

	<b>NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH</b>	
	<b>DEPARTMENT OF BACTERIOLOGY</b>	
	<b>HANDBOOK FOR BACTERIOLOGY DEPARTMENT SERVICES</b>	
	<b>Reference Number: Bac-063-1.0</b>	<b>Effective Date: 1st August 2024</b>

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## **INTRODUCTION**


Within the context of the global research agenda and the research priorities of Ghana, the Department of Bacteriology operates three “flagship” research programs. These are Mycobacterial diseases, Antimicrobial Resistance/stewardship and Neglected Tropical Disease (NTD) of bacterial aetiology. Buruli ulcer (BU) and tuberculosis (TB) are the two most important mycobacterial diseases of public health importance in Ghana. The department in collaboration with other research partners is contributing to the global fight against TB and BU by conducting studies aimed at improving understanding of disease epidemiology, genetic diversity within the causative agent, host-pathogen interactions, and laboratory diagnosis. We have facilities and expertise for the following assays/techniques for our TB research: Genomics and DNA fingerprinting (such as spoligotyping, MIRU/VNTR, RD and SNP, mutational analysis in drug target genes) Immunodiagnostics for TB (QuantiFERON TB tests, T.Spot-TB tests). The department houses the best state-of-the-art pathogen level 3 (P3) facility in West Africa where most of the TB work commences.

Our research on antimicrobial resistance/stewardship includes antimicrobial resistance (AMR) detection in commonly isolated bacteria species recovered from hospitals, communities, food, livestock and water. We perform phenotypic detection of AMR in commonly isolated bacteria species such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp*, *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae* by disk diffusion and broth dilution methods. We also have expertise in molecular detection of AMR genes for methicillin resistance, vancomycin resistance, extended spectrum beta lactamase production and others by polymerase chain reaction as well as Whole Genome Sequencing (WGS) of commonly isolated bacteria species/sequence analysis.

Our studies on neglected tropical disease of bacterial aetiology aim to provide laboratory support for the control and elimination of skin neglected tropical diseases specifically Yaws, Buruli ulcer and Leprosy. This includes development and validation of novel diagnostic tools for Buruli Ulcer (BU) and Yaws. We also carry out research on Trachoma, caused by *Chlamydia trachomatis*.

The Department also has programs in diarrhoea and gut microbiome, food, water and environmental microbiology as well as bacteria sexually transmitted infections. Equipment available for bacteria speciation include BD BACTEC FXTM 40 system and MALDI-TOF MS bio typing.

Within our research activities, we pay particular attention to the environment of the bacteria in focus and do also study coinfection with other diseases like malaria, HIV and diabetes as well as understanding the host immune response to the bacterial infections.

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Over the years, in addition to good laboratory practices and development of quality management systems, the department has built capacity in biostatistics, bioinformatics, data analysis, genome analysis which are utilized in various genomic epidemiological and transmission dynamics studies.

To make our research findings beneficial for disease control, we work with endemic communities in close collaboration with the respective national control programmes and district health management team of the Ghana Health Service (GHS). Our laboratory serves as reference laboratories for both TB and BU and as such we are involved in the organization and maintenance of the National TB Laboratory Network. This includes development of training manuals, organization of laboratory training, implementation of nationwide TB laboratory Quality Assurance, and anti-TB drug resistance surveillance.

The department has been involved in manpower training for the GHS and the Ministry of Health in the area of correct identification and standard antimicrobial susceptibility testing of common bacteria species and on correct identification of skin NTDS. We have also been involved in the training of laboratory staff from several West African countries through the JICA/NMIMR 3rd country training.


We collaborate with several other units of the University of Ghana – the Department of Biochemistry, Cell & Molecular Biology, the West African Centre for Cell Biology of Infectious Pathogens, School of Veterinary Medicine, Department of Medical Microbiology in research and training of students through internships and research project supervision.

## **VISION**

Our vision aligns with that of the University and the Institute to be a leading global biomedical research department.

## **MISSION**

The Bacteriology Department aims to improve the quality of life first for Ghanaians and the world at large by conducting research into bacterial diseases of public health importance, which aligns with that of the Institute.

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## QUALITY OBJECTIVES

Although not currently accredited, the department practices the quality standards as pertaining to the ISO 15189 as well as ISO 9001. We ensure that the majority of our processes are performed according to controlled standard operating procedures (SOPs).

Our main quality objectives:

### **1. Leadership & governance**

1.1. To enhance the integrity of the Institute by attaining & maintaining ISO 15189:2022 for methods in the Bacteriology Department.

### **2. Quality infrastructure**

2.1. To maintain at least 80% of all set quality indicators of the quality management system.


### **3. Research & development**

3.1.a To publish at least twenty-seven (27) papers in peer reviewed journals annually.

3.1.b To submit at least sixteen (16) grant applications.


