

	NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH	
	DEPARTMENT OF BACTERIOLOGY	
	HANDBOOK FOR BACTERIOLOGY DEPARTMENT SERVICES	
	Reference Number: Bac-063-2.0	Effective Date: 1st August 2026

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

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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 Diseases (NTDs) 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) Immunodiagnosics for TB (QuantiFERON TB tests, T.Spot-TB tests). The Department houses a state-of-the-art Biosafety Level 3 (BSL-3) pathogen facility, recognised as a 4-stars BSL-3 facility by Africa CDC and one of the leading facilities in West Africa, which serves as the primary platform for TB research activities.

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 diseases 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 sexually transmitted bacterial 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 ensure that research findings contribute meaningfully to disease control, the Department engages with endemic communities in close collaboration with the relevant national disease control programmes and district health management teams of the Ghana Health Service (GHS). The TB and BU laboratories serve as reference laboratories, and the TB laboratory plays a key role in coordination and maintenance of the National TB Laboratory Network. These responsibilities include the development of training manuals, organization of laboratory training programmes, implementation of nationwide TB laboratory quality assurance systems, and surveillance of anti-TB drug resistance.

The Department has been actively involved in manpower development for the GHS and the Ministry of Health, particularly in the correct identification of bacterial species, standardised antimicrobial susceptibility testing and the accurate identification of skin NTDs. In addition, the Department has contributed to regional capacity building through the training of laboratory personnel from several West and Central African countries through the JICA/NMIMR Third country Training Programme.

The Department maintains collaborative partnerships with several units of the University of Ghana, including the Department of Biochemistry, Cell & Molecular Biology; the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP); the School of Veterinary Medicine, the School of Public Health and the Department of Medical Microbiology. These collaborations facilitate joint research initiatives and enhance student training through internships, as well as the supervision of undergraduate and postgraduate research projects.

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.

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QUALITY OBJECTIVE

The department is currently accredited and adheres to the ISO 15189:2022 quality standards for general bacteriology and mycobacteriology culture and identification. Our methods, among others include Gram staining, Antimicrobial Susceptibility Testing (AST), GeneXpert, Line Probe Assay (LPA), and Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS). We ensure that most of our processes are carried out in accordance with controlled standard operating procedures (SOPs). We aim to attain ISO/ IEC 17025: 2017 accreditation for our environmental laboratory, as well as the food and water laboratory.

Our main quality objectives:

1. Leadership & governance

1.1. To enhance the integrity of the Institute by attaining ISO/ IEC 17025: 2017 and maintaining ISO 15189:2022 for methods in the Bacteriology Department.

2. Quality infrastructure

2.1. To maintain at least 90% of all set quality indicators of the quality management system.

3. Research & development

3.1.a To publish at least sixty (60) papers in peer-reviewed journals, with nineteen (19) lead or corresponding authors from the Department.

3.1.b To submit at least thirty-six (36) grant applications and win at least 20% grants.

