

# Antimicrobial Discovery and Biobanking

## WORKSHOP REPORT

10-12 OCTOBER 2023, ACCRA, GHANA







## Executive Summary

The National Biofilms Innovation Centre (NBIC), in collaboration with the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) and Noguchi Memorial Institute for Medical Research (NMIMR) in Ghana, organised a workshop on Antimicrobial Discovery and Biobanking, which took place in Accra, Ghana on the 12-14 October 2023.

Biofilms are implicated in some of the most critical global challenges and have significant economic impact within multiple sectors including healthcare, where they are a leading cause of chronic infections and antimicrobial resistance.

This workshop brought together researchers and industry representatives from the UK and Ghana to establish a new partnership between the UK's NBIC and the WACCBIP and NMIMR at the University of Ghana, to address biofilm-related challenges within areas of biobanking and antimicrobial discovery.

The key objectives of the workshop were to:

- Bring together researchers and industry representatives from the both countries, to exchange knowledge and identify areas of synergy within biofilm-related research.
- Understand the expertise, facilities, technologies, and capabilities available through each centre (NBIC, WACBIP and NMIMR).
- Scope out opportunities for future research collaborations.

The meeting was organised by the UK's National Biofilms Innovation Centre (NBIC) and the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) and was supported by the UK Biotechnology and Biological Sciences Research Council (BBSRC) Global Partnering Award.

## Contents

### ANTIMICROBIAL DISCOVERY AND BIOBANKING - WORKSHOP REPORT

Executive Summary  
PAGE 3

Background  
PAGE 4

Workshop  
PAGE 6

Setting and aims  
PAGE 6

Workshop programme  
PAGE 6

Day 1 - Presentations and knowledge exchange  
PAGE 6

Day 2 - WACCBIP facilities tour and visit to Atlantic Lifesciences Ltd.  
PAGE 9

Day 3 - Future collaboration planning  
PAGE 11

Conclusions and Next Steps  
PAGE 15



# Background

## BIOFILMS IN CONTEXT

Biofilms are implicated in some of the most critical global challenges and have significant economic impact across multiple sectors<sup>1</sup>. They are the leading cause of chronic infections and antimicrobial resistance (AMR), described in June 2021 by G7 Health Ministers as a “silent pandemic”<sup>2</sup> and the cause of at least 700,000 deaths globally each year. This is predicted to rise to 10M deaths a year and cost US\$100Tn in world GDP by 2050 if no action is taken<sup>3</sup>. In the UK, biofilm-mediated chronic infections are estimated to cost the NHS £7.2Bn per annum<sup>4</sup>.

This workshop aimed at exploring a possibility of partnership between NBIC and WACCBIP in biofilm-related research and challenges. Two areas with common interests between the UK and the Ghana institutes were identified prior to the workshop, which formed focal points of the carried out discussions:

### Biofilm biobanking

WACCBIP recently surveyed the diversity of bacteria in Ghanaian hospitals, resulting in a valuable collection of antimicrobial-resistant isolates. Meanwhile, NBIC is developing a roadmap for the establishment of a biofilm biobank that would contain standardised biofilms. Collaboration between the two organisations is seen as mutually beneficial as the UK biofilm biobank would benefit from gaining access to highly resistant strains, like those from Ghana. Simultaneously, WACCBIP would be able to further analyse Ghanaian hospital samples and access NBIC’s biofilm models to identify drug resistance mechanisms to support the identification of novel drug targets. Establishing a biofilm biobank would be eagerly welcomed by biofilm researchers and the industry, due to the current lack of access to standardised models for developing and testing therapeutic approaches against antimicrobial resistance.

### Antimicrobial discovery

Antimicrobial discovery platforms are essential tools to combat AMR, allowing for the screening and validation of novel targets. Among these platforms are antivirulence strategies, which focus on reducing the pathogenicity of microbes without resorting to the typical antibiotic-induced destruction, thereby minimising the likelihood of resistance development. NBIC researchers are actively exploring methods such as the disruption of bacterial quorum sensing and development of high-throughput profiling assays and imaging tools for antimicrobial discovery. To establish mutually beneficial collaborations in this field, it is essential to understand the comparable capabilities in Ghana.