### **4. Customer satisfaction**

4.1 To attain 80% customer satisfaction among Bacteriology customers.

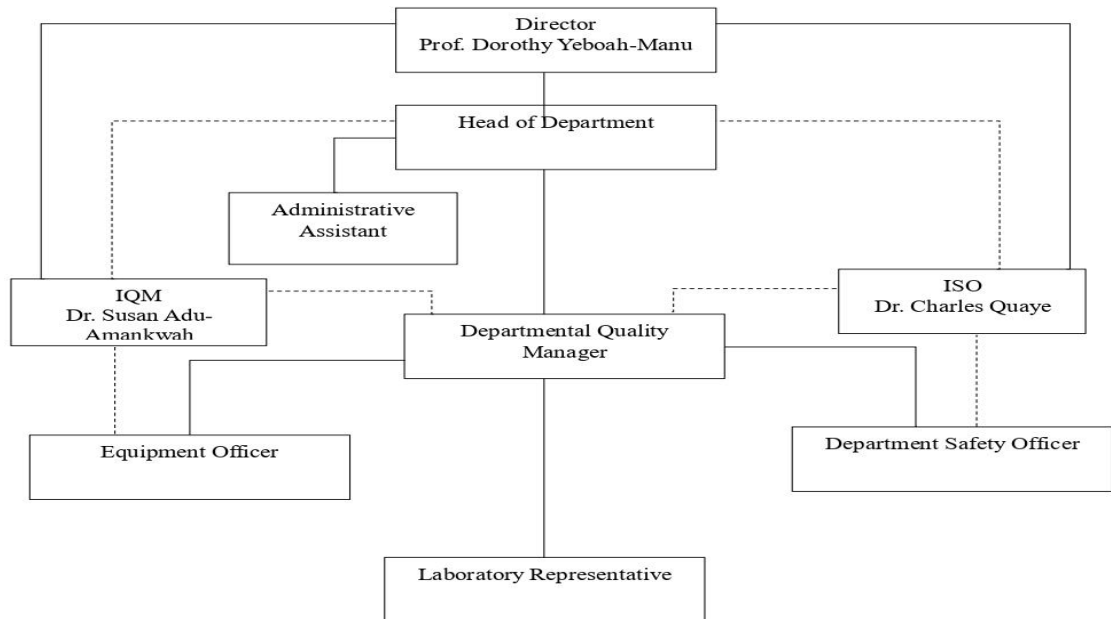
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## ORGANOGRAM

	<b>NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH</b>	
	<b>INSTITUTIONAL QUALITY OFFICE</b>	
	<b>DEPARTMENTAL ORGANOGRAM</b>	
	<b>Reference Number: Mgt-F-085-1.0</b>	<b>Effective Date: 14<sup>th</sup> May 2024</b>

### Department of Bacteriology





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## **STAFF**



As of July 2024, the department housed a total of 80 staff strength including 24 permanent staff and 56 contract staff. The total numbers of contract staff remain fluid across the year, with the introduction of new staff and the end of the contract of some old staff. Annually, the department receives support from up to 20 national service personnel.

<b>Research Scientists</b>		
1	Prof. Anthony Ablordey	Associate Professor & Head of Department
2	Prof. Dorothy Yeboah-Manu	Professor
3	Prof. K.K. Addo	Professor (Retired)
4	Dr. Adwoa Asante-Poku	Senior Research Fellow & Departmental Quality Manager
5	Dr. Gloria Ivy Mensah	Senior Research Fellow
6	Dr. Beverly Egyir	Senior Research Fellow
7	Dr. Isaac Darko Otchere	Senior Research Fellow & Deputy Quality Manager
8	Dr. Nana Ama Amisah	Research Fellow & Safety Officer
9	Dr. Prince Asare	Research Fellow & BSL 3 Lab Representative
<b>Research Assistants/ Technologists</b>		
10	Mr. Kwaku Owusu-Darko	Chief Research Assistant & Biosafety Officer
11	Mr. Lorenzo Moses Akyeh	Principal Technologist
12	Mr. Christian Bonsu	Chief/Supt. Technologist & Equipment Officer
13	Ms. Vida Y. Adjei	Principal Research Assistant & Deputy Quality Manager
14	Dr. Samuel Ofori Addo	Senior Research Assistant & BSL 3 Lab Representative



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15	Dr. Shirley Victoria Simpson	Senior Research Assistant
16	Ms. Emelia K. Danso	Senior Research Assistant and PhD Student
17	Mr. Phillip Tetteh	Research Assistant & Deputy BSL 3 Lab Representative
18	Mr. Siam Mintah Ishaque	Research Assistant & Deputy Lab 4 Representative
19	Ms. Ivy Naa Korshie Lamptey	Research Assistant & Deputy Lab 2 Representative
20	Ms. Elizabeth Akyeama Antwi	Technologist & Lab 3 Representative
21	Mr. Isaac Sakyi Asare	Technologist & Deputy Equipment Officer
22	Ms. Nanabea Akuffo-Lartey	Technologist & Deputy BSL 3 Lab Representative & Safety Officer
<b>Administrative Assistant</b>		
23	Mrs. Gifty Wemakor (Out-going)	Chief Administrative Assistant
23	Mrs. Marian Annowa Nyako (In-coming)	Chief Administrative Assistant
<b>Other Support Staff</b>		
24	Mr. William Nyarko Amoah	Technical Assistant
<b>TOTAL PERMANENT STAFF STRENGTH = 24</b>		
<b>Contract Staff</b>		
1	Dr. Stephen Osei-Wusu	Post-Doc Fellow & PCR Suite Lab Representative
2	Dr. Henry Onyame	Post-Doctoral Fellow
3	Dr. Festus Kojo Acquah	Post-Doctoral Fellow