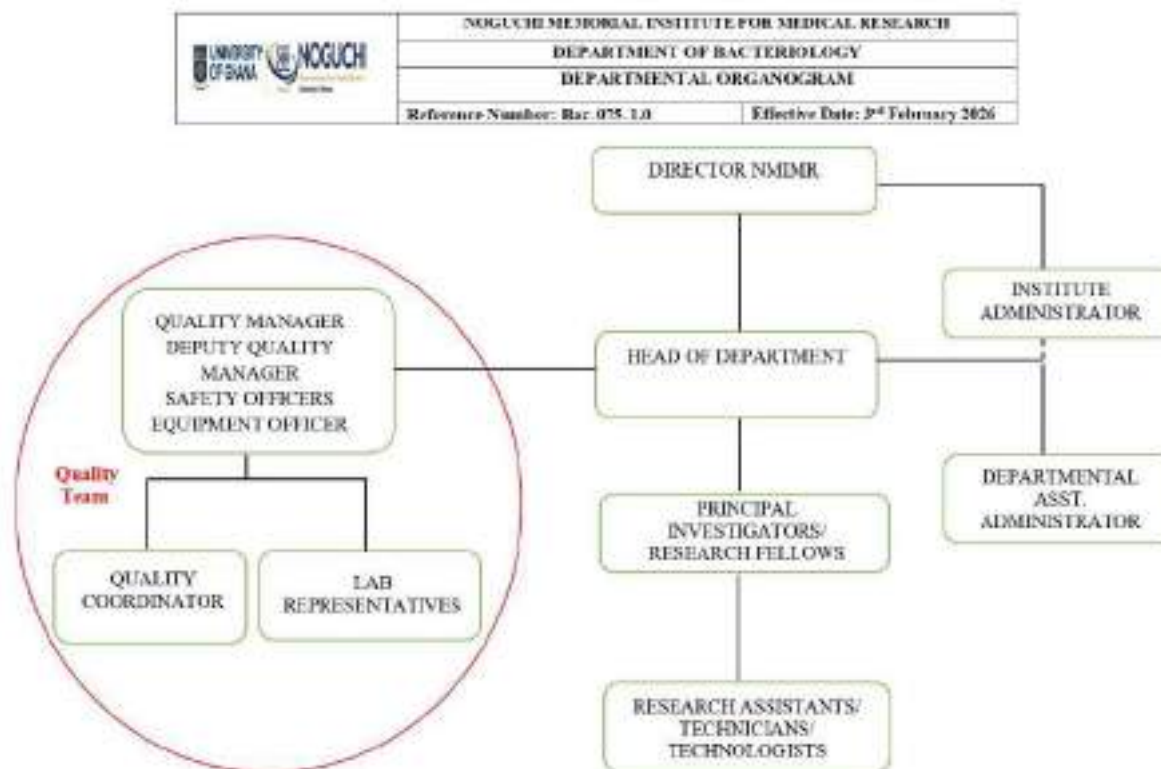
4. Customer satisfaction

4.1 To attain 80% customer satisfaction among Bacteriology customers.



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ORGANOGRAM



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STAFF

As of March 2026, the department housed a total of 67 staff strength including 23 permanent staff and 44 contract staff. The total number of contract staff remains fluid throughout 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.

Research Scientists		
1	Prof. Adwoa Asante-Poku	Associate Professor & Head of Department
2	Prof. Dorothy Yeboah-Manu	Professor
3	Prof. Kennedy Kwasi Addo	Professor (post-retirement contract)
4	Prof. Anthony Ablordey	Associate Professor (post-retirement contract)
5	Prof. Gloria Ivy Mensah	Associate Professor
6	Prof. Beverly Egyir	Associate Professor
7	Dr. Isaac Darko Otchere	Senior Research Fellow
8	Dr. Prince Asare	Senior Research Fellow & Quality Manager
9	Dr. Samuel Ofori Addo	Research Fellow & BSL 3 Lab Representative
Research Assistants/ Technologists		
10	Mr. Kwaku Owusu-Darko	Chief Research Assistant & Lab 2 Representative
11	Dr. Lorenzo Moses Akyeh	Principal Technologist
12	Mr. Christian Bonsu	Chief /Supt. Technologist
13	Dr. Vida Y. Adjei	Principal Research Assistant & Deputy Quality Manager
14	Dr. Shirley Victoria Simpson	Senior Research Assistant
15	Dr. Emelia Konadu Danso	Senior Research Assistant & BSL 3 Lab Representative, main building

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16	Mr. Phillip Tetteh	Research Assistant & Deputy BSL 3 Lab Representative
17	Mr. Ishaque Mintah Siam	Research Assistant & Media Preparation room Representative
18	Ms. Ivy Naa Korshie Lamptey	Research Assistant & Deputy Lab 2 Representative
19	Ms. Elizabeth Akyeama Antwi	Technologist, Safety Officer & Lab 3 Representative
20	Mr. Isaac Sakyi Asare	Technologist, Equipment Officer & Lab 4 Representative
21	Ms. Nanabea Akuffo-Lartey	Technologist & Deputy BSL 3 Lab Representative & Safety Officer
Administrative Assistant		
22	Ms. Marian Annowa Nyako	Chief Administrative Assistant
Other Support Staff		
23	Mr. William Nyarko Amoah	Technical Assistant
TOTAL PERMANENT STAFF STRENGTH = 23		
Contract Staff		
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
4	Dr. Justice Akwensi	Post-Doctoral Student
5	Ezekiel Kofi Vicar	PhD Student
6	Dr. Mary O. Ayoola-Wiliams	PhD Student
7	Gloria Pokua Manu	PhD Student

