ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

A Reflection on the Journey of Establishing the Multidisciplinary Research Unit under DHR, MoHFW at Aiims Gorakhpur

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Publication Date: 2025/07/09

Abstract: Education and health are essential to the growth of a country. To effectively handle the issues brought on by India's fast-expanding population, which has topped 1.4 billion people, investment in public health research and the efficient use of cutting-edge technology are essential. Significant healthcare inequalities exist in Uttar Pradesh, the densely populated state in India, especially in the Purvanchal area. A Multidisciplinary Research Unit [MRU] has been formed by AIIMS Gorakhpur, an esteemed institution of national importance, to address these issues by promoting excellent healthcare research and strengthening biomedical research infrastructure.

The MRU aims to address regional health problems, including mother and child health, rising antibiotic resistance, and non-communicable illnesses through multidisciplinary research and evidence-based solutions. With its cutting-edge lab equipment and capacity-building initiatives, the MRU helps students and teachers become more proficient researchers. Early results, such as extramural and intramural genomic research and diagnostics programs, show that it can transform the healthcare delivery in the area. The aims of the MRU to promote the multicentric clinical trials, the augmentation of research capabilities via cutting-edge technology, and the sharing of results through cooperative networks. Establishment of MRU project addresses the healthcare issues and highlights the possibilities of developing research infrastructure to improve public health results in eastern Uttar Pradesh.

Keywords: *Multidisciplinary Research Unit; Biomedical Research Infrastructure, Public Health Innovation, Non-Communicable Diseases, Capacity Building, Healthcare Disparities.*

How To Cite: Hari Shanker Joshi; Dr. Anand Mohan Dixit; Dr. Tejas Patel; Dr. Atul Rukadikar; Dr. Mukul Singh; Dr. Navneet Ateriya; Dr. Prabhat Singh; Dr. Charushila Rukadikar (2025). A Reflection on the Journey of Establishing the Multidisciplinary Research Unit under DHR, MoHFW at Aiims Gorakhpur. *International Journal of Innovative Science and Research Technology*, 10(6), 2835-2845. https://doi.org/10.38124/ijisrt/25jun839

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

I. INTRODUCTION

With 75 districts and a total of 240,928 km2, Uttar Pradesh is the fourth-largest state in India [1]. It is the most populated state in the nation, home to more than 21 crores [210 million] [2]. Out of this population, 77.73% lives in villages area and 22.26% lives in cities areas [3]. A population's productivity and general socioeconomic development are closely linked to health, that highlights how critical a strong infrastructure for health and research is to improving the population's welfare. In eastern Uttar Pradesh and the neighbouring areas, the uneven distribution of health research facilities is a major problem [3]. Research shows significant differences in health outcomes across districts and regions, and poor health indicators are relatively common [3].

The healthcare system in Eastern Uttar Pradesh is severely challenged by the region's consistently high newborn and maternal mortality rates [4]. Additionally, data from the 75th National Sample Survey Office [NSSO] shows that Uttar Pradesh's rural and urban healthcare spending is above the national average, placing an undue financial burden on the state's citizens [4]. Notably, communicable, maternal, neonatal, and nutritional disorders [CMNND] account for 40.5% of Uttar Pradesh's disease burden, with lower respiratory infections, diarrheal illnesses, and TB being the leading causes of death [5].

The Global Burden of Illness (GBD) 2019 study states that morbidity and disability account for 28.4% of the state's overall disease burden, while premature death accounts for 71.6% [6, 7]. 47.9% of Disability-Adjusted Life Years [DALYs] are caused by non-communicable illnesses, including chronic obstructive pulmonary disease (COPD), ischemic heart disease, and type 2 diabetes mellitus (T2DM) [7, 8]. In addition to having almost 47 perinatal fatalities per 1,000 pregnancies lasting seven months or more, Uttar Pradesh tops the country in the number of fatal road accidents recorded each year [9].

A significant obstacle is the inadequate research infrastructure in medical institutions, even with the gradual expansion of public health facilities since 2005 [2]. Previous studies stated that there is a gap between the creation of policies and their execution, since expanded health infrastructure by itself has not successfully resulted in improved health outcomes in Uttar Pradesh [3]. Addressing the increasing health burden requires establishing a comprehensive medical research infrastructure while bridging the gap between regional health goals. Critical insights into illness patterns, risk factors, treatment results, and the effectiveness of public health measures are all made possible by health research [10].