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4	Justice Akwensi	PhD. Student
5	Augustine Asare	PhD. Student
6	Edmond Kwaku Ocloo	PhD Student
7	Ezekiel Kofi Vicar	PhD Student
8	Dr. Mary O. Ayoola-Wiliams	PhD. Student
9	Gloria Pokua Manu	PhD. Student
10	Felicia Owusu Amoa	Chief Research Assistant & Lab 4 Representative
11	Jeannette Bentum	Chief Research Assistant
12	Christian Owusu Nyantakyi	Principal Research Assistant
13	Alfred Bortey	Principal Research Assistant
14	William Boateng	Principal Research Assistant
15	Blessing Kofi Adu Tabi	Principal Research Assistant
16	Rhodalyne Tagoe	Principal Research Assistant
17	Grebstard Rabbi Amuasi	Principal Research Assistant
18	Theophilus Afum	Principal Research Assistant /PhD student & Deputy PCR Suite Lab Representative
19	Priscilla Ferguson Barnes	Principal Research assistant/ QMS Coordinator
20	Quaneeta Mohktar	Senior Research Assistant
21	Ridhiwani Manyuti	MSc Student
22	Tabitha Naa Koney	MSc Student
23	Daniel Kwaku Baka	Senior Research Assistant
24	Kelvin Smith Ofosu-Darko	Research Assistant

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25	Amy Dziejzorm Dzadey	Research Assistant
26	Justice Ohene Amofa	Research Assistant
27	Kwabena Gyampo	Research Assistant
28	Mohammed Shaban	Research Assistant
29	Monia Enyonam Honyo	Research Assistant
30	Jones Anan	Research Assistant
31	Jaylyn Lolonyo Akwetea-Foli	Research Assistant
32	Amanda Tetteh	Research Assistant
33	Susan Darkwahene-Boateng	Research Assistant
34	Daniel Okyere	Research Assistant
35	Emmanuel Afreh Kyei	Research Assistant
36	Nii Arku Laryae	Research Assistant
37	Simon Elikplim Alobuia	Research Assistant
38	Emmanuella Obike	Research Assistant
39	Makonk Najah	Research Assistant
40	Agnes Akosua Gyamaah Oclu	Research Assistant
41	Justice Danso	Research Assistant
42	Gabriella C.A. D. Acquah	Research Assistant
43	Ernest Quayson Eluerkeh	Research Assistant
44	Naa Shika Tettey	Research Assistant
45	Francisca Esifua Adu-Tsum	Research Assistant
46	Emmanuel Darko	Research Assistant

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47	Jonelle Darmoe	Research Assistant
48	Jennifer Seyram Amedior	Research Assistant
49	Danielle Emefa Deegbe	Research Assistant
50	Margaret Anima Annang	Research Assistant
51	Mohammed Jibril	Research Assistant
52	Comfort Sakyi-Addo	Research Assistant
53	Ezra Acquah	Research Assistant
54	Dorcas Abena Serwah Ofori	Research Assistant
55	Salamatu Ibrahim	Field Staff
56	Isaac Darko	Driver
<b>TOTAL CONTRACT STAFF STRENGTH = 56</b>		

## **CONTACT DETAILS**

For all telephone enquiries please contact the institute administration on +233 302 940 422 or +233 303 942 842.

For IP communication, contact the department through 4237 (department's secretary's office), 2090 (room 209), 2100 (room 210), 4116 & 4117 (research fellows office), 4120 (technicians office), 4216/4107 (lab 3) and 4230 (BSL-3 lab).

For email enquiries please contact us through the institute on [info@noguchi.ug.edu.gh](mailto:info@noguchi.ug.edu.gh) or through Bacteriology QMS at [bacteriologyqms@noguchi.ug.edu.gh](mailto:bacteriologyqms@noguchi.ug.edu.gh)

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## **OPERATIONAL HOURS AND LABORATORY SERVICES**

Apart from statutory public holidays and weekends, the department is opened between the hours of 8:00 am and 5:00 pm daily.

We offer analytical services upon request through any of the following.

1. The Director
2. The Head of Department
3. The Department's Administrative Secretary
4. Research Scientist (Project PI's)

### **ROUTINE ANALYTICAL SERVICE**


We currently do not offer analytical services on a routine basis but have the capacity to perform such analysis as and when demanded. Consequently, patients are not allowed to walk into the department to request analysis to be performed. We do, however, periodically receive direct analytic requests from clinicians to whom results or reports are submitted directly. Depending on the analysis requested, such requests are normally processed between 24 hours and 1 week. Advance analysis such as culture of *Mycobacteria tuberculosis* and *M. ulcerans* may take up to 3 months.

### **RESEARCH-BASED ANALYTICAL SERVICE**

Research-based analytical services cover in excess of 90% of the total workload of the department. This is not surprising as our core mandate is to perform research into bacterial infections.