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8	Felicia Owusu Amoa	Chief Research Assistant & Lab 4 Representative
9	Jeannette Bentum	Chief Research Assistant
10	Christian Owusu Nyantakyi	Principal Research Assistant
11	Alfred Bortey	Principal Research Assistant
12	William Boateng	Principal Research Assistant
13	Blessing Kofi Adu Tabi	Principal Research Assistant
14	Rhodalyne Tagoe	Principal Research Assistant
15	Grebstard Rabbi Amuasi	Principal Research Assistant
16	Theophilus Afum	Principal Research Assistant /PhD student & Deputy PCR Suite Lab Representative
17	Priscilla Ferguson Barnes	Principal Research assistant/ QMS Coordinator
18	Ridhiwani Manyuti	MSc Student
19	Tabitha Naa Koney	MSc Student & Deputy Lab 1 Representative
20	Daniel Kwaku Baka	Senior Research Assistant
21	Kelvin Smith Ofosu-Darko	Research Assistant
22	Amy Dziedzorm Dzadey	Research Assistant
23	Justice Ohene Amofa	Research Assistant
24	Mohammed Shaban	Research Assistant
25	Monia Enyonam Honyo	Research Assistant
26	Jones Anan	Research Assistant

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27	Jaylyn Lolonyo Akwetea-Foli	Research Assistant
28	Amanda Tetteh	Research Assistant
29	Daniel Okyere	Research Assistant
30	Emmanuel Afreh Kyei	Research Assistant
31	Nii Arku Laryae	Research Assistant
32	Simon Elikplim Alobuia	Research Assistant
33	Emmanuella Obike	Research Assistant
34	Makonk Najah	Research Assistant
35	Agnes Akosua Gyamaah Oclu	Senior Research Assistant & Deputy Media Room & Store 3 Representative
36	Justice Danso	Senior Research Assistant & MPhil student
37	Gabriella C.A. D. Acquah	Senior Research Assistant
38	Naa Shika Tettey	Research Assistant & Deputy Lab 1 Representative
39	Francisca Esifua Adu-Twum	Research Assistant
40	Emmanuel Darko	Research Assistant
41	Jennifer Seyram Amedior	Senior Research Assistant & Deputy Lab 3 Representative
42	Mohammed Jibril	Research Assistant
43	Salamat Ibrahim	Field Staff
44	Isaac Darko	Driver
TOTAL CONTRACT STAFF STRENGTH = 44		

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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 or through Bacteriology Secretariat at bnmimr@noguchi.ug.edu.gh or through Bacteriology QMS at bacteriologyqms@noguchi.ug.edu.gh

OPERATIONAL HOURS AND LABORATORY SERVICES

The Department operates from 8:00 am to 5:00 pm, Monday to Friday, excluding statutory public holidays and weekends.

Requests for analytical services may be directed to the Director of the Institute with all of the following in copy as the case may be,

1. The Head of the Bacteriology Department
2. The Bacteriology Department's Administrative Secretary
3. The Research Scientist (Project PI's if known)

ROUTINE ANALYTICAL SERVICE

The Department does not provide routine walk-in diagnostic services. Analytical services are conducted primarily within the context of approved projects or upon formal request. Consequently, patients or the public are not permitted to present directly to the Department for laboratory testing. However, the Department periodically receives analytical requests directly from clinicians, to whom results and reports are communicated accordingly. Turnaround times for most analyses ranges from 24 hours to one week, depending on the nature of the investigation. Specialised analyses such as the culture of *Mycobacterium tuberculosis* and *Mycobacterium ulcerans* may require up to 3 months.

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

Research-based analytical services constitute over 90% of the Department's workload, consistent with its core mandate of conducting research into bacterial diseases.

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.

## **HANDLING OF URGENT (STAT) SAMPLES/ ANALYTICAL REQUESTS**

### **Purpose**

The Department of Bacteriology recognizes that certain specimens require expedited processing due to their potential impact on patient management, infection prevention, outbreak investigations, or public health interventions. Such specimens are designated as **Urgent (STAT)** samples and are given priority throughout the laboratory testing process.

### **Identification of Urgent Samples**

To ensure prompt handling, urgent samples should be clearly identified at the time of submission by:

- Marking "**URGENT**", "**STAT**", or an equivalent designation on the request form and specimen container, where applicable.
- Communicating the urgency to laboratory personnel at the time of sample submission.
- Providing relevant clinical or public health information to justify expedited processing.