II. CONCEPT OF MULTIDISCIPLINARY RESEARCH UNIT [MRU]

The Multidisciplinary Research Unit [MRU] initiative was started in 2013 by the Department of Health Research [DHR], Ministry of Health & Family Welfare [MoHFW], Government of India. This project aimed to enhance the health care research infrastructure throughout the medical institution in India. The primary objective of this program is to improve the population's overall health by promoting the development of evidence-based diagnostic techniques, processes, and methodologies [11]. The MRU initiative aims to augment the capacity for high-quality research that informs and improves healthcare delivery systems by addressing critical infrastructure deficiencies and creating a conducive research environment inside medical institutions.

The operational framework of MRUs is carefully designed to enhance high-quality research in healthcare and medical institutions, focusing specifically on non-communicable diseases. The program also supports focused, need-driven research efforts that coincide with the goals established by relevant authorities. The advancement of research infrastructure and capacity building in health research is a fundamental aspect of undertaking, ensuring the sustainability of research endeavors and developing a pool of proficient experts [12]. States and union territories submit proposals for the establishment of MRUs to the DHR, which are meticulously assessed according to established criteria. Approval is given to those who satisfy the qualifying criteria, ensuring the strategic proper use of resources [13]. The MRU initiative seeks to improve and strengthen research environments at different health care institutions, which aims to address infrastructural limitations to enhance the provision of health services and research capacities [14]. This initiative enhances public health by establishing evidence-based diagnostic protocols. Additionally, MRUs facilitate multicentric research collaborations that enhance the transfer of knowledge, which is crucial for addressing complex health challenges [15].

MRUs systematically organize and execute workshops, conferences, and seminars addressing various aspects of medical education and research to achieve their objectives. These initiatives aim to enhance research capabilities, foster collaboration, and facilitate knowledge-sharing among healthcare practitioners and researchers [16]. Furthermore, MRUs are essential in the formulation of research proposals and in aiding researchers to obtain extramural funding from reputable organizations such as the Department of Science and Technology [DST], the Indian Council of Medical Research [ICMR], the University Grants Commission [UGC], and the DHR [17]. The MRUs are also authorized to do clinical trials per the Government of India's Allocation of Business Rules, underscoring their dedication to connecting research with real healthcare applications [18]. The MRU project aims to strengthen the research culture and rectify systemic deficiencies, thereby considerably improving India's research environment and eventually enhancing health outcomes for the population.

III. ESTABLISHMENT OF THE MULTIDISCIPLINARY RESEARCH UNIT [MRU] AT AIIMS GORAKHPUR

Establishing the MRU at AIIMS Gorakhpur shows a pivotal advancement in addressing healthcare and research inequalities in the Purvanchal area of Uttar Pradesh (figure 1-

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

5). AIIMS Gorakhpur, a premier medical institution, has shown its dedication to improving healthcare infrastructure and promoting scientific research in the country. The MRU helps not only an infrastructure development but a strategic endeavour to address urgent healthcare needs and signify the research environment in this area.

The MRU represents an objective for equitable distribution of research infrastructure, facilitating access to advanced diagnostic and research instruments. Focusing on non-communicable illnesses, maternity and child health, and antibiotic resistance underscores a targeted and evidence-driven strategy for tackling the region's urgent health challenges. By concentrating on these domains, the MRU coincides with national health objectives and serves the requirements of an area that has long faced substantial healthcare access and quality obstacles.

The formation of the Local Research Advisory Committee (LRAC) demonstrates the forethought in incorporating local knowledge and matching research goals with area health issues. The LRAC's proactive involvement in evaluating applications, overseeing current projects, and providing counsel on resource distribution highlights the strategic methodology used by the MRU.

LRAC has conducted five meetings to steer and supervise the strategic path of MRU AIIMS Gorakhpur. During the initial meeting, participants were acquainted with one another. They sanctioned the suggested equipment inventory and initiatives under the ICMR scheme for MRUs and Model Rural Health Research Units. The subsequent meeting reaffirmed the endorsement of the projects submitted by the ICMR. A formal welcome address was delivered during the third meeting, an action report was meticulously presented, and further project approvals were assigned. The fourth meeting included a further welcome address, a comprehensive review of prior action reports, the approval of the financial budget for research initiatives, the sanctioning of interviews for new MRU staff scheduled for April 2023, and the authorization of a research methodology conference set for early May 2023, in addition to discussing other relevant agenda items. The fifth meeting concentrated on selecting research proposals intended for submission to the DHR for multicentric studies and approving additional equipment procurement for the MRU.