Most of the research-based analytical services start from the field, where samples are collected and brought to the laboratory for analysis upon which reports are forwarded back to requesting officers. Trained research assistants and national service personnel are mostly deployed to the field for sample collection and transportation to the laboratory with a few instances where samples are transported to the laboratory independent of our trained laboratory staff.

Apart from churning out results in the form of reports to requesting clinicians, most of our analyses are published to inform both local and global public health control measures.

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### **URGENT ANALYTICAL REQUESTS**

As our mandate to support the Ghana Health Service and the Ministry of Health, by offering specialized diagnosis services, the department periodically receives samples to be tested in an urgent manner. As some of these cases may be suspected diseases that may pose a threat to the nation, priority is given to the analysis of such samples and results communicated as soon as available. Any such urgent request must be made to the department through the director and the head of the bacteriology department.

### **SPECIALIZED SERVICE ON MALDI-TOF BIOTYPING**


The Department of Bacteriology (NMIMR) provides microbial diagnostic services using the Matrix Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI-TOF-MS) Biotyper on commercial basis. The MALDI Biotyper identifies microorganisms by measuring the unique protein fingerprint of an organism. Specifically, the MALDI system measures highly abundant proteins that are found in microorganisms. The characteristic patterns of these proteins are used to reliably identify a particular microorganism by matching the respective patterns with an extensive database to determine the identity of the microorganism down to species level.

#### **The MALDI-TOF-MS Biotyper System is**

- Highly accurate and reproducible
- Applicable to a wide range of microorganisms—for example bacteria and fungi
- Much faster than traditional methods
- Cost effective.

#### **Guidelines for booking**

- Booking must be done by completing a form (soft or hard copy) via the Departmental secretary (gwemakor@noguchi.ug.edu.gh) at least one week before submission of cultures for analysis.
- Client(s) will receive an invoice from the Departmental secretary after booking.
- Upon receipt of the invoice, payment must be made at the accounts office of Noguchi Memorial Institute for Medical Research.

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- Research at a rate of \$8 per isolate for NMIMR staff, \$10 per isolate for UG clients and \$12 per isolate for non-UG clients
- Client(s) must submit a copy of the receipt to the Departmental secretary after payment and submit cultures for analysis.
- Upon receipt of cultures, analysis will be done within One-week. There is no restriction on the number of samples to be submitted for analysis.
- Bacterial cultures must be pure, grown on a suitable agar medium, forming single colonies and should not be older than 24 hours.
- All fungal cultures must be pure, grown on suitable medium; one culture per agar plate.
- All samples should be clearly (legible) identified, i.e. have a proper code written on the bottom of the Petri dish no longer than 5 digits.
- MALDI-TOF-MS diagnostic services runs from Monday-Friday, 9am – 3pm.

### **SAMPLE RECEIPT AND PROCESSING**


All samples collected for the above-mentioned services should comply with the institute’s SOP for collecting/receiving and storage of samples for processing (Mgt-030-1.0 and Mgt-031-1.0). Basically, samples should always be appropriately labelled with Name, Date, Time and tests to be performed and should come with accompanying test request forms. Inadequately labelled specimens will not be analyzed. Also, very important, the sample request forms should be filled with at least the Patient name, Age, Gender, clinical information, clinicians name and contact number.

All samples received in the department are processed in one of **eight** laboratories available in the department.

### **LABORATORIES IN THE DEPARTMENT**

In addition to some support laboratory areas (media room), the department houses **eight** main laboratories, two of which are biosafety level three (BSL-3) and the remaining five BSL-2 labs. One each of the BSL-3 and BSL-2 labs are located in the P3 facility attached to the main institute building and the remaining labs are housed in the advanced research laboratories (ARL).

1. Lab 1: BSL-2 lab located in the ARL mainly used for processing food and water samples

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2. Lab 2: BSL-2 lab located in the ARL mainly used for processing samples related to sexually transmitted infections
3. Lab 3: BSL-2 lab located in the ARL mainly used for processing pathological (clinical) samples
4. Lab 4: BSL-2 lab located in the ARL mainly used for processing environmental samples
5. Lab 5: Media Preparation laboratory mainly used for the sterile preparation of media
6. Lab 6: BSL-3 lab located in the ARL mainly used for processing *Mycobacterium* clinical samples
7. Lab 7: BSL-2 lab located in the main building mainly used for processing animal and environmental samples
8. Lab 8: BSL-3 lab located in the main building mainly used for processing animal and environmental samples
- 9.


**Lab 1: BSL-2 laboratory located in the ARL mainly used for processing food and water samples**

Lab 1 is one of the BSL-2 laboratories in the Department of Bacteriology. The lab is used for microbiological analysis of food and water, hence samples received are primarily food and water samples. The lab is well equipped with equipment that enables the smooth running and analysis of the samples received; while adhering to standard protocols and quality control processes.

Testing procedures and processes in Lab 1 are designed to enumerate, detect and identify bacteria, fungi, and other microorganisms present in foods and water. Important foodborne pathogens detected in the lab are, *Salmonella*, *E. coli*, *Listeria monocytogenes*, *campylobacter* spp. *Staphylococcus aureus* etc. Some processes carried out in the lab are culturing and sub-culturing of bacteria, biochemical testing for identification of bacteria, Gram staining, microscopy, Antimicrobial resistance (AMRs) etc.

