

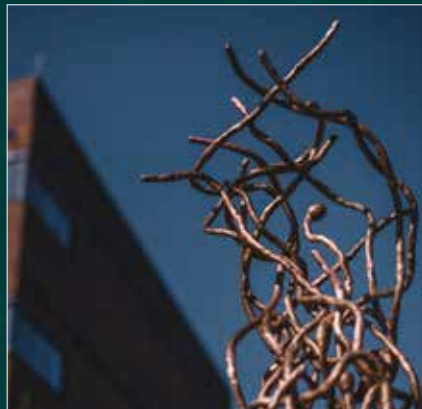
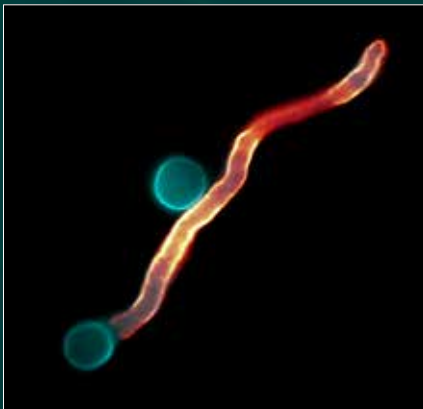


MRC Centre
for Medical
Mycology



University
of Exeter

Medical Research Council Centre for Medical Mycology at the University of Exeter



2019-2023

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Front cover top left image. *Rhizopus arrhizus*. Hypha growing from a germinated spore. An ungerminated spore is also present. Blue indicates chitin cell wall. Orange indicates cell wall antigen bound by diagnostic antibody TG11. Credit: Dr Alyssa Hudson, University of Exeter

Main background cover image. Multi-coloured *Candida albicans* hyphae displaying GFP-tagged mitochondria (green). The cell wall is outlined with calcofluor white (cyan), while the vacuoles are highlighted with FM-464 dye (red). Credit: Dr Tina Bedekovic, University of Exeter

KEY FACTS

GLOBAL CHALLENGES



Over 1 billion infections per year



Over 2 million fungal-related deaths annually



Limited antifungal drugs



No vaccines



Widespread antifungal resistance



Difficult to diagnose



Critical lack of capacity

MRC CMM KEY FACTS 2019-2023



£25 million joint investment between MRC and UoE



Relocated from Aberdeen to Exeter



Grown to 24 academic staff and Early Career Fellows



3 International Centres



Over 60 externally funded research & training grants totalling over £29 million



76 medical mycology trainees



Engaged with 90,000 people through public outreach activities



294 Publications
5,527 Citations



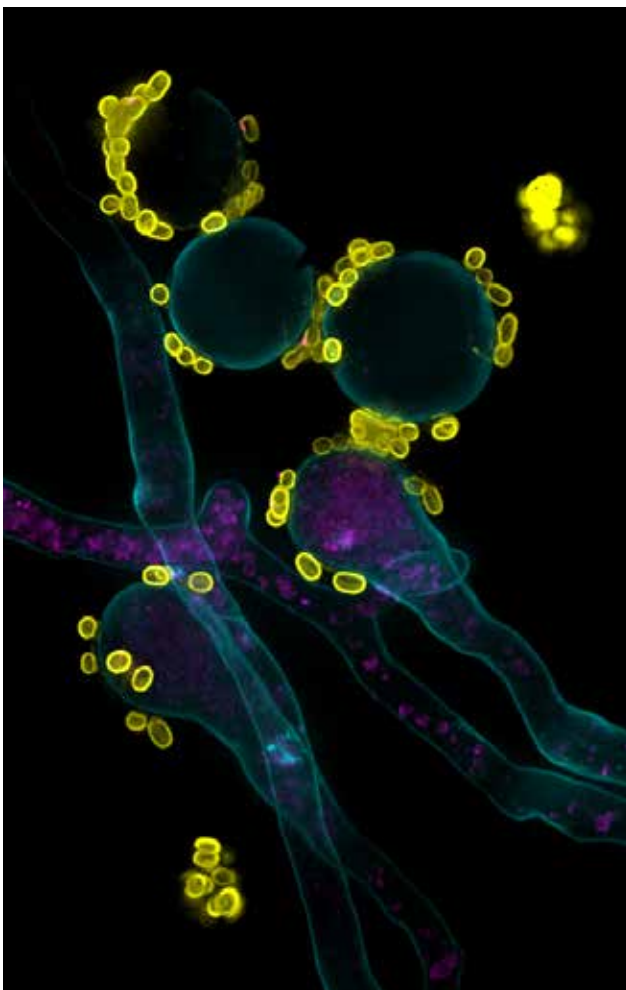
Hosting over 30k videos on YouTube



78 International Collaborators

OVERVIEW AND STRATEGIC NEED

Medical mycology is an area of urgent medical need, affecting billions of people annually. More than 1.7 million deaths worldwide each year are caused by fungal infections, and incidence of antifungal resistance is increasing rapidly. Billions suffer fungal skin infections, but these have become hard to treat due to the emergence of antifungal resistance. In addition, new multi-drug resistant fungi have appeared, such as *Candida auris*, which the World Health Organization (WHO) has now classified as a serious global health problem¹. An outbreak of the first ever reported fungal zoonosis is becoming a world-wide threat², and the recent COVID-19 pandemic has highlighted the destructive power of viral-fungal co-infections³.



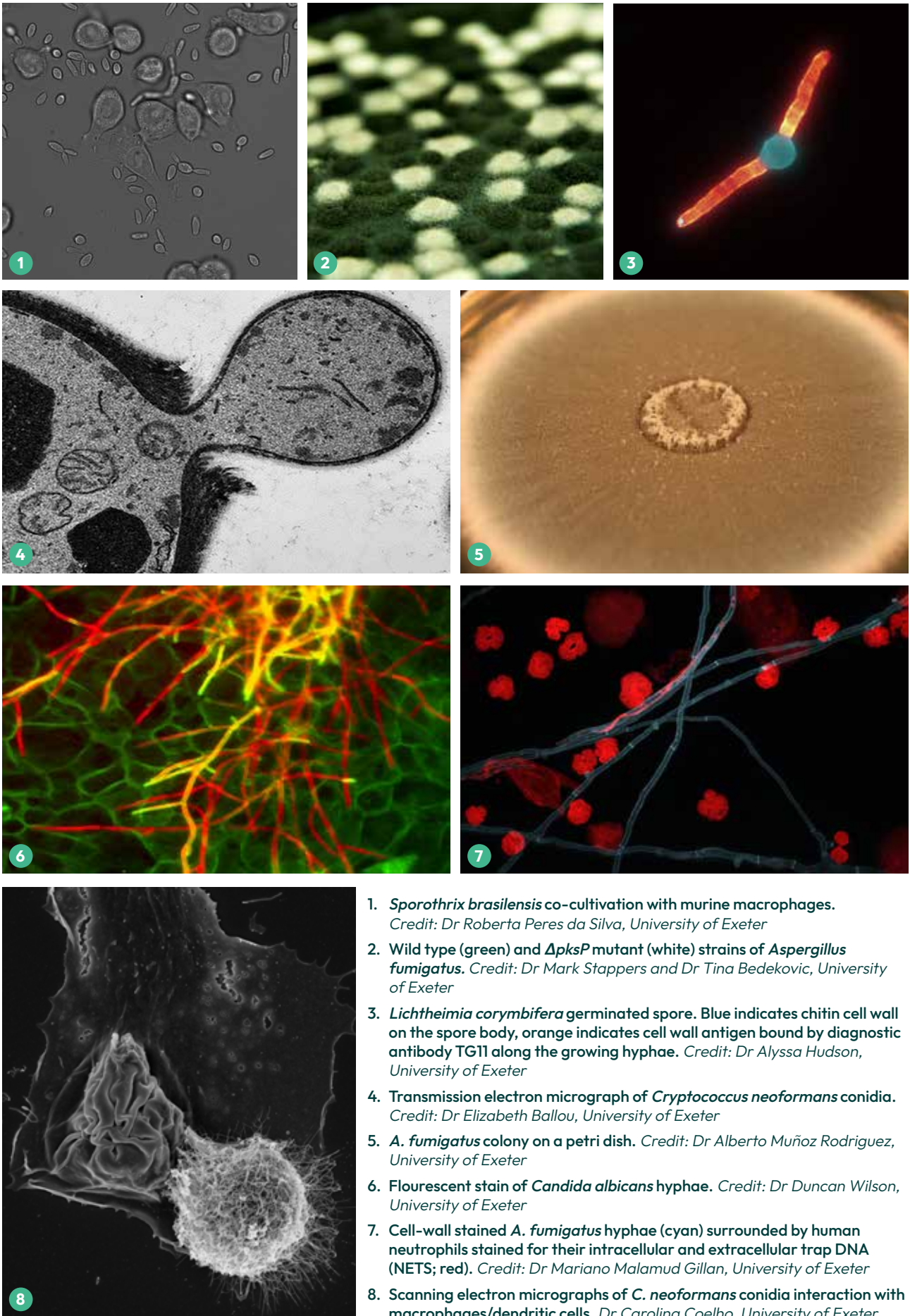
Overnight co-culture of *Rhizopus delemar* (cyan-calcofluor) and *Klebsiella pneumoniae* (yellow/magenta-ConA/Bactlight) at low temperature.
Credit: Dr Dora Corzo Leon, University of Exeter

Despite the high fatality rates and ill-health that fungal diseases cause, their devastating impact is not widely appreciated. We need better diagnostics, safer and more effective antifungal drugs, and a clearer understanding of fungal virulence and antifungal immunity. The global lack of capacity in basic and clinical mycology is a major contributing factor that is hindering our ability to tackle these challenges. The Medical Research Council Centre for Medical Mycology (MRC CMM) is focussed on tackling these major challenges, promoting pioneering cross-disciplinary research and training that covers areas of scientific, translational and clinical importance.

The MRC CMM was created via multi-million-pound joint investments by the MRC and the Universities of Aberdeen and then Exeter. The Centre was first established in July 2016 at the University of Aberdeen and then relocated to the University of Exeter in September 2019. Moving to the University of Exeter enabled the Centre to grow significantly and to strengthen in key areas, including immunology, microbiology and clinical mycology. As well as enhancing its cutting-edge interdisciplinary research activities, the Centre was also able to develop its training programmes, which are addressing the capacity deficit in this area. The MRC CMM currently represents one of the most ambitious strategic investments in medical mycology worldwide.

References

1. WHO fungal priority pathogens list to guide research, development and public health action. Geneva: World Health Organization (2022) www.who.int/publications/i/item/9789240060241
2. The first three reported cases of *Sporothrix brasiliensis* cat-transmitted sporotrichosis outside South America. Barnacle, J et al (2023) *Medical Mycology Case Reports* www.sciencedirect.com/science/article/pii/S2211753922000483
3. Pathogenesis of Respiratory Viral and Fungal Coinfections. Salazar, F et al (2021) *Clinical Microbiology Reviews* <https://doi.org/10.1128/CMR.00094-21>



1. *Sporothrix brasiliensis* co-cultivation with murine macrophages. Credit: Dr Roberta Peres da Silva, University of Exeter
2. Wild type (green) and $\Delta pksP$ mutant (white) strains of *Aspergillus fumigatus*. Credit: Dr Mark Stappers and Dr Tina Bedekovic, University of Exeter
3. *Lichtheimia corymbifera* germinated spore. Blue indicates chitin cell wall on the spore body, orange indicates cell wall antigen bound by diagnostic antibody TG11 along the growing hyphae. Credit: Dr Alyssa Hudson, University of Exeter
4. Transmission electron micrograph of *Cryptococcus neoformans* conidia. Credit: Dr Elizabeth Ballou, University of Exeter
5. *A. fumigatus* colony on a petri dish. Credit: Dr Alberto Muñoz Rodriguez, University of Exeter
6. Fluorescent stain of *Candida albicans* hyphae. Credit: Dr Duncan Wilson, University of Exeter
7. Cell-wall stained *A. fumigatus* hyphae (cyan) surrounded by human neutrophils stained for their intracellular and extracellular trap DNA (NETS; red). Credit: Dr Mariano Malamud Gillan, University of Exeter
8. Scanning electron micrographs of *C. neoformans* conidia interaction with macrophages/dendritic cells. Dr Carolina Coelho, University of Exeter

VISION AND OBJECTIVES

The overarching vision of the MRC CMM is to deliver world-leading research that will substantially advance our understanding of fungal pathogenesis, host immunity and disease phenotypes. This will enable the generation and utilisation of skills and knowledge that will improve the prevention, diagnosis and treatment of fungal diseases in the future. This vision is being achieved by delivering on four objectives.

- 1** To promote innovative interdisciplinary research that tackles the major challenges facing the field, including key areas such as antifungal drug resistance and infectious co-morbidities.
- 2** To increase capacity in medical mycology in the UK and globally, by delivering strong cohorts of researchers in medical mycology, through bespoke training programmes focussed at different stages of career development.
- 3** To support global efforts to tackle devastating fungal infections, by establishing and strengthening research and training Units in low- and middle-income regions of the world, which lack expertise and suffer high burdens of fungal disease.
- 4** To promote medical mycology and the activities of the Centre through an ambitious programme of engagement that seeks to inspire future medical mycologists and to challenge and change public perceptions of fungal disease.