### **Handling Procedure for Urgent Samples**

Upon receipt of an urgent sample, the laboratory shall:

1. **Prioritize sample reception and registration** to minimize delays in accessioning.

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2. **Assess specimen acceptability** according to established sample acceptance criteria.
3. **Notify the responsible laboratory personnel** of the urgent request.
4. **Prioritize testing and examination activities** over routine samples where operationally feasible.
5. **Monitor progress of testing** to ensure timely completion.
6. **Review and authorize results promptly** once testing is completed.
7. **Communicate critical or urgent results immediately** to the requesting clinician, investigator, or authorized recipient using approved communication channels.
8. **Document urgent communications**, including date, time, recipient, and name of laboratory personnel providing the information.

#### **Turnaround Time for Urgent Samples**

The laboratory will make every reasonable effort to process urgent samples within the shortest achievable timeframe. However, turnaround times may vary depending on:

- The type of examination requested;
- Availability of personnel and equipment;
- Complexity of testing procedures;
- Requirement for confirmatory testing; and
- Sample quality and acceptability.

Where delays are anticipated, the laboratory will communicate the expected timeframe to the user.

#### **Limitations**

Certain microbiological examinations, including culture-based methods such as tuberculosis culture, blood culture, and antimicrobial susceptibility testing, require defined incubation periods and cannot be significantly accelerated without compromising result quality. In such cases, urgent handling will focus on prioritizing processing, monitoring, and reporting activities while maintaining the integrity of the examination process.

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### **User Responsibilities**

Users requesting urgent testing shall:

- Clearly indicate the urgency of the request.
- Provide complete clinical or project-related information.
- Ensure timely delivery of specimens to the laboratory.
- Provide accurate contact information for rapid communication of results.

### **Contact for Urgent Requests**

Users requiring urgent laboratory services should contact the Department of Bacteriology through the official departmental contact numbers or email addresses provided in this handbook before or at the time of sample submission. Any such urgent request must be made to the department through the director and the head of the bacteriology department.

### **ORAL REQUESTS**

#### **Justification of exclusion:**

The UG-NMIMR is a biomedical research facility. Laboratory examinations carried out are for research purposes or following a referral from a medical facility. Referral cases from identifiable medical facilities are accompanied by a supporting requisition (e.g. test request form or line list). Oral requests are not accepted and hence excluded under the QMS.

### **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 a 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

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- 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 copy sent via [maldi-tof@noguchi.ug.edu.gh](mailto:maldi-tof@noguchi.ug.edu.gh) with Bacteriology Secretariat [bnmimr@noguchi.ug.edu.gh](mailto:bnmimr@noguchi.ug.edu.gh) in copy or hard copy) at least one week before submission of cultures for analysis. Client(s) will receive an invoice after booking.
- Upon receipt of the invoice, payment must be made at the accounts office of Noguchi Memorial Institute for Medical Research.
- 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 submitted to the Department for the above-mentioned services must comply with the institute's SOPs for the collection, receipt and storage of samples for laboratory processing (Mgt-030-1.0 and Mgt-031-1.0). Each sample must be appropriately labelled with the following information: patient or sample identification (where applicable), date and time of collection, type of specimen, and requested laboratory test(s). All samples must be accompanied by a completed laboratory request form containing at a minimum: patient name, age, sex, relevant clinical information, requesting clinician's name and contact details of the requesting clinician. Samples that are inadequately labelled or submitted without the required accompanying information may be rejected in accordance with the Institute's sample acceptance policy.

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All accepted samples are received, logged, and processed in the appropriate laboratory based on the nature of the specimen and the analytical procedures required.

## **LABORATORIES IN THE DEPARTMENT**

The Department has seven specialised laboratories, supported by ancillary facilities such as the media preparation room and other shared laboratory support areas. These laboratories provide infrastructure for diagnostic, research, and training activities across the Department's areas of specialization. The Department operates two Biosafety Level 3 (BSL-3) laboratories and five Biosafety Level 2 (BSL-2) laboratories. One BSL-3 laboratory and one BSL-2 laboratory are located within the Pathogen Level 3 (P3) facility adjoining the main Institute building, while the remaining laboratories are housed in the Advanced Research Laboratories (ARL). Each laboratory is equipped to support specific research and diagnostic activities and operates in accordance with institutional biosafety, biosecurity, and quality management requirements. The Department's laboratory facilities comprise the following specialised laboratories:

**Laboratory 1 (BSL-2, ARL)** – Dedicated to the processing and analysis of food and water samples.

**Laboratory 2 (BSL-2, ARL)** – Dedicated to the processing and analysis of specimens related to sexually transmitted infections (STIs).