Equipment found in the laboratory are  $-20^{\circ}\text{C}$  freezer, incubators (with temperatures ranging from  $25^{\circ}\text{C}$  to  $44^{\circ}\text{C}$ ), an autoclave, one biosafety cabinet and one clean bench, light microscopes, colony counters, a refrigerated centrifuge, vortex, water bath,  $+5^{\circ}\text{C}$  refrigerator, a rotaphor, and Millipore apparatus. These equipment are calibrated, verified, and serviced regularly to ensure its optimum functioning.

Project works currently being run in the department includes antimicrobial residue detection and Antimicrobial susceptibility testing (of pathogens) in fish and fish feed, and Microbial quality of water from different sources. The lab occasionally analyzes food samples for individuals and institutions upon referral from the Ghana Standard Authority and the Food and drugs Authority.

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**Lab 2: BSL-2 laboratory located in the ARL mainly used for processing samples related to sexually transmitted infections**

Lab 2, situated within the Advanced Research Laboratory (ARL), operates as a Biosafety Level 2 (BSL-2) facility, primarily dedicated to processing samples related to sexually transmitted infections (STIs). Despite its primary focus on STIs, Lab 2 serves as the core for most of the molecular assays performed in the department. The laboratory specializes in handling a diverse range of samples, including those associated with STIs, skin diseases and respiratory infections. These samples encompass urine, sputum and swabs from genital, rectal, wounds and oral sites.


As the core lab for most of the molecular assays, Lab 2 conducts nucleic acid amplification tests (NAATs) to detect DNA or RNA from pathogens such as *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Mycobacteria spp.* and other relevant microorganisms. In addition to NAATs, common microbiological procedures such as culture, biochemical assays (Gram staining and MALDI-TOF) and Microscopy are performed in this lab. Some of the equipment that uniquely differentiate Lab 2 from other labs in the department include: Microscan, for bacterial identification and antibiotic susceptibility testing, a Freeze Dryer, for removal of water from perishable material for preservation purposes, Twincubator, for genotyping, identification and drug susceptibility testing, Tecan Spark, for measuring absorbance. Apart from the aforementioned equipment, Lab 2 is endowed with other essential equipment such as microscopes, biosafety class II cabinets, -80 °C, -20 °C, and +4 °C refrigerators, 37 °C incubators, heating blocks, body weight scales, and an autoclave.

Under the leadership of Mr. Christian Bonsu, the lab representative, and supported by Mr. Abdul Basit Musah as the deputy lab representative, Lab 2 ensures that trained users adhere to established protocols and standards, ensuring the reliability and accuracy of results. Moreover, the laboratory actively contributes substantial support for downstream activities initiated by other labs within the department.

**Lab 3: BSL-2 laboratory located in the ARL mainly used for processing pathological (clinical) samples**

Lab 3 is one of the BSL-2 laboratories in the Department of Bacteriology. The lab primarily is used for the receiving and analysis of pathological (clinical) samples (blood, urine, stool, and other bodily fluids) and bacteria isolates. Lab 3 is well equipped with equipment that enables the smooth running and analysis of the samples received and ensures standards are met and quality



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control processes are adhered to. Equipment found in the laboratory include a –80°C and a –20°C freezers, incubators (with temperatures ranging from 32°C to 37°C), an autoclave, one biosafety cabinet and one clean bench, a digital microscope, a refrigerated centrifuge, vortex, BACTEC blood culture equipment and a +5°C refrigerator.

The laboratory is managed by two laboratory representatives (Ms. Elizabeth Akyeama Antwi and Ms. Jennifer Seyram Amedior). The laboratory employs different processes in the analysis of the pathological samples and the bacteria isolates it receives. These processes include; Bacteria Culture, Identification of Bacteria, Antimicrobial Susceptibility Testing, DNA Extraction, Polymerase Chain Reaction and Whole Genome Sequencing of Bacteria.

Main research projects being investigated in the laboratory as of December 2023 are Sequencing of bacteria, particularly the ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter* spp.) and Surveillance of Carbapenem Resistant and Extended Spectrum Beta-Lactamase producing enteric bacteria.

The laboratory adheres to safety protocols, quality management systems, and ISO Standards in performing its work.


#### **Lab 4: BSL-2 laboratory located in the ARL mainly used for processing environmental samples**

Lab 4 plays an important role in the Bacteriology Department and on a large scale the Noguchi Memorial Institute for Medical Research. Its primary focus lies in the analysis of environmental samples which contribute valuable insights into the microbial landscape of our surroundings. Samples received include but are not limited to soil, water, air filters and various organic matter.

##### ***Purpose:***

- To accurately analyze environment samples for bacterial isolates using various techniques.
- To contribute valuable insights into the microbial landscapes of our surroundings.

The laboratory routinely receives a diverse range of environmental samples for analysis. Samples received include soil, water, various organic matter from the environment, and other samples in constant relationship with the environment.