## NATIONAL BIOFILMS INNOVATION CENTRE (NBIC)

NBIC was formed in December 2017 as an Innovation Knowledge Centre (IKC), funded by BBSRC and Innovate UK. NBIC has the mission of harnessing the UK’s Industrial and Academic strength in biofilms.

NBIC is the recognised UK hub for accessing biofilm expertise, capability, science, and innovation capacity. Its aim is to catalyse growth in the UK’s scientific, technological, and industrial expertise in biofilms with the goal of delivering:

- World class science and scientists
- Breakthrough innovations
- Economic and societal value

NBIC is working to create a network and community of researchers and industrial/commercial partners, across the UK and internationally, who together are working to progress all these elements.

## WEST AFRICAN CENTRE FOR CELL BIOLOGY OF INFECTIOUS PATHOGENS (WACCBIP)

The West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) is one of the World Bank’s African Centres of Excellence (ACE), led by faculty from the Department of Biochemistry, Cell and Molecular Biology (BCMB), the University of Ghana Computing Systems, the Department of Biomedical Engineering and the Noguchi Memorial Institute for Medical Research (NMIMR) at the University of Ghana.

The centre strives to improve the diagnosis, prevention, and control of infectious diseases in sub-Saharan Africa by conducting applied research into biology and pathogenesis, with the aim of increasing research and innovation by enhancing collaboration among biomedical scientists and industry leaders across Africa. The strong focus of WACCBIP lies in providing advanced-level training and research excellence in cell and molecular biology with the goal of becoming a major hub for biomedical research training and a leading producer of home-grown African science leaders.



# Workshop on Antimicrobial Discovery and Biobanking

## SETTING AND AIMS

The workshop was held in Accra, Ghana, from 10 - 12 October 2023.

Over 30 delegates attended the workshop, including representatives from the UK's and Ghanaian's academic institutions, industry, networks, and regulatory agencies, to share knowledge, discuss research and development priorities, as well as learn about the available at the two countries infrastructure and technologies, with the aim to identify areas of collaboration in biofilm-related research concentrated around biobanking and antimicrobial discovery platforms.

## WORKSHOP PROGRAMME

### Day 1 - Presentations and knowledge exchange

The meeting started with a welcome and introduction to the workshop by Lydia Mosi (WACCBIP), followed by an introduction to WACCBIP and a series of short presentations provided by WACCBIP students and research fellows - Maame Ekuia Acquah, Molly Abban, Harry Hayford, Eunice Ayerakwa Barbara Yaa, Tosin Senbadejo, Angela Ayiku, and Elvis Amoah, showcasing the breadth of projects and activities undertaken by the Centre. This was followed by a series of more detailed presentations from the faculty members and industry representatives in Ghana.

The following talks were given:

*Antimicrobial resistant pathogens from surgical site infections in Ghana.*  
Beverly Egyir (University of Ghana).

*Harnessing microbes and their products for control of malaria.*  
Jewelna Akorli (University of Ghana).

*Assessing antibiotic residues in food animals for targeted intervention.*  
Gloria Ivy Mensah (University of Ghana).

*Drug discovery and manufacture in Ghana.*  
Smart Bediako (Atlantic Lifesciences Ltd., Ghana)

*Introduction to the antimicrobial resistance research work at the Council for Scientific and Industrial Research-Water Research Institute (CSIR-WRI).*  
Kassim Balagara (CSIR-Water Research Institute, Ghana).

*Introduction to CABI - Ghana*  
Victor Clotley (CABI - Ghana).

In the second part of the day, Jo Slater-Jefferies provided the introduction to NBIC, which was followed by presentations from NBIC Co-Directors:

*Approaches and capabilities to target virulence traits in biofilm-mediated infections.*  
Miguel Camara (University of Nottingham, UK).

*Bacterial biofilms and soft matter composites.*  
Cait MacPhee (University of Edinburgh, UK).