**Laboratory 3 (BSL-2, ARL)** – Dedicated to the processing and analysis of clinical (pathological) specimens.

**Laboratory 4 (BSL-2, ARL)** – Dedicated to the processing and analysis of environmental samples.

**Laboratory 5 (BSL-3, ARL)** – Dedicated to the processing and analysis of clinical specimens containing *Mycobacterium* species for tuberculosis diagnosis and research.

**Laboratory 6 (BSL-2, Main Building)** – Dedicated to the processing and analysis of animal and environmental specimens, including Ziehl–Neelsen staining of inactivated specimens.

**Laboratory 7 (BSL-3, Main Building)** – Dedicated to the processing and analysis of animal and environmental specimens for research on zoonotic tuberculosis, non-tuberculous mycobacteria (NTM) infections and other bacterial zoonosis.

|                                                                                  |                                                        |                                        |
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**Media Preparation Room (ARL)** – Responsible for the preparation, sterilization, quality control, and storage of microbiological culture media and related reagents for departmental laboratory activities.

### **Laboratory 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°C freezer, incubators (with temperatures ranging from 25°C to 44°C), an autoclave, one biosafety cabinet and one clean bench, light microscopes, colony counters, a refrigerated centrifuge, vortex, water bath, +5°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. This laboratory is under the leadership of Dr. Vida Adjei and Ms. Naa Shika Tettey.

### **Laboratory 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

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(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 Dr. Moses Lorenzo Akyeh, the lab representative, and supported by Ms. Tabitha Naa Koney 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.

### **Laboratory 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 control processes are adhered to. Equipment found in the laboratory include a -80°C and -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 mini centrifuge, vortex, BACTEC blood culture equipment and +5°C refrigerators.

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 February 2026 are Sequencing of bacteria, particularly the ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter*

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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.

#### **Laboratory 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.

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

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are fundamental elements of the laboratory's commitment to maintaining the highest standards. This lab is managed by Mr. Isaac Asare.

### **Laboratory 5: BSL-3 laboratory located in the ARL mainly used for processing *Mycobacterium* clinical samples**

The Biosafety Level 3 (BSL-3) Laboratory, located in the ARL, is a state-of-the-art containment facility dedicated to the safe handling and processing of *Mycobacterium* clinical specimens for both diagnostic and research purposes. The laboratory is equipped with advanced instrumentation, including a BACTEC™ *Mycobacteria* Growth Indicator Tube (MGIT) 960 System for mycobacterial culture and drug susceptibility testing; two GeneXpert® real-time PCR systems for tuberculosis (TB) diagnosis and drug resistance detection; a Thermo Scientific Multiskan™ spectrophotometer; a nephelometer; four conventional light microscopes, an inverted light microscope; two LED fluorescence microscopes; two Class II biosafety cabinets; two Tomy digital autoclaves; -80 °C, -20 °C, and 4 °C storage units for samples and reagents; two refrigerated centrifuges; and four 37 °C incubators, one of which is equipped with CO<sub>2</sub> control.

The facility incorporates a High-Efficiency Particulate Air (HEPA) filtration system that maintains a laboratory negative pressure of -50 Pa. Access to the laboratory is through two sequential ante-rooms maintained at -10 Pa and -30 Pa, respectively, with air-lock and controlled-access systems. This design ensures unidirectional airflow into the laboratory, providing effective containment of infectious agents and enhancing personnel and environmental safety.