Concurrently with the LRAC meetings, ten internal meetings were conducted to oversee the operational and administrative aspects of MRU AIIMS Gorakhpur. The internal meetings encompassed a range of operational and administrative matters, such as civil works about MRU laboratories, budget allocation, evaluation of significant scientific post applications, examination of recruitment forms, scheduling of interviews, financial decisions regarding equipment and infrastructure, and the appraisal of workshop contributions. Subsequent meetings concentrated on the presentation of concept proposals for multicentric studies within the MRU and MRHRU frameworks, evaluations of performance via conclaves, acquisition of consumables, creation of specialized portals and e-office systems, as well as the methodical assignment of responsibilities encompassing equipment management, recruitment processes, organization of workshops, allocation of funds, and comprehensive record-keeping.

Alongside these organized internal meetings, the MRU office upholds a thorough collection of record registers and file logs that meticulously follow its operations. The registers include a diverse array of entries, such as file records, documentation of staff leave, collections of news, logs of visitors, follow-up actions, records of office movements, financial transactions, details of training sessions, and attendance of staff, alongside other essential information. Comparably, an exhaustive inventory of files encompasses documentation pertinent to equipment acquisition, research endeavors, meeting minutes, personnel recruitment and associated files, sanction orders, audit documentation, IT and GeM transactions, and performance evaluations. This careful documentation guarantees clarity, responsibility, and effective management of every facet of the MRU's functions.

The MRU at AIIMS Gorakhpur features a comprehensive array of advanced instruments, including a refrigerated centrifuge, a real-time PCR system, a vertical laminar air flow unit, a biosafety class 2 cabinet (BSL2), and a mini spin centrifuge. The facility is equipped with a chemiluminescence imaging system for sophisticated imaging and analysis. Storage requirements are adequately addressed by a -20° deep freezer, a -80° deep freezer, and a 360 L refrigerator. The supplementary apparatus includes an ELISA reader equipped with a washer, micropipettes (both single and multi-channel), a dry bath incubator, a vertical autoclave, an ultra-water purification system, an ice flaking machine, a pH meter, a vertical gel electrophoresis unit, a nucleic acid extractor, and a voltmeter—each meticulously chosen to bolster and advance innovative biomedical research and diagnostics (figure 6-11).

The MRU's capacity-building approach highlights the procurement of advanced research equipment and the organization of workshops and training programs. These programs align with the primary goal of developing a robust research culture inside medical institutions. The measurable improvement in participants' skills, assessed by systematic evaluations, underlines the importance of these capacity-building activities in improving skill deficits and empowering researchers. The workshops included research methodology, molecular biology techniques, and manuscript preparation, establishing a basis for both independent and collaborative research endeavors that tackle health priorities on both at the local and global scales.

The MRU's capacity to bring in funding and execute critical intramural research initiatives underscores its promise as a centre of innovation. Alongside these initiatives, the unit is thoroughly involved in a variety of intramural projects: an assessment of the prevalence of aneuploidy and structural chromosomal anomalies in products of conception in eastern Uttar Pradesh; an evaluation of the use of antidepressants based on genotype-predicted metabolizer phenotypes in North Indian patients; characterization of carbapenemase

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

genes among CRE isolates recovered from clinical samples in eastern Uttar Pradesh; an evaluation of the immune status of antigen-presenting proteins, checkpoint inhibitors, and regulating the miRNA in triple-negative breast cancer patients compared to other breast cancer patients; detection of Rickettsia Orientia Tsutsugamushi infection by real-time PCR, TrueNat real-time microchip-based PCR, and serology in acute febrile illness in children within the Gorakhpur district; an assessment of the prevalence and antimicrobial susceptibility pattern of Methicillin Resistant Staphylococcus aureus (MRSA) among healthcare workers at a tertiary care hospital of eastern Uttar Pradesh; and an assessment of autonomic function among diabetics, yoga practitioners, and controls in the Gorakhpur district.