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These tests enable the laboratory to monitor and identify potential sources of microbial contamination in both urban and rural environments.

The laboratory employs various testing methods in analyzing environmental samples received. These tests are designed to detect and identify bacteria, fungi, and other microorganisms present in the environment. The most common procedure includes culture-based methods. In collaboration with other laboratories, procedures such as polymerase chain reaction (PCR), biochemical assays for identification of bacteria, MALDI-TOF identification of bacteria, and Gram staining.

The laboratory plays a very key role in understanding the potential health implications associated with environmental factors. By analyzing environmental samples received in the lab and identifying microbial pathogens, the laboratory contributes to the surveillance and monitoring of diseases linked to environmental sources. This includes but not limited to waterborne diseases, respiratory infections, and soil-transmitted illnesses.


The laboratory adheres to established protocols and standards in its day-to-day activities. This is to ensure the reliability and accuracy of results. This includes regular calibration of equipment, biosafety training, adherence to Good Laboratory Practices (GLPs) and proficiency testing which are fundamental elements of the laboratory's commitment to maintaining the highest standards.

### **Lab 5: Media Preparation laboratory mainly used for the sterile preparation of media**

The media room in the bacteriology unit of the ARL is a BSL 1 lab. It is primarily used for the sterile preparation of media in the department. The media room is equipped with instruments like

- autoclave for sterilization
- clean bench (laminar flow hood) for aseptic work
- electronic weighing balance for measuring the media
- water bath provides a controlled and consistent temperature for heating, cooling media to desired temperature as well as keeping autoclaved media for some time without solidifying
- pipettes for precise liquid handling

These are just a few examples of the equipment available in the media room. It is a well-equipped space for sterile media preparation in the department. Media is a substance or a mixture that provides nutrients and conditions necessary for the growth and cultivation of microorganisms like bacteria or fungi. In the department, we prepare and use

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various types of media, including but not limited to MacConkey Agar. MacConkey agar is a selective and differential medium that helps isolate and identify gram-negative bacteria. Another example is Blood agar, which contains added blood (usually from sheep or horses). It's used to detect and differentiate different types of bacteria based on their ability to breakdown blood cells.


A lab representative, Ms Agnes Oclu, manages the media room in the Bacteriology Department.

**Lab 6: BSL-3 laboratory located in the ARL mainly used for processing *Mycobacterium* clinical samples**

The BSL-3 located in the ARL, is a modern pathogen level three laboratory with state-of-the-art equipment not limited to, but including one BACTEC, mycobacteria growth indicator tube (MGIT) 960 system for mycobacterial culture and antimicrobial sensitivity analysis, 2 Gene Xpert rtPCR machine, for tuberculosis (TB) diagnosis and drug resistance monitoring, 1 Thermo scientific Multiskan Spectrophotometer for colorimetric readings, 1 nephelometer, 1 inverted light microscope, 2 biosafety class II cabinets, 2 Tomy digital autoclaves, 1 each of -80 °C, -20 °C and +4 °C refrigerators for storage of samples and reagents, 2 refrigerated centrifuges and four 37 °C incubators with one equipped with CO<sub>2</sub>. The main laboratory is fully fitted with a High Efficient Particulate Air (HEPA) filter system, that maintains a negative pressure of -50 Pa which is preceded by two ante-rooms (with air lock and access control) with -10 Pa and -30 Pa negative pressures respectively to allow the unilateral flow of air into the lab space. This very efficient system enhances the containment of organisms the lab is exposed to.

The laboratory is managed by two lab representatives (Dr. Prince Asare and Mr. Samuel Ofori Addo) and assisted by Mr. Phillip Tetteh. This BSL-3 laboratory is primarily used for the analysis of clinical bacterial pathogens belonging to the *Mycobacterium tuberculosis* complex (MTBC) both for diagnosis and research purposes. It currently has over 20 well equipped and competently trained facility users that are able to carry out various laboratory processes including, MTBC diagnosis by Gene Xpert, culture, ZN staining and microscopy, cell viability microplate Alamar Blue assay, DNA extraction among others. Some research activities that either start or culminate in the lab include Basic TB Research, One Health Research on TB, TB Epidemiology and Transmission, TB Comorbidity and Paediatric TB

The laboratory also heavily supports the National Tuberculosis Control Program (NTP) by providing diagnosis services and monitoring of difficult-to-treat TB cases. Samples that are mainly

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received in the laboratory include sputum samples with occasionally gastric lavage and cerebrospinal fluid.

**Lab 7: BSL-2 laboratory located in the main building mainly used for processing animal and environmental samples**



This BSL-2 laboratory is located within the main building, ensuring convenient access for authorized personnel. This laboratory is dedicated to supporting Zeihl-Neelsen staining procedures, a vital technique used in the identification of acid-fast bacteria, including Mycobacterium species.

To facilitate this, the lab is fully equipped with a comprehensive range of staining stock solutions, such as carbol fuchsin, acid-alcohol, and methylene blue, along with specialized staining apparatus like racks, jars, and slide holders. a clean bench, offering a sterile workspace for handling slides and staining solutions, thereby minimizing contamination risks. An integrated high-efficiency fume extractor ensures the removal of hazardous fumes and chemical vapors generated during staining procedures, maintaining a safe and clean environment. Dedicated cabinets are provided for the secure and organized storage of staining solutions, promoting longevity and preventing contamination.