Wild type (green) and $\Delta pksP$ mutant (white) strains of *Aspergillus fumigatus*.
Credit: Dr Mark Stappers and Dr Tina Bedekovic, University of Exeter

RESEARCH

To achieve these ambitious goals, the MRC CMM had developed a uniquely diverse team that brings a broad range of scientific expertise to our research. We have focussed our activities into five interdisciplinary research themes that underpin our scientific and training strategies.

RESEARCH THEME I

Fungal growth, adaptation and morphogenesis in the context of human infections, and implications for immunity, disease phenotypes and therapy.

Key topics include the fungal cell surface (as the primary interface with the host immune system, and target of antifungal drugs), fungal responses, growth and morphological transitions (in the context of virulence, tissue invasion and antifungal resistance) and environmental, nutrient and stress sensing and adaptation, including inter-kingdom/species communication (as crucial parameters facilitating fungal virulence, immune evasion, and drug resistance).

RESEARCH THEME II

Fungal components as antifungal drug targets, diagnostics, vaccine antigens and adjuvants.

Focus areas include the development of *in vitro* and *in vivo* approaches to identify and validate novel antifungal drug targets, drugs and modes of action, and the development of antifungal antibodies.

RESEARCH THEME III

Evolution and impact of antifungal drug resistance, and mitigation strategies.

Our aim is to gain fundamental new insights in understanding the evolution, prevalence and mechanisms of antifungal resistance (including in emerging global and endemic pathogens), testing new and combinatorial drug therapies (in terms of clinical efficacy, molecular basis for synergy and as an approach to combat antifungal drug resistance), and on improving antifungal stewardship to reduce the emergence of antifungal drug resistance

RESEARCH THEME IV

Host-fungus interactions and key mediators of disease establishment and progression at molecular, cellular and organismal levels.

Utilising innovative cutting-edge *in silico*, *in vitro* and *in vivo* technologies, we seek to define new critical components involved in temporal host fungal interactions at the molecular, cellular and organismal levels. We are establishing the impact on disease pathogenesis of the extracellular environment (and its physical characteristics) as well as the key mechanisms underlying host-fungal genetic, epigenetic, transcriptional, metabolic, cellular and immunological responses.

RESEARCH THEME V

Determinants of patient susceptibility, including immunity and comorbidities, to enable directed diagnosis, treatment and prevention of fungal disease.

Under this theme we are clarifying key mechanisms of innate and adaptive antifungal immunity, how these systems contribute to susceptibility or protection from disease, and how defects or alterations of these systems affect susceptibility to fungal infections in patients. We are determining how co-morbidities (especially co-infections with viruses, bacteria and helminths) influence immunity and disease pathology, and will establish improved approaches to diagnose, treat and prevent fungal infections.

RESEARCH EXEMPLARS

We have chosen our clinical PhD projects to highlight the multi-disciplinary nature of our research and its translational potential in the MRC CMM as a whole. All our projects involve multiple supervisors with different expertise, and involve investigators from other UK institutes and our international centres.

Dr William Hurt (2022-2025)

Susceptibility to *Aspergillus* superinfection in severe influenza and COVID-19.

Research themes **IV** and **V**

Supervisors: **Professor Elaine Bignell** (CMM University of Exeter), **Dr Tihana Bicanic** (St Georges and CMM University of Exeter), **Dr Darius Armstrong-James** (Imperial College London).

Dr Hurt is studying how pulmonary aspergillosis complicates severe viral pneumonia. Using blood immune cells, collected from patients, he is determining how these cells respond to influenza or SARS-CoV-2 and then *Aspergillus* infection. He will determine the impact of these co-infections using lung organoids. Identifying how the immune response to *Aspergillus* is affected by flu or COVID-19 is important if we are to understand how to recognise patients at risk, and to understand how to modulate appropriate immune pathways to reduce the risk of *Aspergillus* co-infection.

Dr Alison Gifford (2022-2026)

Epidemiology and fungal neuroimmune interaction of paediatric cryptococcosis in South Africa.

Research themes **III**, **IV** and **V**

Supervisors: **Professor Adilia Warris** (CMM University of Exeter), **Professor Nelesh Govender** (The National Institute for Communicable Diseases, South Africa and CMM University of Exeter), **Dr Rachel Dangarembizi** (CMM AFRICA Unit).

Dr Gifford's research project aims to assess the number of childhood cryptococcal infections between 2017 and 2022 in South Africa using established databases. She will also prospectively identify new infections and collect cryptococcal isolates in South Africa. By using an experimental mouse model and murine and human brain slices she will investigate the interaction between clinical isolates of *Cryptococcus* and the neuroimmune system. Her work will enhance our understanding of the incidence of paediatric cryptococcosis and help inform the development of treatment strategies.

Dr Matthew Steward (2023-2026)

Role of the human airway in shaping macrophage antifungal responses mediating severe asthma.

Research themes **II** and **V**

Supervisors: **Dr Peter Cook** (CMM University of Exeter), **Professor Michael Gibbons** (Royal Devon University Healthcare NHS Foundation Trust, Exeter), **Professor Chris Scotton** (University of Exeter).

Repeated exposure of fungal spores can trigger a form of asthma called 'severe asthma with fungal sensitivity' (SAFS). How fungal spores trigger and worsen asthma in humans is not known. Our understanding of its interaction with cells in human airways is mainly based on experimental models and the use of cell lines. In this project, Dr Steward will collect samples from patient's airways, and ascertain how immune cells in this area trigger SAFS. This work is aiming to identify new treatments to improve quality of life and prognosis for patients with SAFS.

FLAGSHIP TECHNOLOGIES AND EXPERTISE

The MRC CMM occupies the entire third floor of the Geoffrey Pope Building, comprising 700m² of contiguous laboratory and 315m² of office space. In addition to in-house platforms detailed below, CMM researchers and students are able to access key facilities and technologies across the University of Exeter and the GW4 alliance (an alliance of four research-intensive universities in the UK's South West: Bath, Bristol, Cardiff and Exeter), including genomics and proteomics, cytomics, bio-imaging, and multiple facilities offering rodent, fish and invertebrate models of fungal infection.

Infection biology imaging: The MRC CMM utilises live-cell microscopy to gain new insights into the spatio-temporal basis of fungal growth, adaptation, pathogenesis and responses to antifungal drugs at super resolution and whole organ scales. The Centre is equipped with a suite of bespoke confocal and widefield microscopes within its own containment level 2 (CL2) laboratory. Each system is set-up for various 4D host-pathogen interaction studies, pathogen-focussed cell biology and drug treatment studies. Ancillary technologies provide us with control of the cellular environment, including microfluidic and on-chip platforms coupled with environmental gas control for various humidity,

CO₂ and O₂ concentrations. This platform is managed by a senior experimental officer, Dr Darren Thomson, who supports and develops new experimental and analysis pipelines from conception to publication. Our suite also collaborates with industrial partners aiming to understand long-term single-cell dynamics to drug responses.

Antifungal drug discovery: The MRC CMM is focussed on gaining a greater understanding of the mechanisms of antifungal drug resistance and tolerance, exploring and optimising the efficacy of drug combinations to identify new targets for drug development (including fungal virulence factors), and for development of