*New technology development and opportunities in the detection and control of AMR and biofilms in healthcare and environmental settings.*  
Jeremy Webb (University of Southampton, UK).

*Surfaces, Materials and Nanoscience for Antimicrobial Technologies and Hygiene.*  
Rasmita Raval (University of Liverpool, UK).

Further, the workshop concentrated on sharing a broad knowledge of regulatory frameworks, industry perspectives and the overview of biobanking practices in the two countries, in relation to the areas of microbiology and antimicrobial discovery.

Presentations included:

*Regulatory science for accelerated market access.*  
Chrysi Sergaki (Medicines and Healthcare Products Regulatory Agency, UK).

*Presentation from Antimicrobial Materials Limited.*  
Brian Greenhoe (Antimicrobial Materials Limited, UK & USA).

*Regulatory hurdles/barriers to new drugs/antibiotics.*  
Jennifer Bonah (Food and Drugs Authority, Ghana).

*Biobanking overview in the UK.*  
Matthew Ryan (CABI, UK).

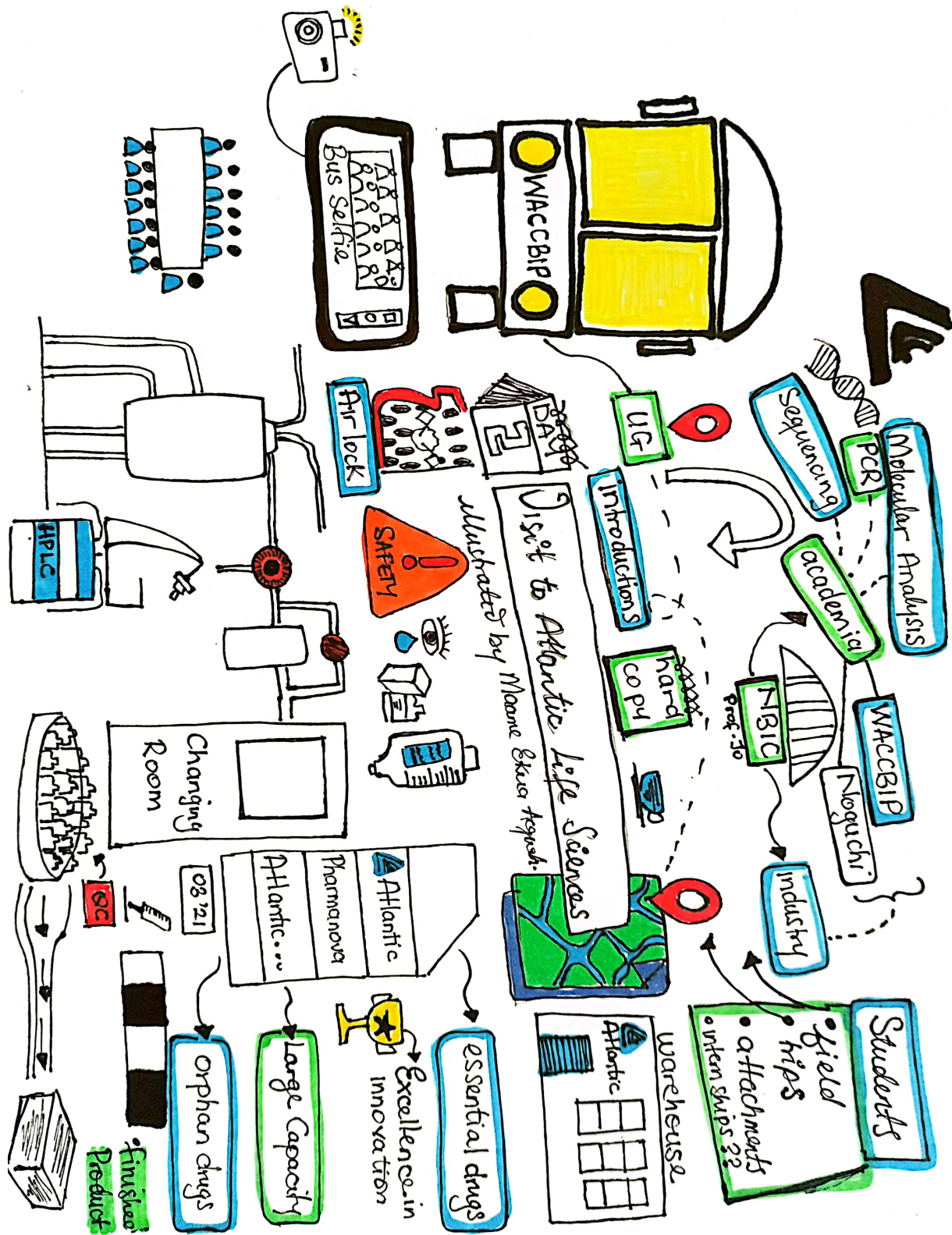
*Biobanking overview Ghana.*  
WACCBIP faculty members.