Stringent safety protocols are enforced by laboratory representatives, Dr. Prince Asare and Dr. Samuel Ofori Addo, to mitigate risks associated with staining procedures. All users are required to wear appropriate personal protective equipment, including lab coats, gloves, and safety goggles, at all times during lab activities. All staining procedures must be conducted within the designated area to minimize exposure to aerosols and splashes. Chemical spills or accidents are promptly reported and addressed using designated spill kits and disinfectants. Slides prepared in the adjacent BSL-3 lab undergo inactivation procedures, before being transferred to the BSL-2 lab for staining. This ensures that the slides are rendered non-infectious and safe for handling in a BSL-2 environment. All users are expected to adhere strictly to the guidelines and procedures outlined in the laboratory handbook to maintain a consistent standard of safety, professionalism, and operational efficiency.

**Lab 8: BSL-3 laboratory located in the main building mainly used for processing animal and environmental samples**

Our BSL-3 laboratory, situated within the main building, is a cutting-edge facility dedicated to the analysis of zoonotic tuberculosis and non-tuberculous mycobacteria (NTM). Equipped with

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state-of-the-art instrumentation and adhering to stringent safety protocols, our laboratory provides a secure environment for conducting essential research in the field of infectious diseases. Equipment includes an Air tech Biosafety cabinet, one Tomy digital autoclave, and refrigeration units at -20°C and +4°C for the storage of samples and reagents. Essential laboratory equipment such as centrifuges and three 37°C incubators, one of which is equipped with CO<sub>2</sub>, are available to support various analytical processes.

The main laboratory space is outfitted with a High-Efficiency Particulate Air (HEPA) filter system, maintaining a negative pressure of -50 Pa to ensure the containment of airborne pathogens.

Preceding the main lab are two anterooms with controlled access and negative pressures of -10 Pa and -30 Pa respectively, facilitating the unilateral flow of air into the lab space for enhanced containment. Our laboratory is under the expert management of two dedicated lab representatives, Dr. Prince Asare and Dr. Samuel Ofori Addo, with support from Ms. Nanabea Akuffo-Lartey. A team of approximately 10 skilled and trained facility users contribute their expertise to carry out diverse laboratory processes, including MTBC culture, ZN staining and microscopy, cell viability assays, DNA extraction, and more.


Our research activities encompass a broad spectrum of investigations related to zoonotic tuberculosis and NTM.

Research initiatives include fundamental studies on TB pathogenesis, One Health approaches to understanding TB transmission dynamics, and epidemiological investigations aimed at informing public health interventions.

We actively collaborate with researchers, public health agencies, and veterinary professionals to advance knowledge and address challenges associated with zoonotic tuberculosis and NTM infections.

## **LIST OF KEY RESEARCH DISEASE AREAS/ PROJECTS**

1. Yaws
2. Wound care
3. Skin Health African Research Programme
4. National Tuberculosis Control Programme Sputum transport and TB drug-resistant Survey

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5. Early Life Microbiome of Ghanaian Infants
6. Impact of COVID-19 Control Measures on Health Systems Functioning (UKRI)
7. Food / Water Safety and One Health
8. Antimicrobial resistance (AMR):
9. Tuberculosis Research: One Health Research on Tuberculosis, Paediatric Tuberculosis, Tuberculosis Comorbidity, Basic Tuberculosis Research
10. Diarrhoea Surveillance
11. Basic Tuberculosis Research
12. Microbiome
13. Epidemiology and Transmission
14. COVID-19 and Co-infections
15. Pneumonia and Meningitis: Towards Vaccine Development
16. Trachoma
17. Point of Care Diagnostic Tool Development
18. Clinical Buruli Ulcer Diagnosis, Trainings & Interventions
19. Buruli Ulcer Wound Care
20. Drug Discovery

### **LIST OF ANALYTICAL TESTS AVAILABLE**

1. Tuberculosis Diagnosis by PCR
2. Tuberculosis monitoring by Culture and Sensitivity
3. Spoligotyping
4. MIRU-VNTR genotyping
5. Molecular Bacterial Load Assay (MBLA) for TB
6. MALDI-ToF Biotyping

### **REQUESTS FOR LAB INVESTIGATIONS**

Please refer to the instructions on MALDI-ToF biotyping. All other requests are either made through the director, HOD, Administrative secretary or respective principal investigators.

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## REPORTS COLLECTION

Reports are collected at the designated collection point by using the receipts given when payments were made. Days and times for collecting reports are communicated to the client when the samples are received.

## TURN AROUND TIMES (TAT)

This indicates how long it will take the lab to run tests and release results.