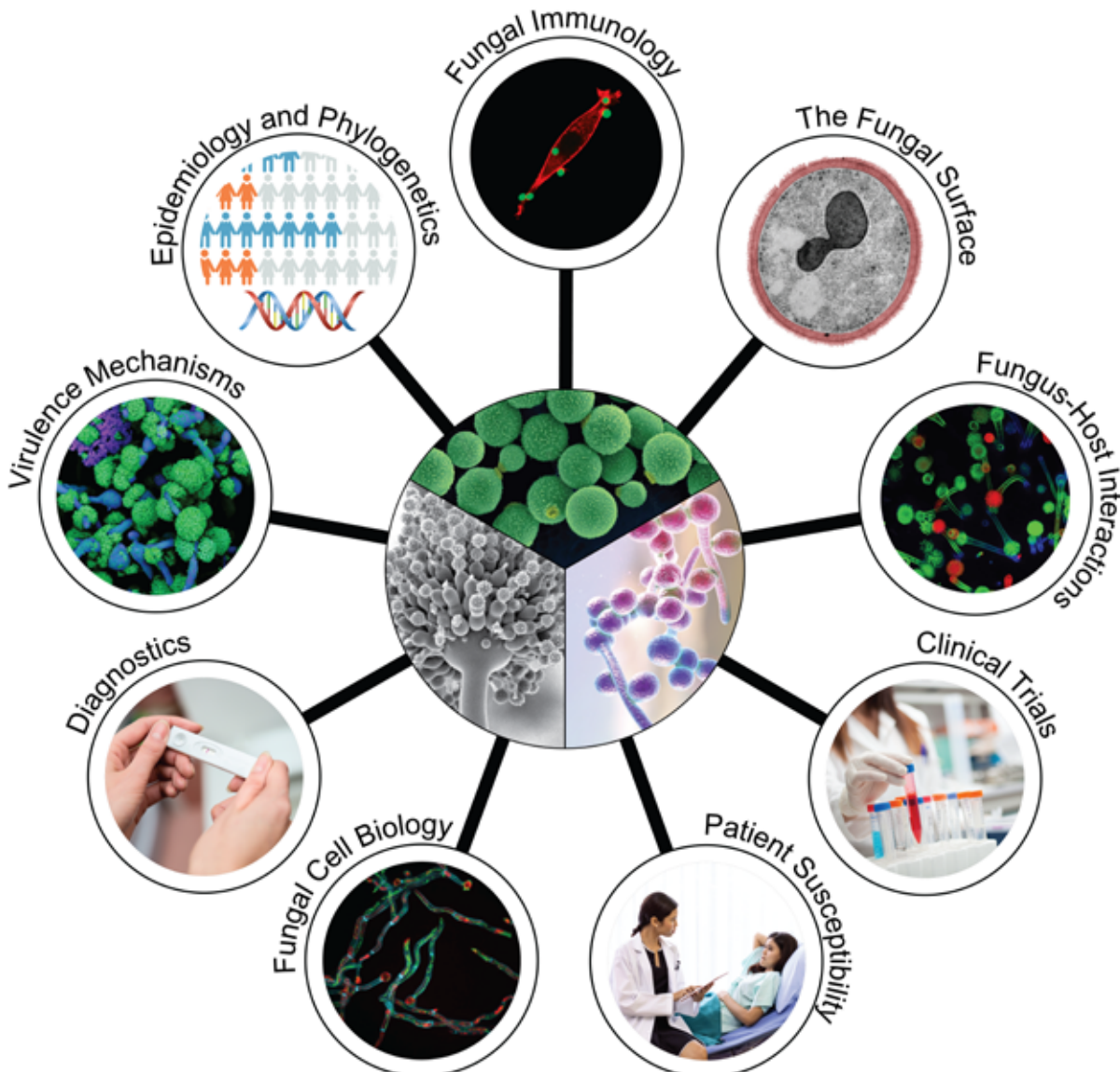


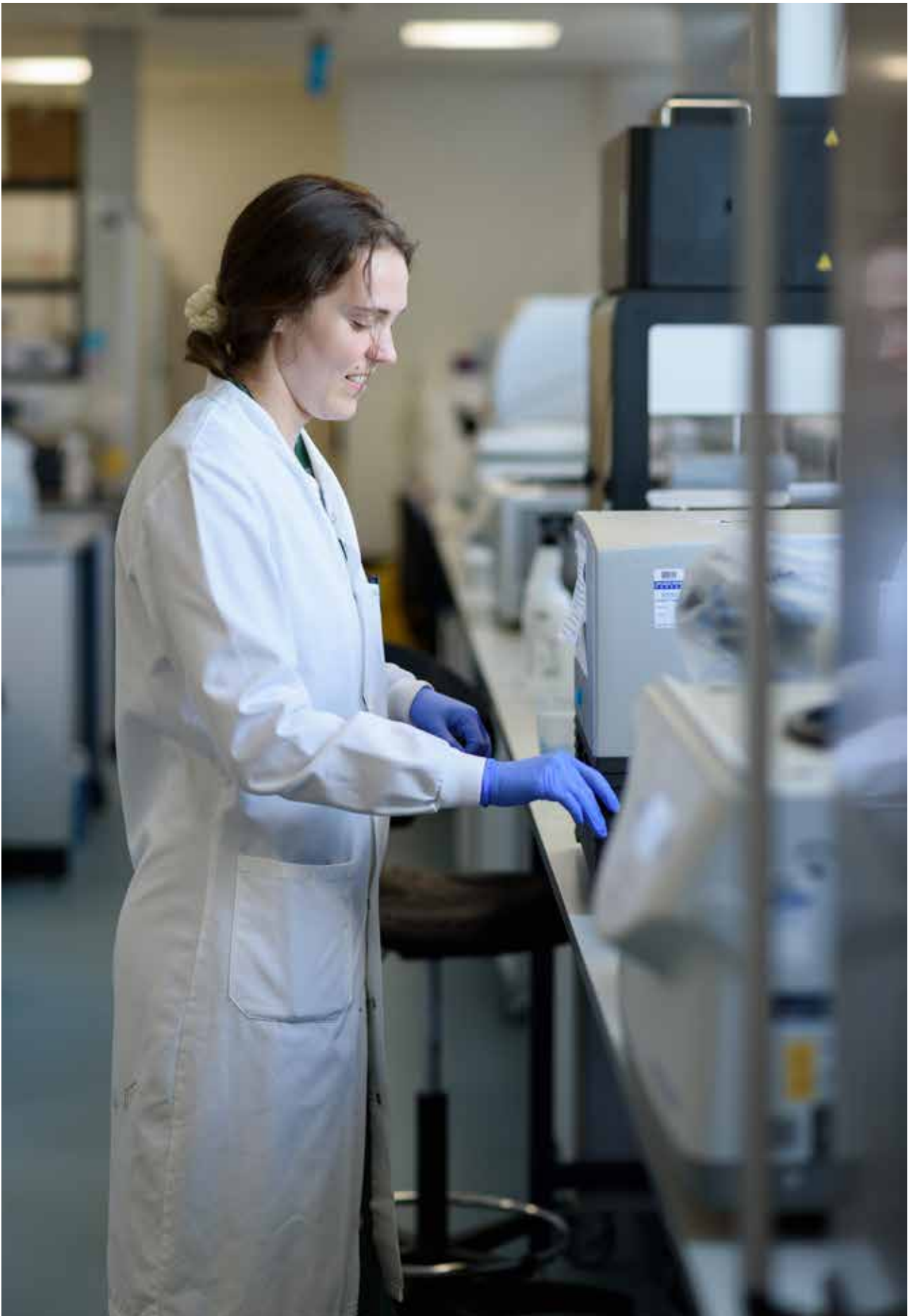
new drugs and drug screens. Current areas of expertise include: antifungal drug discovery (including studies with Blueberry Therapeutics Ltd, Syngenta Ltd, Medchemica Ltd, LifeArc; mode of action drug studies (including those with Gilead Scientific Ltd. and development and commercialisation of antifungal antibodies for diagnostic and therapeutic use (mycoBiologics and ISCA Diagnostics Ltd). This work is supported by Rebecca Inman through *in vitro* screening assays for drug discovery and medium-throughput screening using a newly acquired liquid handling robot.

***In vitro, ex vivo, in vivo, and in silico* experimental models:** Research in the MRC CMM is focused on several key human fungal pathogens, including all those in the WHO critical priority group (*Cryptococcus neoformans*, *Aspergillus*

fumigatus, *Candida albicans* and *Candida auris*). Our work also involves emerging and endemic pathogens (including *Sporothrix* spp and *Emergomyces africanus*). These activities are supported by state-of-the-art laboratory spaces, including bespoke tissue and fungal culture facilities, cutting-edge flow cytometry and imaging platforms, and designated animal facilities, including a quarantine Unit and CL2 laboratories. The MRC CMM works closely with the Exeter Sequencing Service (ESS), which provides advanced, next generation technologies for genomic, transcriptomic and epigenomic investigations. Computational analyses are conducted on Isca (the University's High Performance Computing environment) and the Centre's own dedicated storage and analysis servers.

Breadth of expertise and flagship technologies in the MRC CMM





TRAINING

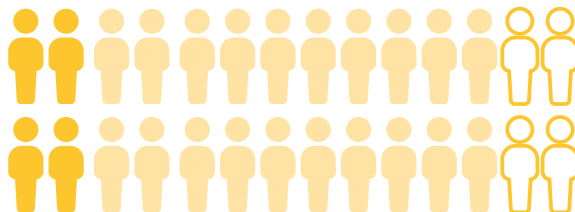
The worldwide lack of capacity in medical mycology is severely constraining progress in tackling the challenges posed by human fungal infections. Increasing capacity in this field by training the next generation of scientists and clinicians is one of our key objectives. MRC CMM Principal Investigators (PIs) have a combined track record of training more than 120 PhD students and 75 post-doctoral researchers during their careers, and have established nine global training networks. The MRC CMM offers bespoke training programmes to support students to grow into future leaders in medical mycology.

Training Programmes

76 Training positions in basic and clinical research (since MRC CMM inception, 2016-2023), including:



5 Early Career Fellowships
(1 completed, 4 currently undergoing)



28 MRes-PhD Studentships
(4 completed, 20 currently undergoing training, 4 to be appointed)



5 Clinical MRes Fellowships
(5 completed)



3 Clinical PhD Fellowships
(3 currently undergoing)



20 Summer Scholars
(14 completed, 6 to be appointed)

Three postgraduate training programmes at the University of Exeter are currently being coordinated and run by the MRC CMM:

- One-year MRes in Medical Mycology and Fungal Immunology.
- Three-year PhD programme.
- Three-year MSc in Medical Mycology (online), in partnership with the British Society for Medical Mycology.

In addition, through our International Units, the MRC CMM promotes capacity building in Africa and Latin America. The CMM AFRICA Unit and CMM LATAM Unit run local and national workshops and training courses for scientists and clinicians in a region where access to training in medical mycology is limited. These workshops and courses are proving to be an invaluable platform for the rapid dissemination, across the continents, of recent developments in diagnosis and management of geographically relevant fungal infections.

ENGAGEMENT AND COMMUNICATIONS

Since 2019, MRC CMM members have reached over 90,000 people through digital and in-person engagement, including art exhibitions, podcasts, media interviews, articles, talks and hands-on activities.



CHANGE public perceptions of fungal disease and increase the visibility of the work of the Centre.

- Five collaborations with artists producing sculptures, art exhibitions, films, comic books and plays.
- Large scale public engagement events: UK Fungus Day, The British Science Festival and Superbugs Exeter.
- Over 98 YouTube videos watched more than 30,000 times.
- Social media following of over 3,500.
- Public facing website 'The Fungal Threat' accessed by visitors from 70 countries.
- Media interviews, podcasts and articles.



INVOLVE the public in two-way dialogue about research.

We are proud to work closely with two National Institute for Health and Care Research (NIHR) Infrastructures – the NIHR Applied Research Collaboration South West Peninsula (PenARC) and the NIHR Exeter Biomedical Research Centre (BRC) – which have established public and patient involvement programmes to involve their perspectives on our research.





STRENGTHEN a culture where researchers value public engagement and are skilled to deliver it.

Alongside the University of Exeter’s annual training program for public engagement, the Centre’s Public Engagement and Communications team provide bespoke training opportunities for researchers at the MRC CMM, enabling them to develop skills in all aspects of public engagement and communications. In addition to this, the team supports researchers in developing public and patient involvement proposals from the project inception through to delivery.



INSPIRE and galvanise young audiences to engage with the importance of robust scientific advances in medical mycology.

- Our social media presence is growing year on year, approaching 170k interactions with our Twitter account in 2023.
- The popular webinar series Myco-Talks and Myco-Clinics provide a free platform for world-renowned scientists and clinicians to present their research, as well as opportunities for learning and networking.
- MRC CMM members visit schools and colleges to deliver workshops, talks and activities for secondary school pupils and A-level students.
- The Centre hosts students through In2Science and other programmes, which provide young people from under-represented communities an opportunity to gain practical experience of science and technology careers.

NIHR | Exeter Biomedical Research Centre

The National Institute for Health and Care Research (NIHR) Biomedical Research Centre for Exeter (Exeter BRC) is the first of its kind in the South West Peninsula and one of a network of 20 such Centres nationwide. They utilise cutting edge translational research to improve health outcomes for patients and the public. By translating scientific breakthroughs into potential new treatments, diagnostics and medical technologies for the people of the South West, they are helping to address the biggest health issues affecting people in our communities today. The Exeter BRC is the first and only to include Clinical Mycology as a standalone theme.

Clinical Mycology is one of five core research themes at The Exeter BRC. Led by Professors Adilia Warris and Gordon Brown, this theme seeks better treatments to prevent and manage potentially deadly fungal infections. Its research focuses on three major areas:

1. Understanding patient susceptibility to provide personalised and targeted management strategies with improved outcomes.

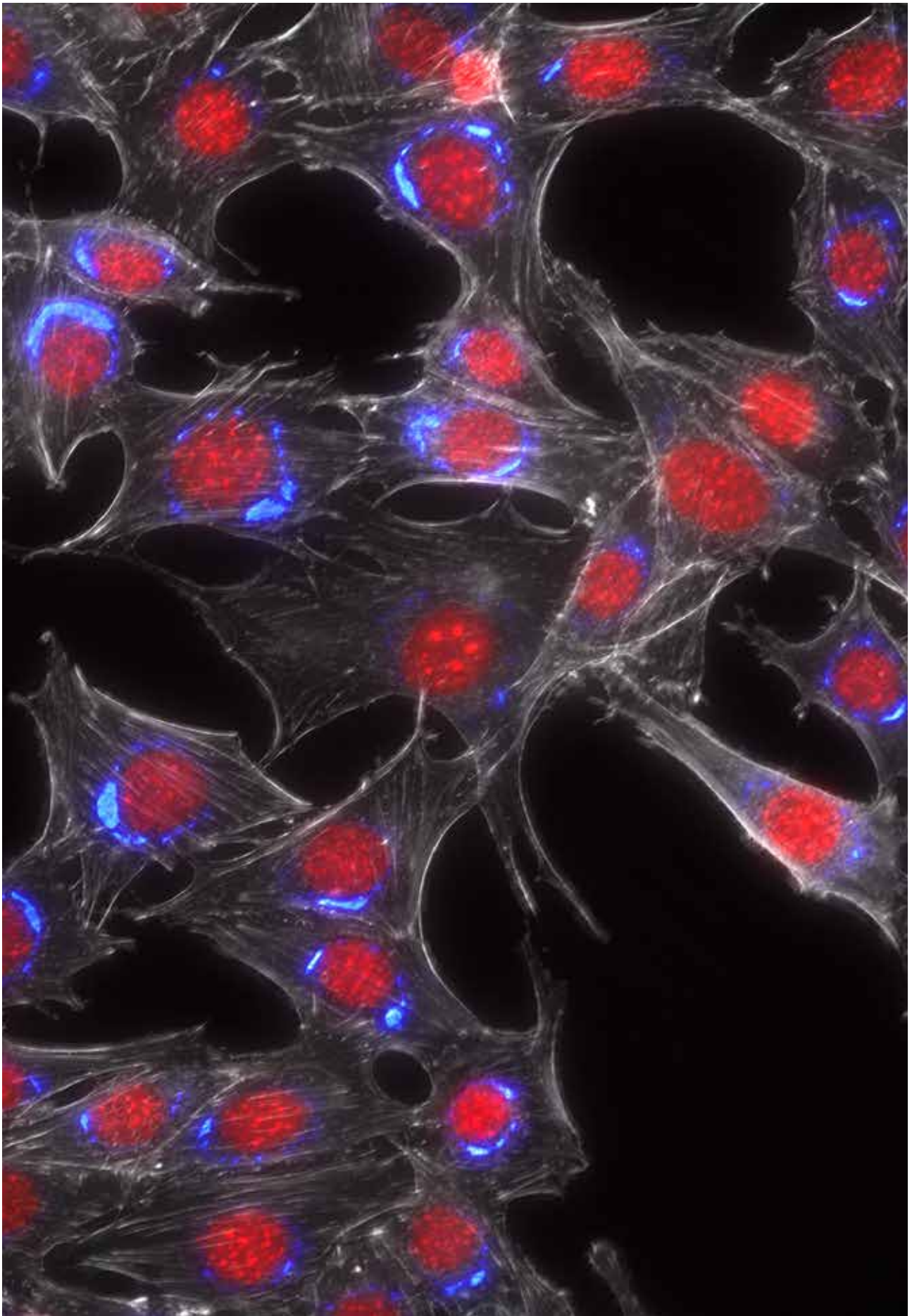
2. Developing new management strategies to reduce the impact and development of antifungal resistance and improve patient outcomes.

3. Defining *Aspergillus* disease phenotypes in patients with chronic lung disorders. This work will help identify biomarkers to enable targeted treatments.

Between 2022 and 2027, The Exeter BRC will enhance translational research activities in mycology through: two Senior Investigator Fellowships, two Mid-career Clinical Fellowships, two Translational Fellowships, two PhD students and pump priming projects, as well as accelerating our patient and public engagement activities.

<https://tinyurl.com/ExeterBRC>





Perinuclear staining of the hMelLec receptor in fixed permeabilised fibroblast cells stained with TRITC phalloidin & DAPI (left panels) & DIC (right panels). Credit: Dr Janet Willment, University of Exeter

INTERNATIONAL UNITS

The Centre is establishing CMM Units in regions of the world suffering high burdens of endemic fungal disease to increase regional capacity and research in medical mycology. The CMM AFRICA Unit was established in 2017 at the University of Cape Town (UCT), South Africa, and the CMM LATAM Unit was created in 2023 at the University of Sao Paulo, Brazil. The CMM ASIA unit will be established in the next few years. These international units, which will be supported through local and UK-based funding streams, are expanding regional networks of medical mycology researchers and clinicians to build a global community tackling these devastating diseases. This will create, for the first time in medical mycology, the type of integrated programme and global network that already exists in the fields of virology, bacteriology and parasitology, which are able to rapidly disseminate state-of-the-art research and training.