### Day 3 - Future collaboration planning

The third day of the workshop was dedicated to discussions and planning to scope out the future collaboration between NBIC network and WACCBIP. It started by the overview of potential funding opportunities for international partnerships available in the UK and Ghana, provided by Paulina Rakowska (NBIC) and Beatrice Biney-Nyamekye (WACCBIP), respectively. In addition, Danielle Sagar and Hannah Boycott from the UK's Medical Research Council provided a very informative overview of the upcoming international funding opportunities available from the MRC.

This was followed by in depth discussions between the workshop participants to identify and prioritise short-, mid-, and long-term goals including training, researcher exchanges, collaborative research and activities, and biobanking.

The main points of discussion are summarised below:

#### Biobanking

Creating a comprehensive catalogue of available strains, along with relevant metadata which would consist of samples collected in both countries, was discussed.

- Since shipment of microbial samples between the UK and Ghana could be very problematic and face administrative challenges, an alternative was proposed; Facilitating exchanges of researchers who work on these samples could provide a solution, fostering at the same time transfer of skills and technology. This collaboration could include various aspects, such as the collection, preservation and storage of biofilms, developing workflows and protocols and refining existing ones.
- The establishment of an accessible digital cloud could significantly enhance data sharing among institutions. The cloud would serve as a platform for sharing information derived from biofilm genome sequencing and other relevant research activities. This integrated approach would streamline collaboration, mitigate administrative obstacles, and advance the collective understanding of strains and associated metadata.
- The potential support from the UK's MHRA's for research, particularly in the area of biofilm biobanking and the tools for preservation of biofilm samples and reference biofilm creation, was discussed. One route would be to explore the feasibility of joint PhD studentships between NBIC researchers and MHRA, focused on this domain.
- The involvement with CABI in the UK and Ghana would leverage their existing expertise in microbial biobanks and contacts in Ghana, to explore available methods and the potential inclusion of biofilms in the existing microbial biobanks.
- The first step in the creation of the biofilm biobank would be to establish a dedicated Biofilm Biobanking Task Group focused on fostering idea exchange, building a community, and inviting key stakeholders from both countries to discuss important aspects like cataloguing strains and data sharing.





## Antimicrobial Discovery Research

There are several infectious diseases of mutual interest for both countries, particularly those caused by ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species). Both centres engage in substantial research related to target identification for antimicrobials, presenting a valuable collaborative opportunity.

- In Ghana, there is a specialised expertise in molecular docking, and WACCBIP possesses chemical libraries that could be used for this purpose. Notably, these libraries, originally used for antimalarial target identification, could now be accessed for drug discovery initiatives by NBIC. Similarly, NBIC has access to compound libraries with supporting in silico docking screening, which could be made accessible to Ghana (eg. Nottingham University's Managed Chemical Compound Collection) for the development of novel antimicrobials. This collaboration could extend to supporting efforts in developing antibiofilm interventions by both countries. Therefore, there is a potential for information and resource exchange between WACCBIP and NBIC, promoting joint initiatives in antimicrobial research and drug discovery.
- The area of infectious disease biosensor research has been also discussed. Expertise in this domain exists at both NBIC and WACCBIP that is actively engaged in the development of technology specifically tailored for parasite biosensors, with potential applications on surfaces.
- Some specific areas of mutual interest and potential areas of collaborative research were discussed, including identification of infection biomarkers for the development of diagnostic tests and using Raman technology for the determination of AMR patterns. NBIC researchers have an extensive experience in the development of innovative Raman measurements for the analysis of microbial and biofilm systems. WACCBIP would be keen in investing in this promising technology and WACCBIP researchers could be trained in the use of this technology by NBIC. Shared database of Raman-detectable AMR markers would be a welcome outcome.
- It was agreed that the development of future collaboration between NBIC and Ghana should focus on formulating a path for sustained research collaboration, focused on a specific theme rather than pursuing smaller, random projects. Smaller, short-term projects carry usually higher risks, and may potentially lead to resource wastage.

