Antimicrobial resistance (AMR) is an urgent public health crisis of global proportion for which new drugs and approaches are urgently required. A deep understanding of antimicrobial pharmacokinetics-pharmacodynamics (PK-PD) is a mandatory requirement for the development of new antimicrobial agents.

The CAP provides the preclinical and early phase clinical support to ensure new drugs are developed in a streamlined manner. In the development of new drugs and approaches for AMR, we provide the underpinning evidence to ensure the right dose is used the first time and ensures effective antimicrobials are available to patients at the earliest possible time.

CAP provides state-of-the-art research facilities for analysing and imaging new molecules in tissues across three centres of research excellence: University of Liverpool (Professor William Hope), Liverpool School of Tropical Medicine (Professor Steve Ward) and North Bristol NHS Trust (Professor Alasdair MacGowan).

**Who do we work with?**
The CAP will work with a broad range of industrial and academic partners who require pharmacokinetic-pharmacodynamic support including academic groups, SMEs and larger pharmaceutical companies. We are well connected with a large network of clinicians, academics and organisations worldwide.

**What do we do?**
We offer a complete, integrated drug development package with expertise in the following areas:

**Experimental Pharmacology and Pharmacodynamics**
The CAP has extensive infrastructure, expertise and track record in experimental pharmacodynamics. We have many well-characterised in vitro and in vivo models of infection, including hollow fibre infection models (HFIM) that are now widely accepted by regulatory authorities. HFIM are especially valuable for understanding the development of AMR and are increasingly used in drug development. The CAP has the largest HFIM laboratory in Europe.

**Advanced Pharmacokinetic Modelling and Simulation**
The CAP uses advanced techniques in quantitative pharmacology that includes PK-PD modelling, Monte Carlo simulation, population pharmacokinetics, optimal design theory, and modelling of the emergence of AMR. Our Dell PowerEdge R630 rack server system enables encryption-secured, multi-user access and parallel computing.
The CAP is responsive to therapeutic challenges related to AMR in low, middle and high income countries. Our primary focus is on antibacterial agents and AMR, but we have expertise in a wide range of drug-pathogen combinations including antifungal and anti-parasitic agents.

Preclinical Imaging
The CAP has made a major investment in MALDI-MSI to assess the spatial distribution of small molecules in target tissues and organs. We offer an AP-SMALDI-10 High Resolution Imaging Source coupled with a Thermo Q Exactive HF Mass Spectrometer allowing drug distribution in diseased tissue to be assessed. Such an approach provides an insight into concentrations of drug at the effect site and provides considerably more information compared with traditional use of tissue homogenates.

Bioanalytical Sciences
The CAP has state-of-the art LC/MSMS machines for the quantification of drug concentrations within clinically relevant matrices. We can run clinical samples under GCP conditions, which is critical for PK studies embedded in clinical trials anywhere along the developmental pathway.

Early Phase Clinical Studies
We collaborate with the Clinical Research Facility (CRF), which is an MHRA accredited first-in-human unit within the Royal Liverpool Hospital. The CRF is supported by National Institute of Health Research (NIHR) funding and has an established track record in early phase clinical trials and experimental medicine. The CAP supports the PK-PD studies that are run within the CRF, but is also able to support similar studies run in other facilities anywhere in the world.

Teaching, Training and Public Engagement
Training the next generation of researchers to continue the fight against AMR is an important part of our mandate. Clinical Fellows are supported by the Wellcome Trust, Medical Research Council (MRC) and NIHR. We organise and run courses in PK-PD modelling. We are a European Society of Clinical Microbiology and Infectious Diseases (ESCMID) Collaborative Centre (ECC) that enables young investigators from around the world to visit and train with us. We have leadership roles in the organisation of international meetings, such as Microbe (American Society for Microbiology) and Drug Development to Meet the Challenge of Antimicrobial Resistance (ASM and ESCMID). We have helped develop policy for the accelerated development of new antimicrobial agents, and participated as experts in workshops conducted by the EMA and FDA.

Why use the Centre for Antimicrobial Pharmacodynamics?

- **Highly specialised:** We are one of a small number of groups in the world with the necessary track record and expertise in antimicrobial PK-PD.
- **Pioneering:** Our team has extensive experience of personally developed experimental and clinical techniques to characterise drug regimens, predict their effects and reduce the risks involved in clinical trials.
- **Well-connected:** We collaborate with a wide network of clinicians, academics and organisations across the globe.
- **Proven impact:** Our work contributes to international pharmaceutical regulations, influencing global public health policy and helping to save lives.