CMM AFRICA Unit

The CMM AFRICA Unit is based in the Institute of Infectious Disease and Molecular Medicine (IDM), University of Cape Town (UCT). The IDM is a powerhouse of translational research and combines basic, clinical, and public health research relevant to the needs of African people. With more than 75% of trainees coming from South Africa and the rest of Africa, the IDM has become a major training hub in Africa, for Africa. Led locally by Dr J. Claire Hoving, whose research is focussed on host immune responses in people with HIV-related fungal infections, the Unit also hosts Dr Rachael Dangarembizi, the only neurobiologist in the world researching the impact of fungal diseases on the brain. With a £2 million investment from the MRC CMM, as well as research funding from Wellcome, MRC, NIHR, NIH and national funding agencies (NRF and SA MRC), the Unit provides cutting-edge expertise and advanced laboratory research facilities and equipment, dedicated to combatting fungal infectious diseases affecting African populations.

The CMM AFRICA Unit has two primary objectives: firstly, to establish research programmes focussed on tackling endemic fungal diseases and, secondly, to increase capacity in medical mycology in Africa. With current basic and clinical research programmes focussed on tackling *Pneumocystis jirovecii*, *Emergomyces africanus* and *Cryptococcus neoformans*, as well as the consequences of

relevant co-infections, the CMM AFRICA Unit is already facilitating research tackling major life-threatening fungal diseases of importance in Africa. These research programmes train numerous undergraduate, masters and PhD students, as well as postdoctoral researchers, helping to build much needed capacity in this field. Moreover, the Unit hosts international conferences (such as the International AIDS-Related Mycoses Meeting), training workshops, lectures and practical courses for African scientists and clinicians.



MRC CMM Latin America (LATAM) Unit

The MRC CMM LATAM Unit is based in São Paulo, Brazil, a Latin American region that has a strong record of medical mycology research. The CMM LATAM Unit started in 2023 with the founding of the Management Board consisting of Arnaldo Colombo, Elaine Bignell, Gordon Brown, Carlos Tarborda, Sandro Almeida, and Fausto Almeida. Underpinned by a £2 million investment from the MRC CMM, the Unit will establish a sustainable, skilled and integrated taskforce to support research, training and public health against endemic mycoses in Latin America.

The aims of the CMM LATAM Unit are: To increase training in medical mycology, to disseminate knowledge of fungal diagnostics and therapeutics amongst health care workers, and to increase public awareness of the impact of human fungal infections in Latin America.

The CMM LATAM Unit will address five main themes:

1. The first will focus on host-pathogen interactions, with a view to developing vaccines and alternative therapies to control fungal infections and combat antifungal drug resistance.
2. The second will identify new biomarkers of fungal infections to develop new improved diagnostic tools.
3. The third theme will address the natural history and clinical management of fungal infections. For example, epidemiological data describing the emergence of *Paracoccidioides* and *Sporothrix* infections will be collected, new state-of-the-art research tools developed, and data gathered on the emergence of antifungal drug resistance and the validation of new diagnostic and therapeutic strategies.
4. The fourth theme will be to create strong interdisciplinary clinical and research networks to accelerate progress in improving health against fungal infections in Latin America.
5. The final theme addresses capacity building and public engagement.

CMM LATAM Management board



Arnaldo Colombo (Director of CMM LATAM Unit and Professor at Paulista Medical School, Federal University of São Paulo)



Elaine Bignell (Co-Director (Research) of the MRC CMM and Exeter Co-Director of CMM LATAM Unit)



Gordon Brown (Professor at the University of Exeter, Director of the MRC CMM and Director of the CMM AFRICA Unit)



Fausto Almeida (Professor at the Department of Biochemistry and Immunology, Federal University of São Paulo)



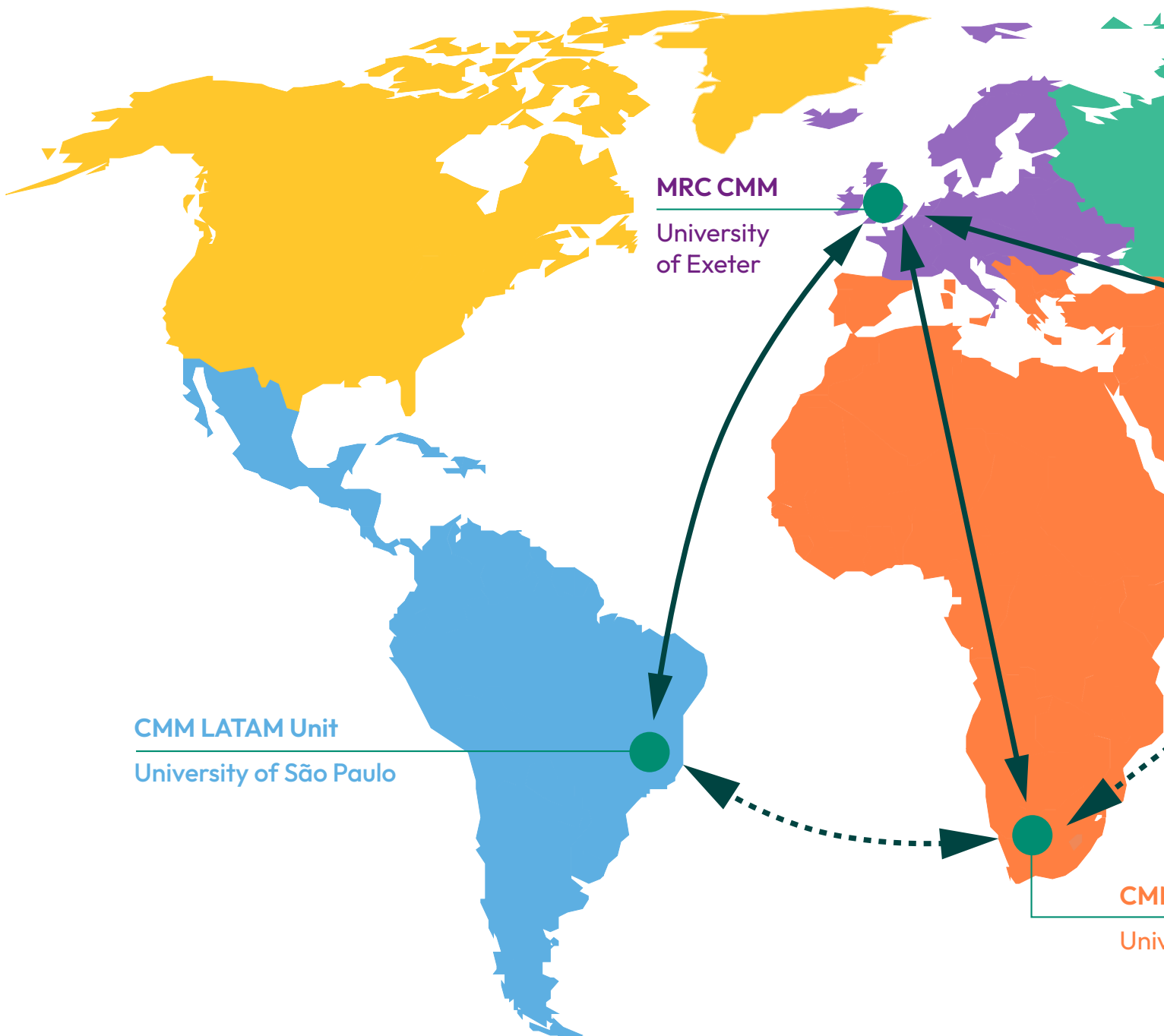
Carlos Tarborda (Professor of the Department of Microbiology, Vice-Dean (2021 – 2025) of the Institute of Biomedical Sciences and Professor of the Laboratory of Medical Mycology, Institute of Tropical Medicine at the University of São Paulo)



Sandro Almeida (Associate Professor at the Faculty of Pharmaceutical Sciences - Federal University of São Paulo)

GLOBAL CONNECTIONS AND SCOPE OF INTERACTIONS

The MRC CMM is a multicultural research and training hub, with members from over 31 different countries worldwide, and with an international reach that extends to collaborations and partnerships with 69 Institutions and 12 companies across 20 countries.



CMM Collaborations and Partnerships

- University of Exeter
- Royal Devon & Exeter Hospital
- University of Bristol
- St George's University of London
- Broad Institute of MIT and Harvard
- Busitema University
- Cardiff University
- Charité – Universitätsmedizin Berlin
- Chiba University
- Dublin Dental University Hospital
- Federal University of São Paulo
- Fiocruz
- Francis Crick Institute
- Hospital Carlos III
- Hospital General “Dr. Manuel Gea González”
- Imperial College London
- Instituto de Salud Carlos III
- Instituto Nacional de Enfermedades Respiratorias (INER)
- Katholieke Universiteit Leuven
- King's College London
- Leeds Beckett University
- Leibniz-Institut für Naturstoff-Forschung und Infektionsbiologie e. V. Hans-Knöll-Institut

- Leiden
- Leiden University
- Makerere University, Infectious Diseases Institute
- Max Planck Institute for Biology of Ageing
- National Institute for Communicable Diseases
- National Institute for Communicable Diseases – Microbiology
- Newcastle University
- Osaka University
- Pasteur Institute
- Queen's University Belfast
- Radboud University Medical Center
- Southmead Hospital, Bristol
- Technical University of Braunschweig
- Tel Aviv University
- The National Cancer Institute
- The Ohio State University
- The University of Edinburgh
- The University of Manchester
- The University of Sheffield
- UMass Chan Medical School
- UKHSA Mycology Reference Lab, University of Oxford
- Universidad Autónoma de Nuevo León
- Universidade Estadual de Maringá
- Université de Paris

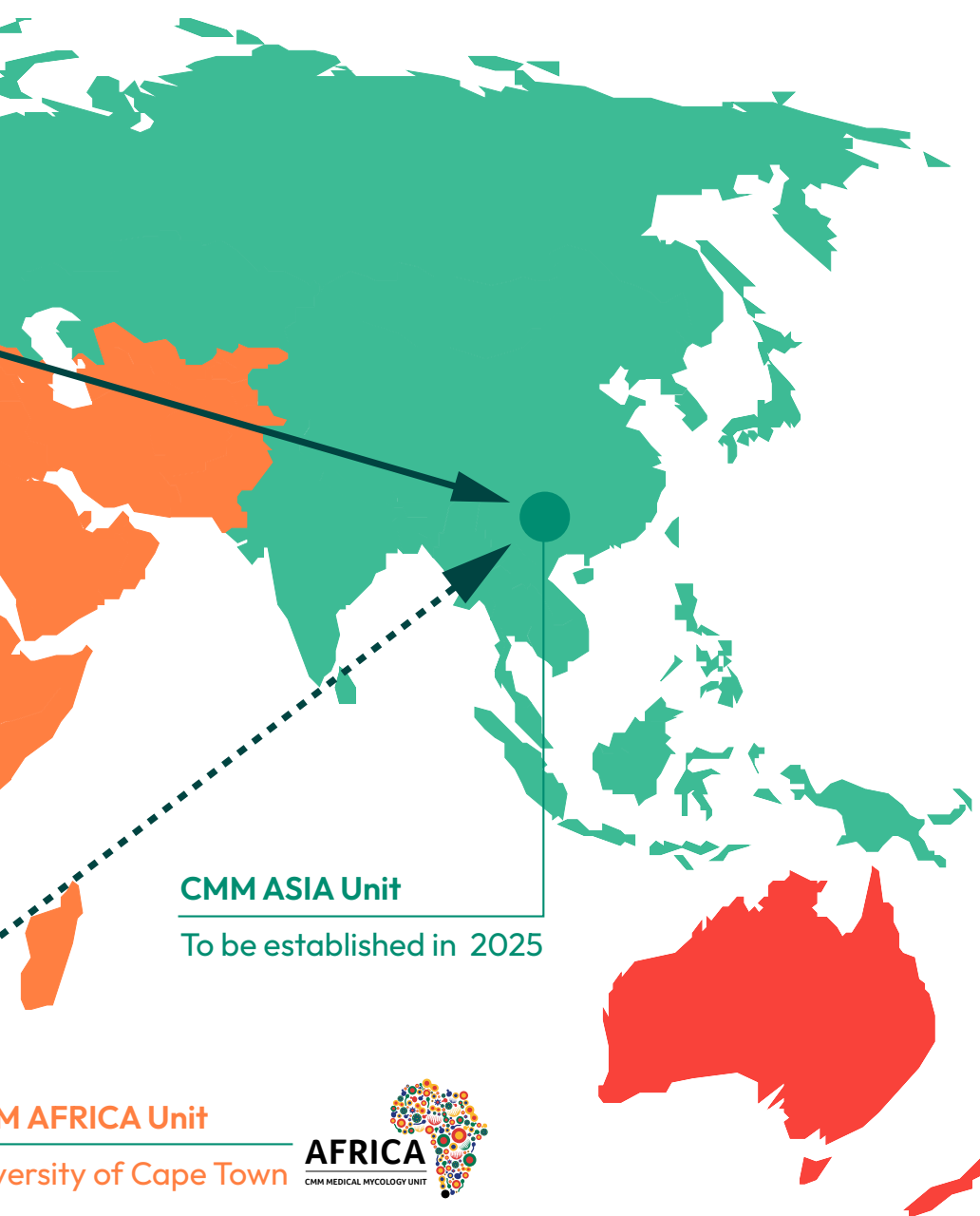
- Universiti Putra Malaysia
- University of Aberdeen
- University of Bath
- University of Dundee
- University of Georgia
- University of Glasgow
- University of Lisbon
- University of Liverpool
- University of Minhho
- University of Minnesota – Twin Cities
- University of Montana
- University of Modena and Reggio Emilia
- University of Nebraska-Lincoln
- University of Oregon
- University of Pennsylvania
- University of Southampton
- University of Trieste
- University of Tsukuba
- University of Wrocław
- University of Zurich
- VHIR – Vall d'Hebron Institut de Recerca
- Utrecht University

CMM member origins

- Argentina
- Brazil
- Chile
- China
- Colombia
- Cyprus
- England
- France
- Germany
- Hungary
- India
- Ireland
- Italy
- Japan
- Kazakhstan
- Luxembourg
- Mexico
- Netherlands
- Pakistan
- Portugal
- Romania
- Russia
- Rwanda
- Scotland
- Slovenia
- South Africa
- Spain
- United States
- Venezuela
- Vietnam
- Wales
- .