## Capacity Building and Knowledge Sharing

The discussion surrounding capacity building and knowledge sharing between WACCBIP and NBIC formed a large part of the discussions, with various avenues for enhancing international collaboration and fostering research exchanges considered.

- A possibility of hosting WACCBIP PhD and Master students for research exchanges has been discussed. There is an availability of Wellcome Trust funding held by WACCBIP, which could be utilised to support these. This funding could support the travel of the students to UK universities for a portion of their doctoral studies, thereby fostering international collaboration. Alignment of potential projects to the research activities and themes carried out by the four core NBIC Universities was discussed, as well as the opportunity of undertaking visits to other research organisations in the wide NBIC network, which could be facilitated with the help of NBIC.
- NBIC has well-established, robust procedures for conducting partner searches and aligning expertise, providing support to the identification of expertise and enhancing collaborations across academic and industrial sectors. These practises could be replicated by WACCBIP, supporting capacity-building initiatives and the establishment of a new network in the region.
- WACCBIP faces a shortage of available positions and/or projects for post-doctoral researchers. This shortfall could be considered as a future objective for the Centre, seeking to enhance its capacity to accommodate researchers at the post-doctoral level. NBIC could support WACCBIP in this aspect by exploring collaborative research and researcher exchanges opportunities between institutes. One scheme to consider is the Flexible Talent Mobility Account (FTMA) held by NBIC, which could provide an opportunity for researcher exchanges and funding for smaller projects. FTMA is open to international collaborations and provides opportunities for training and exchanges of early career, but also established researchers as well as research technicians.

- NBIC has its own doctoral training programme (BITE - NBIC Doctoral Training Centre in Biofilms Innovation, Technology and Engineering), with several courses delivered online. NBIC has offered to open the online courses to the interested students at WACCBIP. The courses include, for example, Introduction to Commercialisation Training, delivered by the Entrepreneur Business School Ltd., access to the NBIC ICURE programme or the Software Sustainability course provided by the Software Sustainability Institute and SETsquared, respectively.
- WACCBIP would be interested in increasing their pool of academics willing to serve as examiners for their PhD dissertation defences. The University of Ghana compensates with a nominal fee for this service. The potential examiners could be drawn for the pool of research fellows. In support, NBIC is willing to proactively identify potential examiners within its network, establishing a pool of individuals possessing expertise in antimicrobial research.
- WACCBIP expressed an interest in establishing joint visiting professorships, offering an opportunity for professors to engage in teaching activities and short-course delivery, with the flexibility of online delivery or potential visits to Ghana. A beneficial output would be courses containing both theoretical and practical components. Potential grant funding to support such initiatives will be sought. There is also a potential for development of a collaborative proposal for a joint summer school, which would further enhance academic cooperation between WACCBIP and NBIC.

## Laboratory Reagents

To accelerate the translation of new drugs into the market, it is imperative for WACCBIP/NOGUCHI to obtain a status of accredited laboratory. Achieving this would require overcoming the major problem of difficult access to the necessary laboratory reagents in Ghana. Several suggestions have been proposed to circumvent challenges related to reagent procurement and tax hurdles:

- Develop a jointly co-authored and published comprehensive white paper, to present current issues in Ghana, advocate for tax exemption and present a case for alleviating procurement obstacles, within the overarching framework of the 'One Health' initiative.
- To complement the white paper, conduct market analysis focusing on health economics with the aims to persuade governments by illustrating the financial benefits of the proposed measures.
- Memoranda of Understanding (MoUs) between NBIC organisations and the University of Ghana would explicitly state mutual support on procurement matters, fostering a collaborative approach to address these challenges collectively.

