Antimicrobial Research (AMR) Laboratory

Department of Biotechnology, University of Mumbai

Research-Services-Extension-Outreach Activities

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The primary research interest of the **AMR lab** is in the analysis of Antimicrobial Resistance (AMR) associated with food and the environment. Specifically, we are studying antimicrobial resistance patterns at the molecular level in the microbial population using conventional culture techniques as well as metagenomics. Another area of research that is being explored is to exploit inherent defence mechanisms of microbes to counteract antibiotic resistance. Other interests include the use of Bioinformatics and AI for surveillance of AMR, and using Nanotechnology to counteract AMR.

Expertise available with the AMR Lab

Molecular Biology Techniques, Microbiological techniques, Bioinformatics, Nanotechnology, Metagenomics, Oxidative stress and DNA Repair study related techniques.

Services available with the AMR Lab

Sample Testing: antimicrobial activity testing/Efficacy studies/Validation studies of drugs/ APIs/antimicrobial agents etc. based on AST/MIC/disc diffusion/ Agar Cup/Zone of Inhibition/Fractional Inhibitory Concentration Test *(FIC test: It is the test to estimate the interaction between two or more drugs intended to be used in combination. The purpose of this method is to test two different antimicrobial agents or new antimicrobial agents in combination with existing for determining the Synergistic effect, Additive effect and/or Antagonism)* etc., in plate/tube/microtitre plate formats, on standard/reference microbial strains (like ATCC strains) or on our own repository of AMR microbial strains isolated from various ecosystems (especially from animal, food and environment samples).

Collaborative Research work : We welcome collaborations involving any aspect of AMR, including Isolation and detection of antibiotic resistant bacteria from environment and food samples, isolation of plasmid, genomic DNA, Isolation of metagenomic DNA from various sources (food, water, soil, sewage etc.), Identification of AMR microorganisms, identification and characterization of antibiotic resistance genes (ARGs), microbiological testing of nanoparticle samples etc.

Microbial Repository: pure, characterized AMR/ non-AMR microbial strains can be provided on a charged basis.

Outsourcing services: for various government & private agencies, for AMR based research work, short-term projects, analysis services on genomic and metagenomic samples, data collection, collation, database generation etc.

Consultancy Services: for various regulatory bodies/ private agencies etc.

Training : aimed at capacity building, skill development, internship, mentoring etc. for students, researchers, teachers, in-service & pre-service personnel (for government, public/private organizations and industries)

Courses : diploma/certificate/short-term/orientation & refresher programs and hand-on-workshops on AMR can be carried out.

Research Funding: Major research grant proposal writing for National /international government/private agencies.

Scientific Social Responsibility (SSR): free community outreach for school/college students or society is carried out for training and community sensitization & awareness about AMR, Health and Hygiene.

Techniques routinely carried out in the AMR Lab

Microbiology:

1. Antibiotic Susceptibility Test (AST) as per CLSI and EUCAST guidelines
2. Determination of MIC and FIC of antimicrobial agents (antibiotics, nanoparticles and other materials) as per CLSI and EUCAST guidelines
3. Microbial Growth curve experiments with/without stressors
4. Cytotoxicity studies on bacteria (using different dyes like MTT)
5. Biofilm formation and inhibition experiments on microtiter plates
6. Isolation, purification and identification of microbial strains from any sample
7. Maintenance & propagation of pure microbial strains

Molecular Biology:

1. Various formats of Polymerase chain reactions (PCR)
2. DNA isolation (plasmid and genomic)
3. Metagenomic DNA isolation
4. Agarose Gel Electrophoresis & purification of samples from gels
5. Polyacrylamide gel electrophoresis (native and SDS) and subsequent analysis

Bioinformatics:

1. Primer Designing
2. Amplification and 16S rRNA sequence
3. Identification of microorganism using 16S rRNA sequence (BLAST)
4. Analysis of metagenomic DNA sequence data (16S or WGS)

Biochemistry:

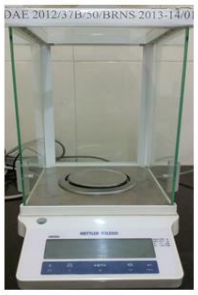
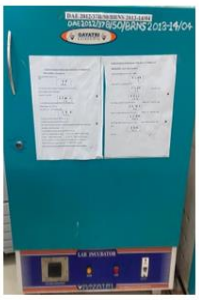
1. Measurement of total DNA/ RNA/protein concentration of sample
2. Sample purity checking (plasmid/genomic DNA/proteins spectrophotometrically/gel based)
3. Measurement of total sugar/ carbohydrate concentration of sample (DNSA method)
4. Spectrophotometric studies of samples (UV-Visible/ fluorescent/ luminescent), cuvette and microtitre plate formats

Materials Science/Bio-Nanotechnology:

1. Method standardization & Synthesis of metal nanoparticles (silver, zinc oxide etc.)
2. Stability testing of nanoparticles (measuring UV-Vis peak)
3. Characterization of nanoparticles w.r.t. size, shape etc.

Major Equipment available with the AMR Lab

Sr. No.	Name of the Equipment	Application
1.	**PCR Gradient Thermal Cyclers**	For any PCR related work. Used to exponentially amplify a specific target DNA sequence, allowing for the isolation, sequencing, or cloning of a single sequence among many.
2.	**Cooling Shaker Incubator**	Maintain a controlled environment so that biological samples can grow continuously. Applications include microbiology, bacteriology and cell and tissue cultures. Refrigerated incubator shakers can incubate samples 20°C below ambient temperature, making cooling incubator shakers important accessory in the laboratory.
3.	**37^{0}C Incubator**	Provides a controlled environment that promotes the growth for culturing microorganisms.
4.	**Biosafety Cabinet**	For study requiring aseptic work with microorganisms. Also for use with antineoplastic drugs, genetic material, carcinogens, allergens and other substances that may generate hazardous airborne particulates. Provide optimal protection for the operator, product, and environment.
5.	**Cooling Centrifuge**	For work with temperature sensitive samples. Used for samples that rquire a consistent range of temperature. This range makes them ideal for the analysis of DNA, RNA, PCR, antibodies etc.
6.	**Micro-centrifuges**	For low volume samples. Micro-centrifuges are typically used for Pelleting nucleic acids, Pelleting proteins from solutions and Microfiltration of small aqueous samples
7.	**-36^{0}C & -20^{0}C deep freezers**	Play important role in safe storage of microbial strains, reagents, lyophilised cultures, enzymes and other temperature sensitive specimens for research purposes that require freezing temperature up to -20^{0}C or -36^{0}C.
8.	**Analytical Weighing Balances**	Highly sensitive lab instruments designed to accurately measure mass. Their readability has a range between 0.1mg to 0.01mg.
9.	**Autoclave**	For sterilization of glassware, plasticware, reagents, samples etc.

Temperature Gradient Thermal Cycler (PCR Machine) 	Analytical weighing balance 	37°C Incubator 
Cooling shaker incubator 	-36°C deep freezer 	Micro-centrifuge 

Major Equipment available with the AMR Lab

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