CMM Industry & BioTech partnerships

- Blueberry Therapeutics
- Gencoverly
- Gilead Sciences Ltd
- Medchemica
- MIMETAS Europe
- Nexbiome
- Poseidon Laboratories
- ProDigest
- Rothamsted Research
- Syngenta
- WILD Biotech



CMM ASIA Unit
To be established in 2025

CMM AFRICA Unit
University of Cape Town



STRUCTURE & MANAGEMENT

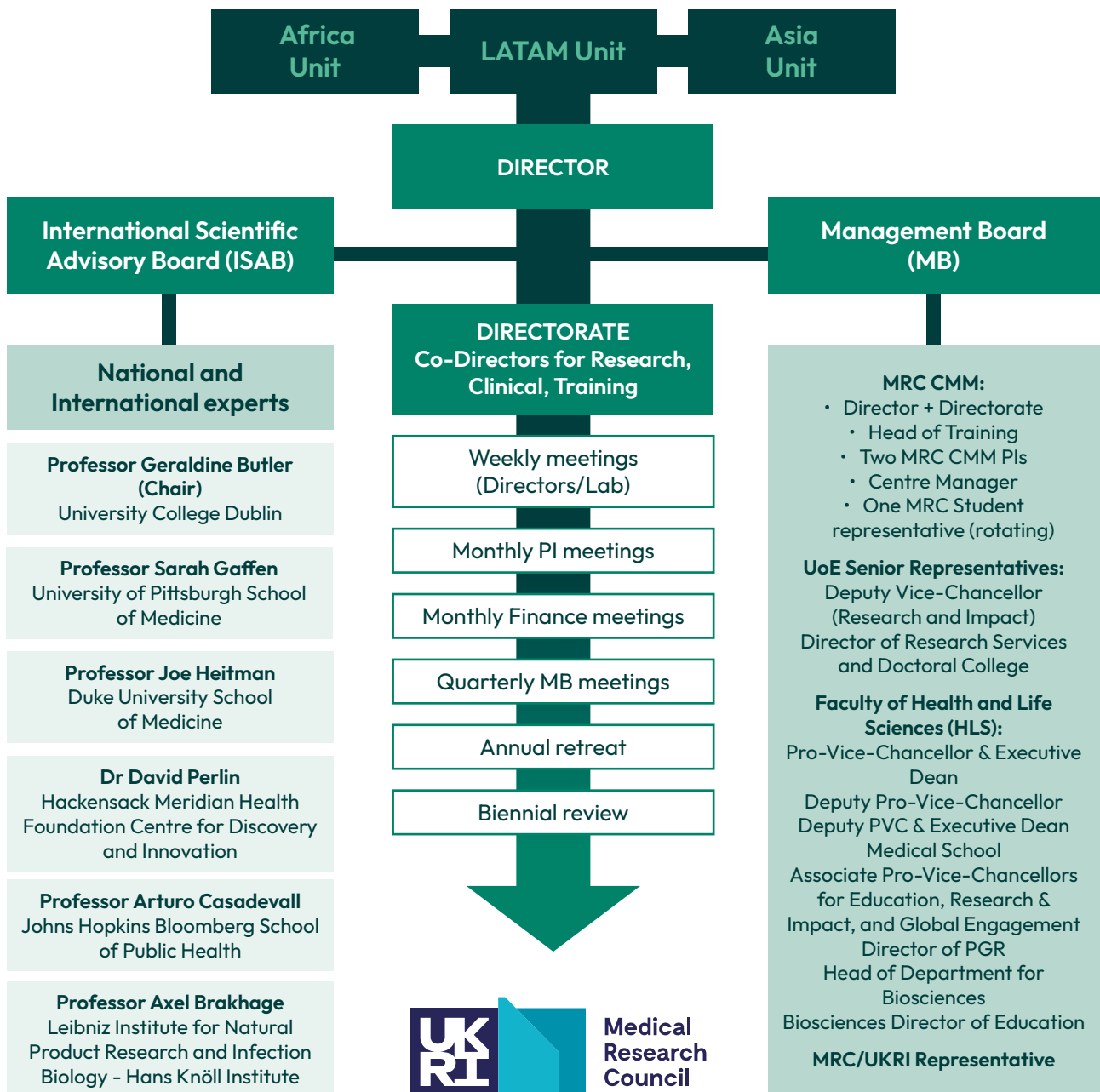
The Director Professor Gordon Brown has responsibility for the strategic direction and development of the MRC CMM, and is supported by three Deputy Directors; Professor Adilia Warris (Co-Director, Clinical), Professor Elaine Bignell (Co-Director, Research), Professor Alistair Brown (Co-Director, Training), and a Centre Manager, Dr Alberto Muñoz-Rodríguez.



MRC Centre for Medical Mycology



University of Exeter



A portrait of Professor Gordon Brown, a middle-aged man with short, light-colored hair, wearing a light blue button-down shirt. He is smiling slightly and looking towards the camera. The background is a blurred green foliage.

Professor Gordon Brown

(MRC CMM Director)

Gordon Brown is a Professor at the University of Exeter and Director of the MRC CMM. He completed a PhD at the University of Cape Town and, following Wellcome Fellowships at the University of Oxford and the University of Cape Town, he moved to the University of Aberdeen. In 2019 he relocated with the MRC CMM to the University of Exeter. Professor Brown is also the Director of the CMM Africa Unit, based at the University of Cape Town, a co-lead of the Clinical Mycology theme within the NIHR Biomedical Research Centre Exeter, a Trustee of the Babraham Institute, and he sits on the management board of the CMM LATAM unit. He is a Fellow of the American Academy of Microbiology, Royal Society of South Africa, Royal Society of Edinburgh, Academy of Medical Sciences, and a Fellow of the Royal Society. His research is funded by Wellcome and MRC.

Gordon Brown's group focuses on understanding the roles of C-type lectin receptors (CLRs) in immunity, and particularly antifungal immunity. His team is defining how immune cells sense pathogens via CLRs, how this information is transmitted intracellularly, and how these receptors initiate and control both innate and adaptive immunity. This work is critical for an understanding of microbial pathogenesis, as well as immunopathology and auto-immunity. Translational benefits of this work include the identification of human polymorphisms associated with disease susceptibility and, significantly, the development of a novel antifungal therapy that has been successfully tested in patients.

A portrait of Professor Elaine Bignell, a woman with blonde hair, wearing a dark blue blazer over a light-colored top. She is smiling and looking towards the camera. The background is a blurred outdoor setting with greenery and a building.

Professor Elaine Bignell

(MRC CMM Co-Director - Research)

Elaine Bignell is a Professor at the University of Exeter and MRC CMM Co-Director for Research. She studied Biochemistry at the University of East Anglia and completed a PhD in Fungal Genetics at Imperial College London, where she received an Imperial College Fast-track to Lecturer Award and an MRC New Investigator Award. Professor Bignell then moved to Manchester as a Co-Founder and Director of the Manchester Fungal Infection Group, and then relocated to the MRC CMM at the University of Exeter in 2020. She is a Fellow of the American Academy of Microbiology, Co-Director of the CMM LATAM unit and is President Elect of the British Mycological Society. Her research is funded by the MRC, BBSRC, Wellcome and GILEAD Sciences Ltd.

Elaine Bignell's group investigates and exploits the molecular mechanisms that support fungal adaptation to, and invasion of, host tissues. The current foci of her research include pH sensing and genome-wide transcriptional regulation during the early stages of *Aspergillus fumigatus* infection, the roles of secreted fungal proteins during tissue invasion, combination antifungal therapy, and the mechanistic basis of post-viral fungal superinfection. Her team is actively translating her discoveries, for example, through the development of small molecule inhibitors of fungal pH signalling as novel antifungal drugs.

A portrait of Professor Alistair Brown, an older man with glasses, wearing a dark blue short-sleeved button-down shirt and dark trousers. He is standing outdoors with green foliage in the background. The image is partially obscured by a white curved shape on the left side, which contains the text.

Professor Alistair Brown

(MRC CMM Co-Director - Training)

Alistair (Al) Brown is a Professor at the University of Exeter and MRC CMM Co-Director for Training. He gained his BSc and PhD in Biochemistry at the University of Aberdeen, did postdocs at the Brewing Research Foundation, Surrey and at MIT, and gained his first faculty position at Glasgow University. He then moved Aberdeen University where, with Neil Gow, he formed the Aberdeen Fungal Group (AFG) in the early 1990s. The AFG blossomed into a large collaborative team, providing the basis for the establishment of the MRC CMM in 2016. Professor Brown then moved to Exeter with the Centre in 2019. He is a Fellow of the Royal Society of Edinburgh, the American Academy of Microbiology, and the European Confederation of Medical Mycology. His research is funded by Wellcome.

Al Brown's team is investigating, in *Candida albicans*, the adaptive mechanisms that promote fungal colonisation and infection of the host. These mechanisms, which include immune evasion as well as nutrient and stress adaptation, appear to be intimately linked, allowing the fungus to exploit host signals to activate anticipatory responses that protect against impending attack by innate immune cells. Defining points of fragility in these protective fungal responses should, in the longer term, facilitate the development of better diagnostics and more effective antifungal therapies.



Professor Adilia Warris (MRC CMM Co-Director – Clinical)

Adilia Warris is a Professor (Clinical) at the University of Exeter and MRC CMM Co-Director (Clinical Research and Training). She obtained her MD at the University of Groningen, and then gained her PhD-degree and completed her clinical training in paediatric infectious diseases at the Radboud University, Nijmegen. She moved to the University of Aberdeen to develop the translational and clinical research portfolio of the Aberdeen Fungal Group, became a Co-Director of the MRC CMM, and then moved with the Centre to Exeter in 2019. Professor Warris is an honorary consultant at Great Ormond Street Hospital, leads the Clinical Mycology Theme at the NIHR Biomedical Research Centre Exeter, and is a Fellow of the Royal College of Paediatrics and Child Health, and the European Confederation of Medical Mycology. Her research is funded by the UK CF Trust, the MRC, the Chloe Fund and Noah's Pink Balloon Leukaemia Fund.

Adilia Warris's team focuses on understanding host responses relating to *Aspergillus* disease with a view to improving treatment and outcomes for specific patient groups. The team has a strong translational focus. Their interests include host-*Aspergillus* interactions in chronic granulomatous disease and cystic fibrosis patients, the development of new management strategies for children with invasive fungal disease, and antifungal drug resistance and stewardship. The drive is towards an increased understanding of damaging host-fungus interactions and towards new treatment modalities.



Dr Elizabeth Ballou

Elizabeth Ballou is a Wellcome Sir Henry Dale Fellow at the University of Exeter. She has a Chemistry degree from Mount Holyoke College, an MSc from the London School of Hygiene and Tropical Medicine, and a PhD in Genetics and Genomics from Duke University. She completed her postdoc at the University of Aberdeen, was awarded a BBSRC Anniversary Future Leaders Fellowship, and then gained her first faculty position at the University of Birmingham's Institute for Microbiology and Infection. Dr Ballou was awarded a Wellcome Henry Dale Fellowship in 2018, joined the MRC CMM in 2021, and was awarded a Lister Prize Fellowship in 2022. Her research is funded by Wellcome.