## Regulations

Regulatory aspects in relation to processes enabling approvals and transfers of therapeutic drugs between the two countries have been discussed.

- MHRA has an Innovation Passport scheme and International Recognition Procedure, which enable an authorisation of medicines for the same product from one of MHRA's specified international Reference Regulators such as US FDA, EU EMA, Singapore HAS and others. It would be worth exploring whether these are already in place in terms of UK - Ghana cooperation. If already in place, NBIC could play a role in enhancing the visibility of this process, to enable the utilisation of clinical drugs approved by MHRA in the UK and reciprocally approved by the FDA in Ghana, thereby fostering an efficient cross-border acceptance.

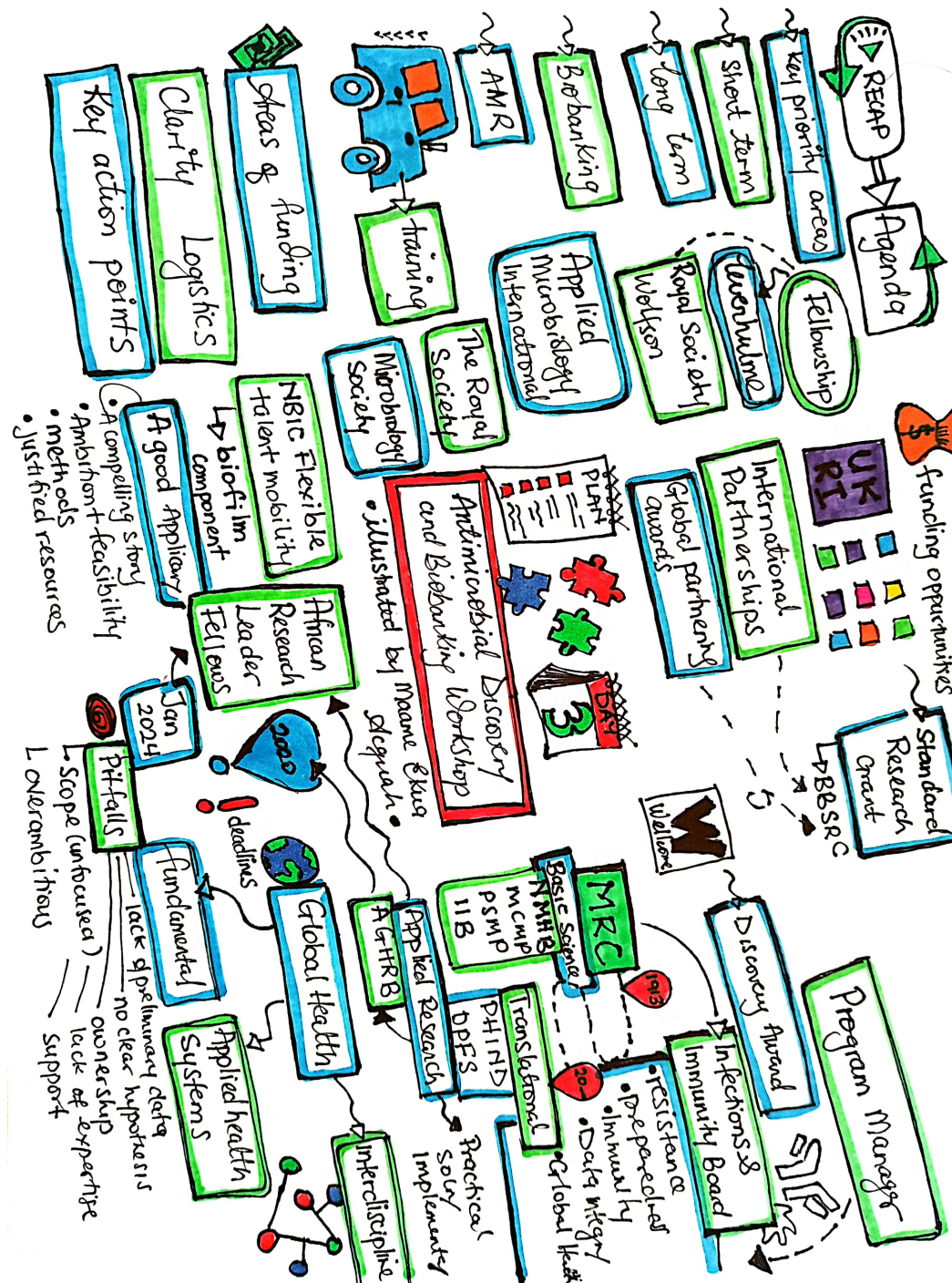


## Public Engagement and Outreach

Outreach activities between NBIC and WACCBIP were discussed as an important area for collaboration. Both centres share a mission to raise public awareness about biofilms, antimicrobial resistance (AMR), and to inspire the scientific aspirations of younger generations, and both have robust outreach and public engagement programmes.

- To initiate collaboration in this area, it was agreed that NBIC would invite representatives from the Ghanaian side to participate in online NBIC public engagement meetings. Further efforts could be directed towards identifying available funding sources for collaborative ventures, such as a joint citizen science projects.

Day 3 of the meeting illustrated by Maame Ekuia Acquah (WACCBIP)



## Conclusions and Next Steps

The in-depth discussions and presentations during the workshop have laid a solid foundation for future collaboration between NBIC and WACCBIP. This exchange of knowledge, expertise, and ideas has highlighted numerous opportunities for joint initiatives in antimicrobial research, biobanking, capacity building, and outreach activities.

Biobanking discussions focused on the establishment of a comprehensive catalogue of microbial strains and metadata, as well as the establishment of a digital platform for data sharing. Facilitation of researcher exchanges would help to overcome logistical problems with biological sample shipment, aiding skills transfer and technology sharing. Collaboration with CABI in the UK and Ghana and the MHRA in the UK would leverage existing expertise and infrastructure in microbial biobanking. As a start, NBIC will create a Biofilm Biobank Task Group to drive the realisation of this long-term objective.

