‘Multidisciplinary approaches to imaging host-pathogen interactions’

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Universities of **Sheffield**, **Birmingham**, **Edinburgh**, and **Newcastle** Led Partnership to **Develop** Host Defence Therapeutics
The Problem; Recalibrating host responses by enhancing microbicidal responses

• Most host-pathogen interactions result in control of the pathogen (the ‘template’).
• Disease results from altered ‘calibration’ favouring the pathogen.
• The host-pathogen interaction involves a series of immune responses (the ‘sequence’).
• Intracellular killing in phagocytes is a critical ‘bottle-neck’
  o Altered calibration has varying consequences
  o Impaired pathogen clearance vs. inflammatory tissue injury
• Optimal calibration results in pathogen clearance at low inflammatory cost
The Need; To accurately measure microbicidical responses

• In the correct cells (those that have ingested the bacteria)
• At the right time
• In the right place

• .... and in vivo
The challenge

- Highly reactive molecules
- Transient production
- Limited in space requiring precision
- Chemical probes not optimal
- Optical solutions not always tailored to needs
- In vivo represents unique but rewarding challenges
The Solution

- Interdisciplinary initiatives and training
- Multiple specialties;
  - Maths, Chemistry, Optical Physics, Engineering, Biology,
  - Medicine Veterinary
  - Academic and Industry
- Co-localisation and layering
  - e.g. optical imaging plus atomic force plus cryo electron microscopy
- Cross-sector funding
The Concept

- Build on existing expertise
- Across disciplines
- Combine technological advances with application
- 2022 Futures
  - ‘accelerating research areas where we will be world-leading in the next decade’
  - ‘provide solutions to society’s big questions’
- UoS Investment
  - Recruitment (staff and students)
  - Equipment and infrastructure
Improving spatial resolution

mROS colocalise with bacteria by SIM
**System and Integration**

**Novel sensors** (Probes and reporters) detect and measure physical conditions and biomedical markers in real-time.

*An innovative approach to the integration of sensing technologies into systems.*

*Data integration and conversion to information for decision making.*

Detect and measure physical conditions and biomedical markers in real-time.
From Glass to Man
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