The Ballou Group investigates how fungal responses to host-relevant environmental signals (including temperature, pH, oxygen and nutrient limitation) and exposure to environmental microbes (bacteria and amoeba) influence cell growth and morphogenesis. Using the model pathogen *Cryptococcus neoformans* and emerging pathogens in the *Mucorales* family, their work addresses key knowledge gaps in the basic biology of these devastating fungal pathogens including drug resistance mechanisms and seeks to define fungal biomarkers of disease.



Dr Steven Bates

Steven Bates is a Senior Lecturer at the University of Exeter. He obtained his BSc in Biological Sciences and PhD in Molecular Microbiology at the University of Leicester, and then joined the Aberdeen Fungal Group as a postdoc. In 2016, he took up a lectureship at the University of Exeter where he established his own research group, and joined the MRC CMM when the Centre moved to Exeter in 2019. His research is funded by Syngenta.

Steve Bates's group focuses on the secreted proteins of *Candida albicans* as many interact with the host but have not been studied experimentally. Therefore, current work is aimed at identifying the full range of proteins secreted by this fungus and determining their roles in causing disease. In addition to increasing our knowledge of this important pathogen, this work has the potential, ultimately, to reveal new antifungal drug targets and novel diagnostic markers of *Candida* infection.



Professor Alexandra Brand

Alex Brand is an Associate Professor and a Wellcome Senior Research Fellow at the University of Exeter. She worked in industry in the UK and overseas before gaining a BSc in Biochemistry and a PhD in Microbiology at the University of Aberdeen. In 2009, she established her independent research group in Aberdeen on a Royal Society University Research Fellowship and an MRC New Investigator grant. In 2019, she moved to Exeter with the MRC CMM where she became an Affiliate of the Living Systems Institute and co-founded the Exeter Microfluidics Network. Her research is funded by Wellcome and the BBSRC.

The Brand group exploits state-of-the-art cell and molecular biology, and collaborates with Mathematicians and Physicists, to characterise sensing and steering mechanisms in fungal hyphae using the pathogen, *Candida albicans*, as a model. Inactivating these mechanisms blocks hyphal growth, thereby inhibiting invasion and reducing pathogenicity. Therefore, drugs that block environmental sensing could prove effective for improving patient survival when used in combination with other antifungal drugs.



Dr Carolina Coelho

Carolina Coelho is a Senior Lecturer at the University of Exeter. She completed a degree in Pharmaceutical Sciences at University of Porto, and in 2008 was awarded a PhD scholarship to the University of Coimbra and Albert Einstein College of Medicine. After postdoctoral fellowships at King's College London and Johns Hopkins Bloomberg School of Public Health, she then joined the MRC CMM in 2019 to establish her independent group. Her research is funded by an Academy of Medical Sciences Springboard Award.

Carolina Coelho's group is deciphering early events of *Cryptococcus neoformans* infection, how innate immunity attempts to clear the fungus, and how the fungus counteracts these responses. A combination of state-of-the-art imaging, infection models, metabolomics and cell biology are being used to define exactly how, when and where the fungus evades innate immune attack. Understanding the components of an effective fungicidal response, and how this sometimes fails, will help to identify better therapeutic approaches for the treatment of cryptococcal disease.



Dr Peter Cook

Peter Cook is a Lecturer and a Wellcome and Royal Society Sir Henry Dale Fellow at the University of Exeter. He completed a BSc in Genetics and his PhD at the University of York, and then did postdocs at the University of Edinburgh and the University of Manchester. In 2016 he was awarded the University of Manchester Dean's Prize and an Academy of Medical Sciences Springboard Award to establish his own independent research group. In 2020 he relocated to the MRC CMM in Exeter. He chairs the British Society of Immunology regional Exeter Immunology Group. His research is funded by Wellcome and the MRC.

Peter Cook's group is defining how cells of our immune system maintain health at mucosal barriers such as those in the lung. The emphasis is on how these immune cells respond to fungi such as the ubiquitous environmental mould *Aspergillus fumigatus*, and why this triggers chronic airway diseases such as asthma in some individuals. Genomic, metabolic and immunological approaches are being combined to examine mouse models, organ-on-a-chip microfluidic platforms, and airway samples from patients to generate fundamental insights with a view to improving therapeutic strategies for patients.



Dr Rhys Farrer

Rhys Farrer is a Senior Lecturer at the University of Exeter. He received his BSc in Cellular Biology and MSc in Bioinformatics from the University of East Anglia, and his PhD in Clinical Medicine from Imperial College London. After his PhD, he gained a Wellcome Postdoctoral Fellowship to study at the Broad Institute of MIT and Harvard. He then worked at University College London before joining the MRC CMM in 2019. His research is funded by a Wellcome Discovery Award.

Rhys Farrer's group is studying the evolution of microbial pathogens, in particular *Cryptococcus*, *Candida* and *Chytrid* species, using genomic, transcriptomic, and epigenomic approaches. His current research seeks to understand the epigenetic regulation of genes in *Cryptococcus neoformans* to identify the locations of conserved and variable histone modifications that govern the expression of genes important for pathogenicity and drug resistance. In the longer term, this work will identify new ways to counteract the pathogenicity and antifungal resistance of *C. neoformans*.



Professor Neil Gow

Neil Gow is a Professor at the University of Exeter. He gained his BSc and PhD in Microbiology at the University of Aberdeen, studied as a postdoc at the National Jewish Hospital, Denver, and then returned to the University of Aberdeen where he landed his first faculty position. There he rose to full Professor, co-founded the Aberdeen Fungal Group with Al Brown, and directed the Wellcome Strategic Award in Medical Mycology and Fungal Immunology. This brought the UK medical mycology community together and helped lay the platform for the establishment of the MRC CMM in 2016. Professor Gow was a Co-Director of the MRC CMM while it was based in Aberdeen. In 2018, he moved to the University of Exeter to become the Deputy Vice Chancellor for Research and Impact. He is a Fellow of the Royal Society, the Academy of Medical Sciences, Royal Society of Edinburgh, the American Academy of Microbiology and the European Academy of Medical Mycology. His research is funded by Wellcome.

Neil Gow's group focuses on the structure and function of the fungal cell wall in relation to its potential as a target for new antifungal drugs, and the importance of the cell wall in initiating immune recognition. Current work focuses on understanding the precise nature and regulation of the cell wall ligands that initiate immune recognition, and how antifungal drug exposure influences the remodelling and immune recognition of the cell wall. This work is of direct relevance to the design and use of antifungal drugs, the development of antifungal drug resistance, and the design of fungal diagnostics and immunotherapies for fungal diseases.



Professor Thomas Harrison

Tom Harrison is Professor of Medicine and Infectious Diseases at St George's University of London, an Honorary Consultant at St Georges Hospital, and a Professor in the MRC CMM at the University of Exeter. He studied Natural Sciences at Cambridge and Medicine at St Georges, and trained in Infectious Diseases in London and Boston. He returned to London on a Wellcome Advanced Training Fellowship and set up clinical studies in Thailand and Sub-Saharan Africa. Professor Harrison joined the MRC CMM in 2020. He is a member of WHO, the Infectious Diseases Society of America, and Southern African treatment guidelines panels, the WHO Expert Group on Fungal Pathogens, the Scientific Advisory Board of the Joint Programme Initiative on Antimicrobial Resistance (JPIAMR), and a Fellow of the Academy of Medical Sciences. His research is funded by the MRC, Wellcome, Department for International Development, and European Developing Countries Trials Partnership.

Tom Harrison collaborates with colleagues in the UK and across Sub-Saharan Africa to study cryptococcal meningitis. His work encompasses improved diagnostics, screening and disease prevention strategies, laboratory studies of host immunity and pathogen evolution and virulence, as well as improved antifungal therapy. He has led clinical trials on anticryptococcal drug regimens to maximise efficacy, minimise toxicity, suppress the development of resistance, and optimise cost-effectiveness. These novel regimens, which were endorsed by WHO, have enhanced global access to the drugs and substantially reduced mortality.



Professor William Horsnell

William (Bill) Horsnell is a Professor at the University of Exeter. He studied Applied Zoology at the University of Leeds, completed his PhD at the Royal Veterinary College, University of London and was a postdoc at the University of Liverpool and then the University of Cape Town (UCT). He landed his first tenured position at UCT, rising to Professor of Infection and Immunity. During this time, he also undertook a sabbatical year at the CNRS-Orleans, and latterly, held a Readership at the University of Birmingham. Professor Horsnell joined MRC CMM in 2023. He is funded by the BBSRC, Royal Society, Deutsche Forschungsgemeinschaft, NIH, UKRI: BactiVac, Poliomyelitis Research Foundation, Allergy Society of South Africa, World University Network, National Research Foundation South Africa, Medical Research Council South Africa and Fonds National de la Recherche Scientifique (Belgium).

Bill Horsnell's group focuses on two big questions. Firstly, how does immunity against one infection influence control of a different infection? For example, his team is studying how gastrointestinal infections affect the control of sexually transmitted infections revealing, for the first time, that eosinophils regulate viral pathology in the female reproductive tract. This has been successfully translated in field studies in West Africa. He is also undertaking studies addressing how helminth infection induced eosinophils alter host control of the fungal pathogen *Pneumocystis*. Secondly, what mechanisms permit mothers to transfer immunity to their children? Ongoing studies are addressing how maternal colonisation by helminths and fungus (e.g. *Candida*) influence microchimeric regulation of immunity, early life epithelial development and lifelong immunity in offspring. His group are translating their discoveries in murine models of infection to human studies.

Dr Liliane Mukaremera

Liliane Mukaremera is a Lecturer at the University of Exeter. She completed a BSc in Biology at the National University of Rwanda and was then retained by the University as a teaching assistant. She won a scholarship to attend the University of Aberdeen where she obtained her MSc in Medical Molecular Microbiology and joined the Aberdeen Fungal Group for her PhD. She moved to the University of Minnesota as a postdoc, and then joined the MRC CMM in Exeter in 2019. Her research is funded by an Academy of Medical Sciences Springboard Award.

Liliane Mukaremera's group is defining factors that affect interactions between fungal pathogens and their hosts, and particularly how fungi alter their cell morphology and cell surface to evade host immunity. The overriding goal is to establish a translational research programme that performs impactful science aimed at improving human health in Sub-Saharan Africa. With this in mind, Dr Mukaremera is collaborating with colleagues in Africa to establish a mentorship programme aiming at engaging African graduate students and training them in Medical Mycology.





Dr Johannes Rack

Johannes Rack is an MRC Career Development Fellow at the University of Exeter. He studied Biochemistry at the University of Hannover and Hannover Medical School, and received his PhD from the University of Bergen where his work was recognised by the ZONA Award for an outstanding PhD in Molecular & Cellular Biology and Biochemistry. He moved to the University of Oxford as postdoc, and then joined the MRC CMM in 2023 to establish his own interdisciplinary research team. His research is supported by the MRC.

Johannes Rack's group is focusing on the DNA damage response in *Aspergillus fumigatus* and its role in adaptation to host-imposed stress. They study ADP-ribosylation, an essential signalling pathway that acts as a master regulator of the DNA damage response, with a view to elucidating how the fungus balances adaptation and survival in the host. Ultimately, this work will lead to new molecular insights that underpin the development of novel strategies for antifungal therapy.

Dr Mark Ramsdale

Mark Ramsdale is an Associate Professor at the University of Exeter. He gained his BSc in Applied Biology and his PhD in Fungal Ecology and Evolutionary Biology at the University of Bath. He worked at Pfizer (Sandwich, Kent) and did a postdoc at the University of Cambridge, before moving to the Aberdeen Fungal Group where he established an independent group. He obtained a lectureship at the University of Exeter and joined the MRC CMM in 2019. Dr Ramsdale is acting Chair of the British Mycological Society Fungal Education and Outreach Committee, is now running the MRC CMM MRes-PhD programme and is setting up the online MSc programme in Medical Mycology. His research is funded by the NC3Rs.

Mark Ramsdale's team is focussing on better understanding the interaction between human fungal pathogens and their host by developing an animal model of infection that permits real-time live cell imaging of fungal cells as they respond to antifungal drugs. With collaborators at the Aquatic Resources Centre in Exeter, his team is establishing the Arabian killifish as a new thermotolerant model with embryo lines that mimic human genetic defects that predispose patients to fungal infection. This alternative model will reduce the usage of mice for studies of fungal pathogenesis.





Dr Jane Usher

Jane Usher is a BBSRC Discovery Fellow at the University of Exeter. She studied Biology and Statistics at the National University of Ireland, Maynooth before completing an MSc in Molecular Medicine and a PhD on Yeast Genomics at Trinity College Dublin. She completed a postdoc in the Institute of Systems Biology at the University of Ottawa, and then moved to the University of Exeter. In 2019, she joined the MRC CMM after its relocation to Exeter. She is the CMM co-lead for the Microbes and Society Network at the University of Exeter. Her research is funded by the BBSRC.

Jane Usher's group focuses on combatting resistance to combinatorial stress and macrophage killing in *Candida glabrata*. They combine genomics, genetics and molecular biology to define how this fungus responds to stress, and how this promotes disease and intrinsic tolerance to azole antifungal drugs. This work will yield new insights into how this major pathogen initiates and progresses infection and could reveal therapeutic targets for drug development and diagnostic markers.