In antimicrobial discovery research, opportunities for resources exchange and collaborative joint projects were identified, particularly in target identification and biosensor development areas. While the discussions will continue to further define the scope of future collaborative research ideas, NBIC and WACCBIP will work together on identifying international funding opportunities and the development of joint grant proposals.

Capacity building and knowledge sharing emerged as important points, with proposals for researcher exchanges, joint PhD projects, joint visiting professorships, and training. Equally, outreach activities aimed at raising public awareness about biofilms and AMR would benefit from collaborative initiatives between WACCBIP and NBIC. Collaborative approach would also aid addressing challenges related to laboratory reagents procurement in Ghana and regulatory processes. As a first step, Memoranda of Understanding between the University of Ghana and NBIC universities will be prepared and signed to cover such activities.

Overall, the workshop provided a roadmap for future joint activities, emphasising shared goals, mutual support, and innovative approaches to address challenges in antimicrobial discovery research, biofilm biobanking and public health in general. Clearly, there is an opportunity and desire from both countries to cooperate and build a sustainable, long-term collaborations.

## REFERENCES

- Cámara, et al. [Economic significance of biofilms: a multidisciplinary and cross-sectoral challenge](#). NPJ Biofilms and Microbiomes. 2022 May;8(1):42. DOI: 10.1038/s41522-022-00306-y PMID: 35618743; PMCID: PMC9135682.
- G7 Health Ministers' Meeting, [communiqué](#) 4 June 2021.
- [The Review on Antimicrobial Resistance](#) Chaired by Jim O'Neill December 2014.
- [International Biofilm Markets - NBIC](#).





Thank You

TO OUR FUNDERS



For further information, please contact [nbic@biofilms.ac.uk](mailto:nbic@biofilms.ac.uk)

<https://doi.org/10.5258/biofilms/014>