The laboratory is managed by Dr. Samuel Ofori Addo and Mr. Phillip Tetteh, who oversee its operations, biosafety compliance, and user training. The facility supports a team of over 20 trained and certified users who perform a wide range of diagnostic and research procedures, including GeneXpert testing, mycobacterial culture and drug susceptibility testing, Ziehl-Neelsen staining and microscopy, cell viability assays using the microplate Alamar Blue method, DNA extraction, and other molecular and microbiological techniques. The BSL-3 laboratory serves as a key platform for the Department's tuberculosis research portfolio, supporting studies in basic TB biology, One Health approaches to TB, TB epidemiology and transmission, TB comorbidities, Biomarkers for TB diagnosis and treatment monitoring and paediatric TB. In addition, it provides critical support to the National Tuberculosis Control Programme (NTP) by offering specialized diagnostic services and laboratory monitoring for drug-resistant and other difficult-to-manage TB cases. The laboratory primarily processes sputum specimens, with other pulmonary and extrapulmonary specimens received when clinically indicated.

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### **Laboratory 6: BSL-2 laboratory located in the main building mainly used for processing animal and environmental samples**

The Biosafety Level 2 (BSL-2) Laboratory, located within the Department's main building, supports the processing of animal and environmental samples and serves as the designated facility for Ziehl–Neelsen (ZN) staining. This laboratory plays an important role in the identification of acid-fast bacilli, including *Mycobacterium* species, following specimen processing and inactivation.

The laboratory is equipped with the reagents and infrastructure required for ZN staining, including carbol fuchsin, acid-alcohol, and methylene blue staining solutions, staining racks, jars, slide holders, a clean bench for aseptic handling of slides, and a high-efficiency fume extraction system to remove hazardous chemical vapours generated during staining procedures. Dedicated storage cabinets are provided for the safe and organized storage of staining reagents and laboratory consumables.

The laboratory is managed by Dr. Emelia Konadu and Ms. Nanabea Akuffo-Lartey, who oversee laboratory operations, biosafety compliance, and user training. All users are required to adhere to established biosafety and operational procedures, including the use of appropriate personal protective equipment (PPE) such as laboratory coats, gloves, and eye protection. Chemical spills and laboratory incidents are managed in accordance with departmental biosafety procedures using designated spill response materials.

To ensure personnel safety, microscope slides prepared in the adjacent BSL-3 laboratory undergo validated inactivation procedures before transfer to the BSL-2 laboratory for staining and microscopy. All users are expected to comply with the Department's laboratory policies and biosafety guidelines to ensure safe, efficient, and high-quality laboratory operations.

### **Laboratory 7: Biosafety Level 3 (BSL-3) Laboratory**

The Biosafety Level 3 (BSL-3) Laboratory, located within the Department's main building, is dedicated to the processing of animal and environmental specimens for the investigation of zoonotic tuberculosis and non-tuberculous mycobacteria (NTM). The facility provides a secure containment environment for research on high-risk pathogens while supporting the Department's One Health research agenda.

The laboratory is equipped with modern instrumentation, including an Airtech Class II Biosafety Cabinet, a Tomy digital autoclave, refrigerated storage units maintained at  $-20\text{ }^{\circ}\text{C}$  and  $4\text{ }^{\circ}\text{C}$ , centrifuges, and three  $37\text{ }^{\circ}\text{C}$  incubators, one of which is fitted with  $\text{CO}_2$  control to support

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specialized culture procedures. The laboratory is further equipped with a High-Efficiency Particulate Air (HEPA) filtration system that maintains a negative pressure of  $-50$  Pa, ensuring effective containment of airborne pathogens.

Access to the laboratory is through two controlled-access ante-rooms maintained at  $-10$  Pa and  $-30$  Pa, respectively, creating a unidirectional airflow system that enhances biosafety and prevents the escape of infectious aerosols.

The laboratory is managed by Dr. Emelia Konadu, with support from Ms. Nanabea Akuffo-Lartey, who oversee facility operations, biosafety compliance, and user training. Trained and authorized personnel perform a range of laboratory procedures, including sample preparation, specimen decontamination, and the culture and characterization of zoonotic *Mycobacterium* species and non-tuberculous mycobacteria.

The facility supports research in tuberculosis pathogenesis, One Health approaches to tuberculosis, zoonotic TB transmission, non-tuberculous mycobacterial infections, and molecular and epidemiological investigations that inform disease surveillance and public health interventions. The laboratory also serves as a platform for collaborative research involving national and international partners, including public health institutions, veterinary professionals, and academic researchers working to address the growing challenges posed by zoonotic tuberculosis and non-tuberculous mycobacterial diseases.