Dr Duncan Wilson

Duncan Wilson is a Wellcome Senior Fellow and a Senior Lecturer at the University of Exeter. He gained his BSc in Microbiology at the University of Glasgow, and his PhD at the University of Manchester in collaboration with Pfizer. He then moved to the Hans Knoll Institute (HKI), Jena as a postdoc before securing a Marie Curie Intra-European Fellowship to stay at the HKI where he was involved in the discovery of Candidalysin. He then secured a Wellcome Sir Henry Dale Fellowship and established his independent research group in the Aberdeen Fungal Group at the University of Aberdeen. In 2019 he was awarded a Wellcome Senior Research Fellowship and relocated to Exeter with the MRC CMM. His research is funded by Wellcome.

Duncan Wilson's group is determining how human fungal pathogens adapt to fluctuations in trace mineral availability in the context of nutritional immunity. His team has shown that *Candida* cells regulate their morphology in response to zinc starvation and defined the mechanisms by which the fungus scavenges, imports and traffics zinc within the cell. With international collaborators, his team has demonstrated that a *Candida* zincophore drives inflammatory immunopathology during vaginal candidiasis. This has led to the development of a simple intervention that prevents vaginal *Candida* infections in experimental infection models and in women.



Dr J. Claire Hoving

Claire Hoving is an Associate Professor at the University of Cape Town (UCT), a Wellcome Intermediate Fellow in Public Health and Tropical Medicine and Senior Lecturer in the Division of Immunology. She completed her BSc in the Netherlands and her PhD in Immunology and Infectious Disease at UCT. She joined the CMM AFRICA Unit in 2017. Her research is funded by Wellcome, MRC-UK and the Carnegie Corporation.

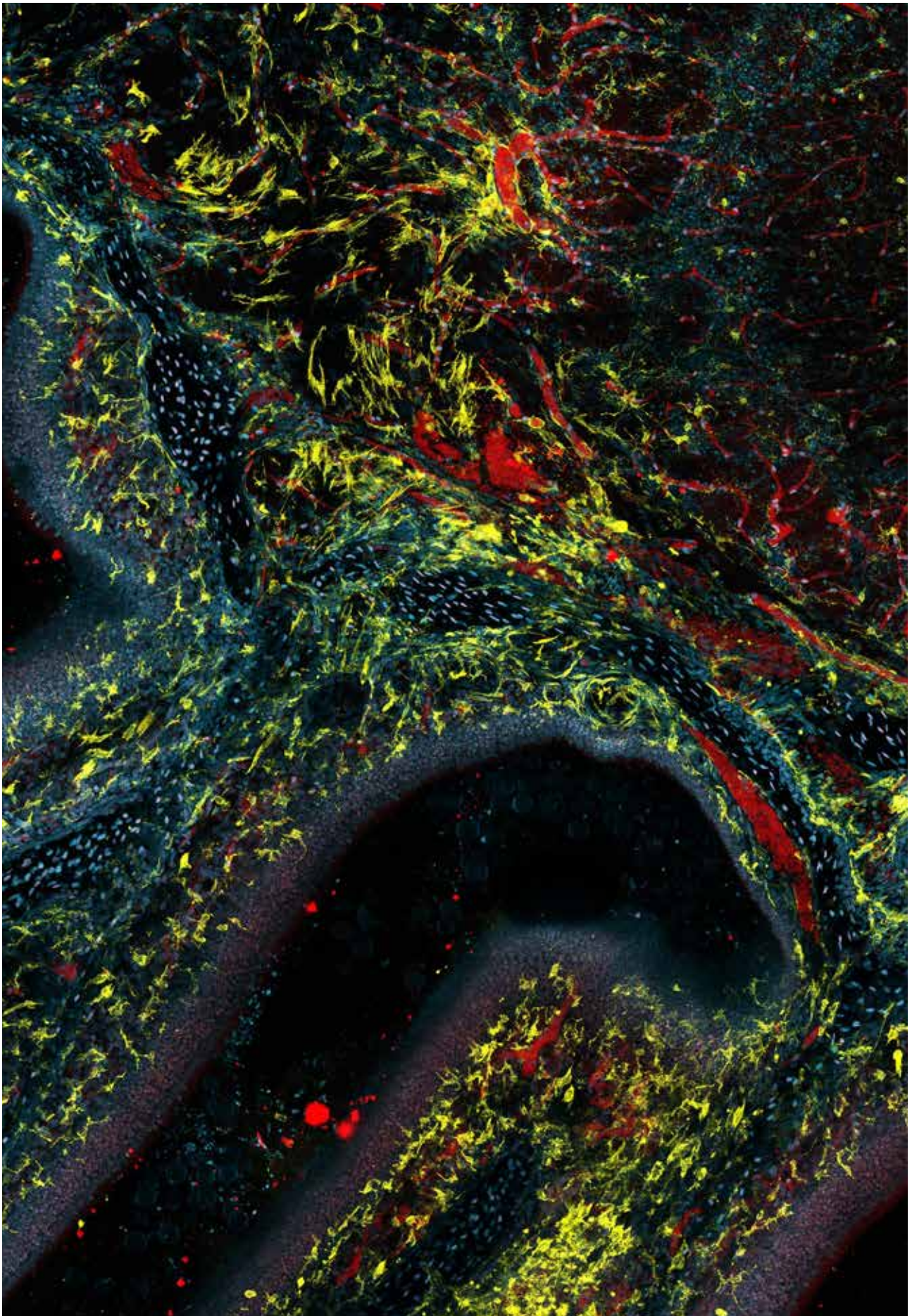
Claire Hoving's group focuses on understanding host immune responses to HIV-related fungal infections that are prevalent in sub-Saharan Africa. For example, the group is investigating the immune responses to *Pneumocystis* species and other relevant fungal infections such as *Cryptococcus neoformans* and the newly identified *Emergomyces africanus*. In addition, they are studying the immunological consequences of co-infection with other pathogens including *Mycobacterium tuberculosis*. Their long-term goal is to develop more effective therapies that reduce the impact of these pathogens across the continent.



Dr Rachael Dangarembizi

Rachael Dangarembizi is Senior Lecturer and neuroscientist in the Department of Human Biology and the Neuroscience Institute at the University of Cape Town (UCT). She completed a PhD in Neurophysiology at the University of the Witwatersrand. She joined UCT as a postdoctoral fellow and the CMM AFRICA Unit in 2019. Her work is funded by the UKRI African Leaders Scheme.

Rachael Dangarembizi's group is defining the mechanisms underlying the neurological damage caused by cryptococcal meningitis, a fatal opportunistic infection that mostly affects immunosuppressed individuals living with HIV/AIDS. Her group specifically focuses on neuroinflammatory dysregulation and the disruption of fluid homeostasis in the brain as potential causes of neurological damage during cryptococcosis.



Imaging of *C. neoformans* in mouse tissues. Credit: Dr Vanessa Francis and Dr Carolina Coelho, University of Exeter. Funded by AMS Springboard Award to Coelho.

EARLY CAREER FELLOWS



Dr Jamie Harrison joined the MRC CMM as an Early Career Research fellow in 2023. Following a PhD on the comparative genomics of bacterial pathogens, Jamie moved to the Genetics of Complex Traits Group at the University of Exeter Medical School, and then to a bioinformatics post at University of Exeter Sequencing Service before returning to a postdoc on microbial genomics. Jamie's research focusses on identifying genetic variants that influence the predisposition to, and outcome from, fungal disease. He exploits population-scale human genetic datasets with a view to informing the personalisation and prioritisation of treatments for fungal disease.



Dr Seána Duggan joined the MRC CMM as an Early Career Research Fellow in 2021. She studied Bioanalytical Science at TU Dublin, pursued a PhD in Microbiology at the Friedrich Schiller University, Jena, and conducted postdoc research in bacterial pathogenicity at the University of Bristol. Seána is investigating why *Candida albicans* and *Staphylococcus aureus* synergise to cause much worse disease during co-infections compared to mono-infections. Seána interrogates fungal-bacterial-human cell cultures with omics approaches coupled with phenotypic and infection assays to define drivers of this synergy with a view to mitigation.



Dr Olga Nev is an Early Career Research Fellow and joined in the MRC CMM in 2020. She obtained a BSc in Applied Mathematics from Nizhny Novgorod State University, followed by an MSc in Applied Mathematics from St. Petersburg School of Economics, and a PhD in Mathematical Biology at Warwick University. She moved to Exeter University as a postdoc and was awarded an MRC Skills Development Fellowship. Olga is attempting to overcome a major obstacle in *Pneumocystis* research – the inability to grow this major pathogen *in vitro*. She is developing *in silico* metabolic models of *Pneumocystis* growth and metabolism and using these to predict optimal *in vitro* growth conditions which are then tested experimentally by her collaborators in the CMM AFRICA Unit. Her research is funded by the MRC and the NIHR Exeter Biomedical Research Centre.



Dr Roberta Peres da Silva is an Early Career Fellow and joined the MRC CMM in 2019. She gained her BSc in Pharmacy and Biochemistry and her MSc from the Sao Paulo State University. She moved to the Federal University of Sao Paulo for her PhD in Medical Mycology, and then was Lecturer in Microbiology and Clinical Mycology at the Universidade Paulista Sao Paulo. She then completed postdocs at the Karolinska Institute and the University of Nottingham before joining the MRC CMM. Roberta's research focuses on the molecular biology and immunology of *Sporothrix* species. She has developed the first CRISPR-based tools for the genetic manipulation of *Sporothrix* and is combining genomics and immunology to define the crosstalk between the host and fungus.

HONORARY PRINCIPAL INVESTIGATORS



Professor Judith Berman is a Professor at Tel Aviv University, Israel and Professor Emerita at the University of Minnesota.

Expertise: *antifungal drug tolerance, antifungal drug response mechanisms*



Dr Tihana Bicanic is a Reader and Consultant in Infectious Diseases at St. George's University of London.

Expertise: *evolution, impact and mitigation of antifungal resistance in Cryptococcus and Candida*



Professor Andy Borman is the Deputy Director of Public Health England's UK National Mycology Reference Laboratory, Bristol, UK.

Expertise: *fungal epidemiology, fungal taxonomy, phyogenetics*



Professor Nelesh Govender is Head of The Centre for Healthcare-Associated Infections, Antimicrobial Resistance and Mycoses (CHARM), part of the National Institute for Communicable Diseases in Johannesburg, South Africa.

Expertise: *medical mycology, epidemiology of fungal diseases, antifungal resistance*



Professor William Hope is Dame Sally Davies Chair of Antimicrobial Resistance Research and Director of Centre of Excellence in Infectious Diseases Research at the University of Liverpool.

Expertise: *antimicrobial pharmacokinetics and pharmacodynamics, antimicrobial drug development*



Professor Elizabeth Johnson is the Director of Public Health England's UK National Mycology Reference Laboratory, Bristol, UK.

Expertise: *diagnosis of fungal infection and identification of pathogenic fungi, antifungal drugs*



Professor Sean Wasserman is a consultant in infectious diseases based at Groote Schuur Hospital, Cape Town, South Africa.

Expertise: *HIV-associated opportunistic infections, optimizing management of tuberculosis*

Affiliated members:



Professor Chris Thornton is a professor in fungal immunology at the University of Exeter and director of ISCA Diagnostics, a University spin-out company since 2021.