<b>TEST</b>	<b>TAT</b>
<b>1. Tuberculosis Diagnosis by PCR</b>	48 hours
<b>2. Tuberculosis monitoring by Culture and Sensitivity</b>	10 working days on liquid medium and 60 working days on solid medium
<b>3. Spoligotyping</b>	48 hours 40 samples
<b>4. MIRU-VNTR genotyping</b>	72 hours per 40 samples
<b>5. Molecular Bacterial Load Assay for TB</b>	48 hours
<b>6. MALDI-ToF Biotyping</b>	8 hours to 48 hours
<b>7. Bacteria AMR Analysis</b>	72 hours
<b>8. Microbial Food and Water Analysis</b>	1 week to 2 weeks
<b>9. Evaluation of kits, drugs and other products</b>	2 weeks to 4 weeks
<b>10. BU diagnosis</b>	48 hours
<b>11. BU Culture</b>	90 working days
<b>12. Gene Xpert PCR for Chlamydia and Gonorrhoea</b>	Within 48 hours
<b>13. LPA for TB DR</b>	1 week

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## **DISCLAIMER**

The department reserves the right to discard any sample as per our sample rejection criteria outlined in our SOPs. For diagnosis and referral cases, the department is not responsible for providing sample containers. Where request forms are incorrectly or illegibly completed, the department reserves the right to reject such requests.



## **LIST OF INTERNAL COLLABORATORS**

1. Dr. Bright Adu, Immunology Department
2. Dr. Evelyn Bonney, Virology Department
3. Dr. George Kyei, Virology Department
4. Dr. Ivy Asante, Virology Department
5. Dr. Kwadwo Asamoah Kusi, Immunology Department
6. Dr. Naiki Puplampu Attram, NAMRU3, Ghana Detachment
7. Dr. Samuel Adjei – Animal Experimentation Department
8. Prof. Kwadwo Ansah Koram (MD, PhD)
9. Prof. Regina Appiah-Opong (PhD)
10. Prof. William Ampofo, Virology Department


## **LIST OF EXTERNAL COLLABORATORS**

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2. Dr. Audrey Forson (Consultant Pulmonologist)
3. Dr. Farida Abdulai, Regional TB Coordinator, GHS
4. Dr. Frank Bonsu, National TB control Programme (NTP), Ghana
5. Dr. Giulia D’Odorico (MSc, PhD, Research Fellow), Department of Global Health and Development, Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine (LSHTM), UK,
6. Dr. Gloria Ansa, University of Ghana Hospital
7. Dr. Iddrisu Yahaya, Chest Clinic, KBTH





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8. Dr. Jacob Novignon, (PhD, Health Economics) Department of Kwame Nkrumah University of Science & Technology, Ghana,
9. Dr. Jane Afriyie-Mensah, MD, Head Chest Dept KBTH
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13. Dr. Mrs. Rita Frimpong-Amenyo– Deputy Programme Manager – NTP
14. Dr. Oliver Commey, Ghana Infectious Disease Center
15. Dr. Pierre Schneeberger, Swiss tropical and Public Health Institute, Switzerland
16. Dr. Rita Patricia Frimpong, National TB control Programme (NTP), Ghana
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23. Dr. Yayra Klinogo, Chest Clinic, KBTH
24. Elisabeth Shayo; Kilimanjaro Clinical Research Institute, Tanzania
25. Elizabeth Ekirapa; Kiracho Makerere University College of Health Sciences, Uganda
26. Eric Agongo Akugre, Veterinary Services Directorate, Ministry of Food and Agriculture, Bolgatanga, Upper East region, Ghana
27. Giuliano Russo; Queen Mary University London, UK
28. Mark Urassa; National Institute of Medical Research, Tanzania
29. Mr. Felix Sorvor – National Laboratory Focal Person – NTP GHS
30. Mr. Michael Amo Omari, Chest Clinic, KBTH

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## **LIST OF FUNDERS**

1. AAS
2. Africa CDC
3. Africa Research Excellence Fund
4. African Society for Laboratory Medicine
5. AMED-JICA (the Science and Technology Research Partnership for Sustainable Development, SATREPS)
6. Aspire
7. Bill and Melinda Gates Foundation
8. CAMBRIDGE-AFRICA ALBORADA FUND
9. CAN
10. European and Developing Countries Clinical Trials Partnership (EDCTP)
11. FIND
12. Ghana Health Service
13. GlaxoSmithKline (GSK) Senior Fellowship
14. Global Emerging Infections Surveillance
15. Global fund
16. Leading House Africa Research Partnership Grant
17. Leverhulme-Royal Society Africa Award
18. Mucosal Pathogen Research Unit, UK
19. NIH
20. NMIMR project funds
21. Pan-Africa Network of Genomic Surveillance of Poverty Related Diseases and Emerging Pathogens (PANGenS)
22. Swiss Tropical and Public Health Institute
23. The Fleming Fund/SEQAFRICA
24. The Pan-African Network for Rapid Research, Response, Relief and Preparedness for Infectious Diseases Epidemics (PANDORA-ID-NET) Consortium
25. UK Research and Innovation (UKRI)
26. Wellcome Trust
27. Wellcome Trust Sanger Institute
28. World Health Organization

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## **ATTACHMENT**

Staff training form

Sample receipt forms

Results Report Form

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## **BIBLIOGRAPHY**

Mgt-030-1.0 - Standard Operating Procedure on sample collection and transport

Mgt-031-1.0 - SOP on Sample Receipt and Storage