### **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 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

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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 break down blood cells. A lab representative, Mr Ishaque Siam and the deputy Ms Agnes Oclu, manages the media room in the Bacteriology Department.

## **FACTORS THAT MAY SIGNIFICANTLY IMPACT EXAMINATION PERFORMANCE OR INTERPRETATION OF RESULTS**

### **Important Information for Laboratory Users**

The accuracy, reliability, and interpretation of laboratory results may be affected by several pre-examination, examination, and post-examination factors. Users are advised to consider the following when requesting tests and interpreting results:

#### **Pre-Examination Factors**

- Incorrect patient/participant identification.
- Inappropriate specimen type submitted for the requested test.
- Insufficient specimen volume.
- Improper specimen collection procedures.
- Contamination of specimens during collection or transportation.
- Delayed transportation of samples to the laboratory.
- Failure to maintain required storage or transport temperatures.
- Use of expired or inappropriate collection containers.
- Missing or incomplete clinical and demographic information.

#### **Examination Factors**

- Poor specimen quality (e.g., haemolysed, leaking, desiccated, contaminated, or improperly preserved specimens).
- Presence of antimicrobial agents or other substances that may inhibit microbial growth.
- Low organism burden below the analytical detection limit of the method.
- Mixed cultures or overgrowth of contaminating organisms.

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- Instrument or equipment malfunction.
- Reagent, media, or quality control failures.
- Environmental conditions affecting test performance.

#### **Post-Examination and Interpretation Factors**

- Clinical interpretation should consider patient history, symptoms, treatment status, and previous laboratory findings.
- Negative results do not always exclude infection, particularly when specimen quality is poor, collection is inappropriate, or antimicrobial treatment has already commenced.
- Results should be interpreted in conjunction with available clinical findings and epidemiological information.
- The laboratory may add comments or qualifications where results require caution in interpretation.

Users requiring clarification on examination methods, limitations, or interpretation of results are encouraged to contact the laboratory.

## **LABORATORY COMPLAINT PROCEDURE**

### **Commitment to Quality**

The Department of Bacteriology is committed to providing high-quality laboratory services and welcomes feedback from clients, patients, researchers, collaborators, and other stakeholders. Complaints are used as opportunities for continual improvement.

### **How to Submit a Complaint**

Complaints may be submitted through any of the following channels:

- Email to the Department of Bacteriology.
- Telephone call to the laboratory.
- Written correspondence.
- In-person reporting to laboratory staff.

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- Through the NMIMR website contact platform (where available).

To facilitate investigation, complainants should provide:

- Name and contact details.
- Date of occurrence.
- Description of the issue.
- Relevant sample identification number, project number, or report reference, where applicable.

### **Handling of Complaints**

1. All complaints are documented and acknowledged upon receipt.
2. The complaint is reviewed by the designated laboratory representative or Quality Manager.
3. An investigation is conducted to determine the cause of the complaint.
4. Corrective action is implemented where necessary.
5. The complainant is informed of the outcome when appropriate.
6. Complaint records are maintained according to the laboratory Quality Management System requirements.

### **Confidentiality**

All complaints are handled confidentially. Information obtained during complaint investigations is managed according to NMIMR policies and applicable regulatory and ethical requirements.

### **Escalation**

Where a complainant is not satisfied with the resolution provided, the matter may be escalated to the Department Head or the NMIMR Institutional Quality Office for further review.

### **Continual Improvement**

Complaint trends are periodically reviewed during quality meetings and management reviews to identify opportunities for improvement in laboratory services.

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

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1. Yaws
2. Wound care
3. Skin Health African Research Programme
4. National Tuberculosis Control Programme Sputum transport and TB drug-resistant Survey
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, Extrapulmonary Tuberculosis, Tuberculosis Comorbidity, Biomarkers for tuberculosis diagnosis and treatment monitoring, Genomic Epidemiology and Basic Tuberculosis Research
10. Diarrhoeal Diseases Surveillance
11. Microbiome
12. Epidemiology and Transmission of Bacterial Diseases
13. COVID-19 and Bacterial Co-infections
14. Pneumonia and Meningitis: Towards Vaccine Development
15. Trachoma
16. Point of Care Diagnostic Tool Development
17. Clinical Buruli Ulcer Diagnosis, Trainings & Interventions
18. Buruli Ulcer Wound Care
19. 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. MALDI-ToF Biotyping
6. All other microbiological tests as available

### **REQUESTS FOR LAB INVESTIGATIONS**

Please refer to the instructions on MALDI-ToF biotyping. All other requests are made either

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through the director to the HOD, Administrative secretary or respective principal investigators.