Expertise: *hybridoma technology, development of monoclonal antibodies, lateral-flow technology*

TECHNICAL, SCIENTIFIC AND PROFESSIONAL SUPPORT STAFF

Centre Management and Administration

Dr Alberto Muñoz-Rodríguez: Research Centre Manager

Jules Bristow: Research Centre Administrator

Merin Cox-Davies: Executive Personal Assistant to Prof Adilia Warris

Finance

Kate Tresidder: Research Finance Assistant Manager

Research Development

Dr Vicki Dunn: Research Development Manager

Public Engagement and Communications

Ange Brennan: Public Engagement and Communications Manager

Rachel Etherington: Public Engagement and Communications Manager

Laboratory Technical Team

Sara Honey: Technical Services Lab Manager

Dr Darren Thomson: Senior Experimental Officer

Marina Albu: Laboratory Technician

Jamie Harvey: Animal Research and Ethics Manager

Dr Andrea Kovacs-Simon: Cell Culture Technologist

Annie Philips-Brookes: Biological Support Unit Technician

Rebecca Inman: Drug Discovery Technician

Research Support Staff

Cameron Bedford: Research Technician

Dr Vanessa Francis: Research Technician

Eduardo Galue: Research Technician

Nicholas Helmstetter: Research Technician

Ian Leaves: Research Technician

Dr Cecilia Rodrigues: Research Technician

Aidana Sagynayeva: Research Technician

Appendix I: Researchers and students

NAME	FUNDER, YEAR	PROJECT
Senior Scientists		
Dr Janet Willment	UoE	Exploring the role of C-type Lectin receptors in immunity and homeostasis, with a focus on their role in anti-fungal immune responses and cell to cell interactions, respectively.
Postdoctoral Researchers		
Dr Masahiro Abe	Japanese Institution	Understanding how fungi are dealt with at mucosal barrier sites.
Dr Tina Bedekovic	Wellcome	Regulation of apical dominance in <i>C. albicans</i> hyphae.
Dr Tanmoy Chakraborty	Wellcome	Characterisation of the zincophore locus in the emerging human fungal pathogen <i>C. auris</i> .
Dr Dora Edith Corzo Leon	BBSRC	Bacterial- <i>Mucorales</i> interactions.
Dr Ivy Dambuza	Wellcome	Role of CLRs in adaptive immunity.
Dr Iana Kalinina	Wellcome	Cell size dynamics during Goliath cells formation.
Dr Qinxin Ma	Wellcome	Mechanistic insights into fungal pathogenicity using a novel lineage of <i>Cryptococcus</i> .
Dr Mariano Malamud	Wellcome	Physiological roles of the C-type lectin receptor CLEC12A.
Dr Dhara Malavia	Wellcome	Targeting <i>C. albicans</i> cell wall enzymes.
Dr Bethany McCann	MRC	Reverse engineering pH signalling of <i>Aspergillus</i> for antifungal drug discovery.
Dr Rashid Minhas	NC3R	Establishing the Arabian killifish as a model for infection studies.
Dr Alexandre Nore	Wellcome	Impact of zinc in fungi niche colonisation.
Dr Arnab Pradhan	MRC	Non-canonical signalling mediates changes in fungal cell wall PAMPs that drive immune evasion.
Dr Mubashshir Rasheed	UoE	Identification of molecular pathways leading to <i>Aspergillus</i> -induced hyperinflammation in CF patients.
Dr Elena Roselletti	Wellcome	Zinc prevents vaginal candidiasis by inhibiting the expression of Pra1, an inflammatory fungal protein.
Dr Sumita Roy	Wellcome	Unbiased screen using Dectin-2 Fc protein to identify novel genes involved in cell wall assembly in <i>C. albicans</i> .
Dr Fabian Salazar Lizama	Wellcome	Role of CLRs in DC biology and immunity to fungi.
Dr Emily Sey	MRC	Role of the microbiome in <i>Aspergillus</i> -induced inflammation in Cystic Fibrosis.
Dr Julio Silva	Wellcome	What drives fungal allergic inflammation?

NAME	FUNDER, YEAR	PROJECT
Dr Mark Stappers	Wellcome	Use of Pattern Recognition Receptor Probes to identify novel genes involved in <i>C. albicans</i> PAMP assembly in the cell wall.
Dr Diana Patricia Tamayo Ossa	Wellcome	Mechanistic insights into fungal pathogenicity using a novel lineage of <i>Cryptococcus</i> .
Clinical Research Fellows		
Dr Emily Chesshyre	UoE	<i>Aspergillus</i> infection in children with Cystic Fibrosis.
Dr Laura Ferreras-Antolin	UoE	Optimizing antifungal management in paediatric patients.
Clinical PhD Fellows (MRC funded)		
Dr Matthew Steward	2023-2026	Examining the role of the human airway in shaping macrophage anti-fungal responses which mediate severe asthma.
Dr Alison Gifford	2022-2026	The epidemiology and host-fungal immune interaction of paediatric cryptococcal disease in South Africa.
Dr William Hurt	2022-2025	Susceptibility to <i>Aspergillus</i> superinfection in severe influenza and COVID-19.
MRes-PhD Students (MRC funded)		
Catrin Williams	2022-2026	Deciphering the network of genes involved in the emergence of drug resistance in the human fungal pathogen <i>C. glabrata</i> .
Adam Bainbridge	2022-2026	Controlling genome integrity: Regulation of the (ADP-ribosyl) transferase Af-Parp from <i>A. fumigatus</i> .
Jack Gregory	2022-2026	Towards a molecular understanding of Mucorales-bacterial interactions underpinning disease.
Harry Osborne	2022-2026	Mechanistic basis of fungal clearance during pulsatile IFN γ immunotherapy.
Orlando Ross	2022-2026	Intestinal epithelial regulation of <i>C. albicans</i> commensalism.
Nguyen Phuong Tuyen	2021-2025	Deciphering how Cystic Fibrosis impairs macrophage led immunity against <i>Aspergillus</i> spores.
Johanna Gosciniak	2021-2025	Mechanistic basis for effector-mediated pathogenicity in the pathogenic fungus <i>A. fumigatus</i> .
Maria Cortada-Roca	2020-2024	Systematic identification of <i>C. albicans</i> secreted proteins required for virulence.
Larissa John	2020-2024	Discovery and functional characterisation of novel combination therapies to combat drug-resistant <i>A. fumigatus</i> and <i>C. auris</i> infections.
Dr Hugh Gifford	2020-2024	Determining the origins of <i>C. auris</i> from experimental, epidemiological and ecological investigations.

NAME	FUNDER, YEAR	PROJECT
Daniel Jones	2020-2024	Investigating the molecular mechanisms regulating the yeast-to-titan switch in <i>C. neoformans</i> .
Daniel Conn	2020-2024	Defining the precise fungal motifs that elicit pulmonary immunity.
Theresa Wacker	2018-2023	Assembly and analysis of the genome architecture of the chytrid <i>Batrachomyces salamandrivorans</i> .
Mark Peacock	2018-2023	Drug induced tolerance mechanisms: a driver for fungal persistence?
Chloe Pelletier	2018-2023	Does the phenotypic adaptability of <i>C. auris</i> enable its success as a multi-drug resistant human pathogen?
Dr Tyng Tan	2018-2023	Development of <i>Aspergillus</i> cell surface-targeting antibodies as novel theranostics.
PhD Students		
Emily Plumpton	NIHR Exeter BRC 2023-2026	Commensal fungi in the lung: innocent bystanders or pathogenic orchestrators of severe asthma?
William Newton	NIHR Exeter BRC 2023-2026	A new link between microbial pathogenesis and dementia: establishing the role of fungal infection in potentiating Alzheimer's disease.
Sophie Nye	GW4 2022-2026	Understanding and modelling fungal growth.
Jane Rush	Wellcome/ UoE 2022-2026	CLRs: a role in launching the adaptive response?
Romey Shoesmith	Wellcome/ UoE 2022-2026	Functional characterisation of MelLec.
Elliot Mahoney	UK CF-Trust 2019-2023	Targeting immunotherapy for fungal infections in Cystic Fibrosis.
Emer Hickey	UoE 2020-2024	The impact of gut-related carbon sources on <i>C. albicans</i> virulence and commensalism.
George Vere	E3 2020-2024	Glycolytic metabolism governs dendritic cell capability to orchestrate anti-fungal allergic inflammation.
Emma Agnew	UoE 2020-2023	The role of fungal membrane organisation in directional growth and tissue invasion by <i>C. albicans</i> .
Callum Parkin	UoE 2019-2023	Calcium flux and dynamics during growth and stress responses in the human fungal pathogen <i>C. albicans</i> .

NAME	FUNDER, YEAR	PROJECT
MRes Students		
Dr Alyssa Hudson	Noah's Pink Balloon Clinical Fellow 2022/2023	Improving the diagnostics of mucormycosis.
Abby Potton	Externally funded 2022-2023	How does Ca ²⁺ influence the <i>C. neoformans</i> yeast-to-titan switch?
Daniel Lloyd Evans	Externally funded 2021-2023	Impact of fungal infection on immunometabolic responses in glia.
Sarah Newman	Externally funded 2021-2023	Characterization of bile acids in the gastrointestinal tract-liver axis during systemic <i>Candida</i> infection.
Summer Scholar Students (MRC-funded)		
Abhita Mhajan	2023	Controlling fungal infections using NK cells expressing a Chimeric Antigen Receptor (CAR). Hosted by Dr Thiago Aparecido da Silva, Ribeirão Preto, Brazil.
Mikey Kessell	2023	How do bacteria influence the causative agents of invasive mucormycosis? Hosted by Dr Liz Ballou, Exeter, UK.

Appendix 2: Alumni since MRC CMM inception in 2016

Early Career Fellows	
Dr Elena Shekhova	2018-2022

Postdoctoral Fellows and Senior Scientists	
Dr Laura Lehtovirta-Morley	2016
Dr Delyth Reid	2016-2018
Dr Bhawna Yadav	2016-2018
Dr Keunsook Kathy Lee	2016-2018
Dr Gabriela Avelar	2016-2019
Dr Judith Bain	2016-2019
Dr Delma Childers	2016-2019
Dr Claudiu Giuraniuc	2017-2019
Dr Maria Spyrou	2018-2020
Dr Jeanette Wagener	2016-2020
Dr Katja Schaefer	2018-2021
Dr Khalil Hussain	2019-2021

Dr Leandro Assis	2020-2021
Dr Petruta Morvay	2018-2022
Dr Alessandra Da-Silva Dantas	2018-2022
Dr Ruben Ramalho	2019-2023
Dr Laure Ries	2020-2023

MRes Clinical Research Fellows	
Dr Joanne Calley	2017-2018
Dr Catherine Mark	2017-2018
Dr Leonard Farrugia	2018-2019
Dr Georgina Newman	2020-2022

MRes-PhD Students	
Dr Christina Nikolakopoulou	2017-2021
Dr Zoe Ross	2017-2021
Dr Alexander Currie	2018-2023
Dr Emily Sey	2017-2023

PhD students	
Dr Bernd Kerscher	2016
Dr Joy Icheoku	2016-2017
Dr Mariana Almeida	2016-2017
Dr Shan Brunel	2016-2018
Dr Ben Rutter	2016-2018
Dr Patawee Asamaphan	2016-2018
Dr Angela Lopez	2016-2018
Dr Ingrida Razuinaite (Vendele)	2016-2018
Dr Ijeoma Okoliegbe	2016-2018
Dr Jill King	2016-2018
Dr Lauren Whitehead	2016-2018
Dr Maria Spyrou	2016-2018
Dr Fernando Alonso	2016-2019
Dr Prashant Sood	2016-2019
Dr Aaron Crawford	2016-2019
Dr Jehan Abdel-Moneim Abdelaziz	2016-2019
Dr Omran Alamir	2016-2019
Dr Marie-Louise Williams	2016-2019
Dr Herbert Itabangi	2017-2019
Dr Rachel Wake	2017-2019
Dr Mohammed Alsarraf	2017-2020
Dr Natasha Motsi	2017-2020
Dr Pizga Kumwenda	2017-2021
Dr Daniel Larcombe	2017-2021
Dr Helen Heaney	2017-2022
Dr Harry Child	2018-2022
Dr Remi Hatinguais	2019-2023

MRes students	
Benjamin Caswall	2021-2022
Danielle Lim	2021-2022

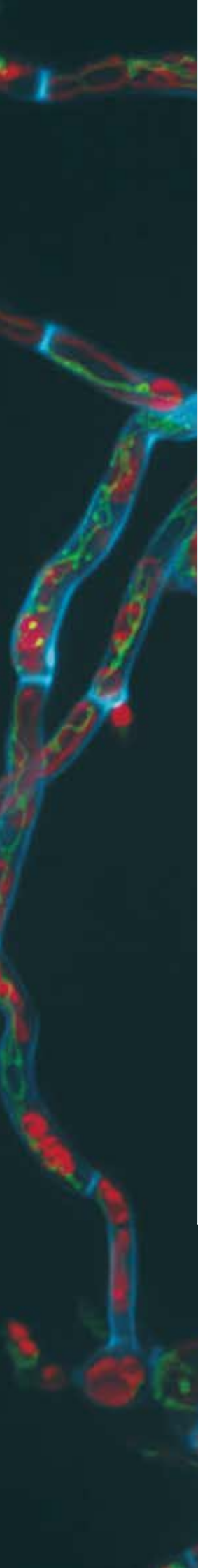
Masters/MSci students	
Ellen Main	2018-2019
Stephen Wall	2018-2019
Danielle Nader	2018-2019

Anna Maria Zhivotikova	2020-2021
India Barber	2021-2022
Christina Bugert	2021-2022

Summer Scholar Students	
Rekha Gurung	2019
Christopher Thoroughgood	2019
Alaina Cockerel	2020
Henry Philips	2021
Emily Rowland	2021
Syntyche Jonah	2021
Alex Smith	2021
Mimi Mostefai	2022
James Forbes	2022

Technicians	
Ian Cunningham	2016-2018
Susan Budge	2016-2019
Hazel Bell	2017-2019
Matthew Edmondson	2018-2022
Dr Debra Carter	2019-2021
Chris Milne	2019-2022
Andy Early	2021-2022
Sophie Hodson	2021-2022
Anya Zhivotikova	2022-2023
Chantelle Davies	2022-2023

Other Support Staff	
Dr Karen McArdle	2016-2019
Dr Barbara Gorgoni	2016-2019
Dr Wendy Pickford	2016-2019
Elizabeth Muckersie	2016-2019
Dr Tehmina Amin	2016-2019
Carol Wallace	2016-2019
Diane Stewart	2016-2019
Lorna Barnes	2020-2021
Michele Waters	2021-2022



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