Recover

With better understanding of the societal impacts of infectious diseases and pandemics we can build the resilience to help us recover more quickly.





# Responsive funding

## Current funding calls:

- **Rapid Response Fund:** The Pandemic Institute (TPI) Rapid Response Fund is supporting new research and other opportunities to tackle emerging infections and future pandemic threats. Proposals submitted must be urgent, with rapid activation, to enable early and valuable outcomes to be established and/or to access time-dependent resources. The aim of the investment is to support unique, time-limited opportunities that demonstrate a need for a rapid commissioning process to be followed. *You can find full details of funding amounts and how to [apply here](#).*

- **Emerging Threats Funding Call – Mpox:** The National Institute for Health and Care Research (NIHR) Health Protection Research Unit in Emerging and Zoonotic Infections (HPRU EZI) and The Pandemic Institute (TPI) in Liverpool are announcing a combined funding call for research on mpox. The aim of the investment is to address critical research gaps in mpox knowledge, specifically in improving our understanding of the Clade I variant.

- **Emerging Threats Funding Call – Oropouche Virus:** A combined call from the National Institute for Health and Care Research (NIHR) Health Protection Research Unit in Emerging and Zoonotic Infections (HPRU EZI) and The Pandemic Institute (TPI) of £300,000 for research on Oropouche virus (OROV). **This call is now closed.**

- **Avian Influenza Funding Call:** A combined call from the National Institute for Health and Care Research (NIHR) Health Protection Research Unit in Emerging and Zoonotic Infections (HPRU EZI), The Pandemic Institute (TPI) in Liverpool and the Pandemic Sciences Institute (PSI) in Oxford. Total funding pot of £750,000 for research on Avian Influenza, in partnership with the UK Health Security Agency (UKHSA).



Established in 2021 to accelerate the response to emerging infections and future pandemic threats, The Pandemic Institute is a unique collaboration of academic, health and civic partners in Liverpool with extensive national and international collaborations.

## What we do

The Pandemic Institute provides an end-to-end approach to emerging infection threats, working across five research themes:



## The Pandemic Institute – Open for Business

At The Pandemic Institute we have all the infrastructure, expertise, techniques and solutions to address the needs of commercial and academic partners wishing to rapidly test and license diagnostics, therapeutics and vaccines against infectious diseases.

- Biosafety Level 3 Facilities
- Pre-Clinical Studies Unit
- Human Organoid “Body on a Chip”
- Human Challenge Facility
- Accelerator Research Clinic
- Vaccine Access & Inequalities

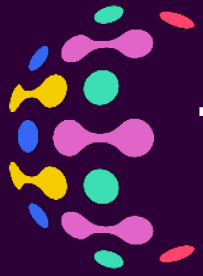
## Pandemic Preparedness and Response Facility

To strengthen the UK’s research, innovation and development capacities around infectious disease, The Pandemic Institute will build a state-of-the-art nationally available Containment Level 4 facility to accelerate the development of diagnostics, therapeutics and vaccines.

## NIHR Clinical Research Facility

Established in 2009, our 24-bed facility (one of only two MHRA Phase I Accredited units in the NHS) has been relocated to the new Liverpool University Hospitals NHS Foundation Trust.





# The Team