## **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> | 42 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. MALDI-ToF Biotyping</b>                                | 8 hours to 72 hours                                          |
| <b>6. Bacteria AMR Analysis</b>                              | 72 hours                                                     |
| <b>7. Microbial Food and Water Analysis</b>                  | 1 week to 2 weeks                                            |
| <b>8. Evaluation of kits, drugs and other products</b>       | 2 weeks to 4 weeks                                           |
| <b>9. BU diagnosis</b>                                       | 48 hours                                                     |
| <b>10. BU Culture</b>                                        | 90 working days                                              |
| <b>11. Gene Xpert PCR for Chlamydia and Gonorrhoea</b>       | Within 48 hours                                              |
| <b>12. 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.

## **ESTABLISHMENT AND REVIEW OF AGREEMENTS FOR LABORATORY SERVICES**

### **Purpose**

The Department of Bacteriology is committed to ensuring that laboratory services provided to patients, clinicians, researchers, sponsors, collaborating institutions, and other users are clearly defined, understood, and agreed upon before laboratory activities commence.

Agreements help ensure that the laboratory has the capability, resources, competence, and capacity to perform requested examinations and related services while meeting applicable quality and regulatory requirements.

### **Establishment of Agreements**

Before accepting requests for laboratory services, the Department shall review and agree on relevant requirements with the user, client, principal investigator, sponsor, or collaborating institution, as applicable.

The agreement may be documented through one or more of the following:

- Approved project proposals or protocols.
- Service agreements or contracts.
- Memoranda of Understanding (MoUs).
- Study agreements.
- Request forms.
- Purchase orders.
- Quotations and acceptance letters.

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- Email correspondence or other documented communications.

Where applicable, agreements shall specify:

- The scope of laboratory services to be provided.
- Types of examinations or testing services requested.
- Sample collection, transportation, handling, and storage requirements.
- Quality and reporting requirements.
- Expected turnaround times.
- Responsibilities of the laboratory and the user.
- Communication channels for enquiries and result reporting.
- Confidentiality and data protection requirements.
- Financial arrangements, where applicable.
- Procedures for handling complaints, nonconformities, and disputes.

### **Review of Agreements**

Prior to acceptance, the laboratory shall review requests and agreements to ensure:

- The requirements are clearly defined and understood.
- Appropriate examination methods are available.
- Personnel are competent to perform the requested activities.
- Required equipment, facilities, consumables, and reagents are available.
- Turnaround time requirements can be achieved.
- Any subcontracted activities are identified and agreed upon.
- Legal, ethical, biosafety, and regulatory requirements can be met.

Where the laboratory is unable to meet agreed requirements, the user shall be informed and alternative arrangements discussed where feasible.

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### **Periodic Review of Agreements**

The Department shall periodically review active agreements to ensure continued suitability and effectiveness.

Reviews may be conducted:

- At predetermined intervals.
- At project milestones.
- Upon renewal of contracts or collaborations.
- When there are significant changes in laboratory services, examination methods, resources, or regulatory requirements.
- Following significant complaints, nonconformities, or service disruptions.

The review shall assess whether:

- User requirements continue to be adequately met.
- Service expectations remain achievable.
- Changes to services or requirements are required.
- Risks affecting service delivery have been identified and addressed.

### **Amendments to Agreements**

Any changes to agreed laboratory services shall be:

- Reviewed and approved by relevant parties.
- Documented and communicated to affected users.
- Implemented only after agreement by all relevant stakeholders.

Records of amendments shall be retained as part of the laboratory quality management system.

### **Records Retention**

The Department shall maintain records of agreements, reviews, amendments, and related communications in accordance with NMIMR document control and record management procedures.

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## **User Enquiries**

Users requiring clarification regarding laboratory services, agreements, or contractual arrangements may contact the Department using the official contact information provided in this handbook.

## **LIST OF INTERNAL COLLABORATORS**

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## **BIBLIOGRAPHY**

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

Mgt-031- SOP on Sample Receipt and Storage