Besides these intramural projects, the MRU is engaged in various extramural research initiatives. The initiatives encompass a project evaluating the feasibility of establishing an antimicrobial resistance sentinel surveillance system using the "Hub and Spoke Model" within the district health framework, alongside an analysis of the trends in antimicrobial resistance patterns of urobacteria among outpatient attendees across various healthcare levels. Additionally, a study investigates the effectiveness of incorporating TrueNat-based HR-HPV testing with VIA as a primary single-sitting cervical screening approach in a rural community in District Gorakhpur. Furthermore, an implementation study focuses on the "zero separation" policy and the DHATRI (Dedicated Hospital Associate for Teaching and Reinforcing) KMC, integrated into standard newborn care, assessing its effects on neonatal morbidities and the duration of Kangaroo Mother Care (KMC) for small stable infants weighing between 1500-2000 grams in MNCU, Reflecting on the future, the MRU's vision of enhancing its infrastructure, launching multicentric clinical trials, and promoting collaborations via a quarterly research newsletter is both ambitious and practical as well. Emphasizing community-oriented research partnerships with funding agencies will help to create a significant and sustainable research environment. The presented approaches highlight the MRU's has ability to improving health infrastructure in Purvanchal region and setting a benchmark for research excellence in similar underdeveloped parts of India.

The recruitment of highly competent research and technical personnel has been executed by the standards set out by the ICMR and the DHR. The MRU team comprises scientists, technicians, and data operators who guarantee the efficient functioning of the facility while enhancing its research productivity. Their collaborative approach has let the MRU maintain the high degree of research and creativity. The MRU's goal is fundamentally capacity development, and it comprises planned seminars and training courses meant to improve the skill development of researchers and healthcare professionals. Recent events have had measurable outcomes, particularly in terms of better understanding of difficult research methods and diagnosis approaches. These projects show an objective to create an independent research environment that supports creativity and effectively addresses regional health inequalities.

The MRU at AIIMS Gorakhpur has positioned itself as a symbol of hope for the Purvanchal area by matching its goals with national health priorities and regional needs, therefore proving the transformational potential of wise investments in research infrastructure. Its holistic strategy for tackling healthcare issues, from capacity enhancement and advanced diagnostics to significant research, highlights its essential function in improving health outcomes. Strengthening its importance as a basic accomplishment in the Indian healthcare research infrastructure, the initiatives under MRU provide a replicable framework for addressing health inequities in resource limited situations.

IV. CONCLUSION

The establishment of the MRU at AIIMS Gorakhpur represents a crucial advancement in mitigating healthcare inequalities and addressing research inadequacies in eastern Uttar Pradesh. The MRU has established a robust foundation for high-quality health research by offering advanced infrastructure, promoting interdisciplinary collaborations, and prioritizing capacity building, directly addressing regional issues such as non-communicable diseases, antimicrobial resistance, and maternal and child health. The MRU helps in empowering researchers, facilitating evidence-based diagnostic progress, and promoting significant intramural and extramural projects highlight its essential function in connecting health concerns with practical solutions. The MRU is poised to broaden its research reach via multicentric clinical trials, innovative technical acquisitions, and community-based projects. These initiatives will reduce the frequency of diseases in the region and show how research infrastructure may be improved in similarly resource- constrained conditions. The MRU's achievements highlight the transforming power of strategic investments in health research and underline its fundamental significance in improving public health results and thus promoting equality in healthcare.

ACKNOWLEDGMENT

We sincerely thank the officials of the Department of Health Research (DHR), Ministry of Health & Family Welfare, Government of India, for their invaluable support in establishing the Multidisciplinary Research Unit (MRU) at AIIMS Gorakhpur. We would like to acknowledge the MRU staff Dr. Mohandas S, Dr. Mantabya Singh, Tiwari N, Nishad S, Jaiswal T, Kumar N for their continuous support in the completion of the project.

- *Conflict of Interest:*
  The authors disclose no conflict of interest.

- *Ethics Approval:*
  The work has been approved by Institutional Ethics Committee. (IEC) AIIMS Gorakhpur.

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

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ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

FIGURE LEGENDS

Fig 1 Multidisciplinary Research Unit, AIIMS, Gorakhpur

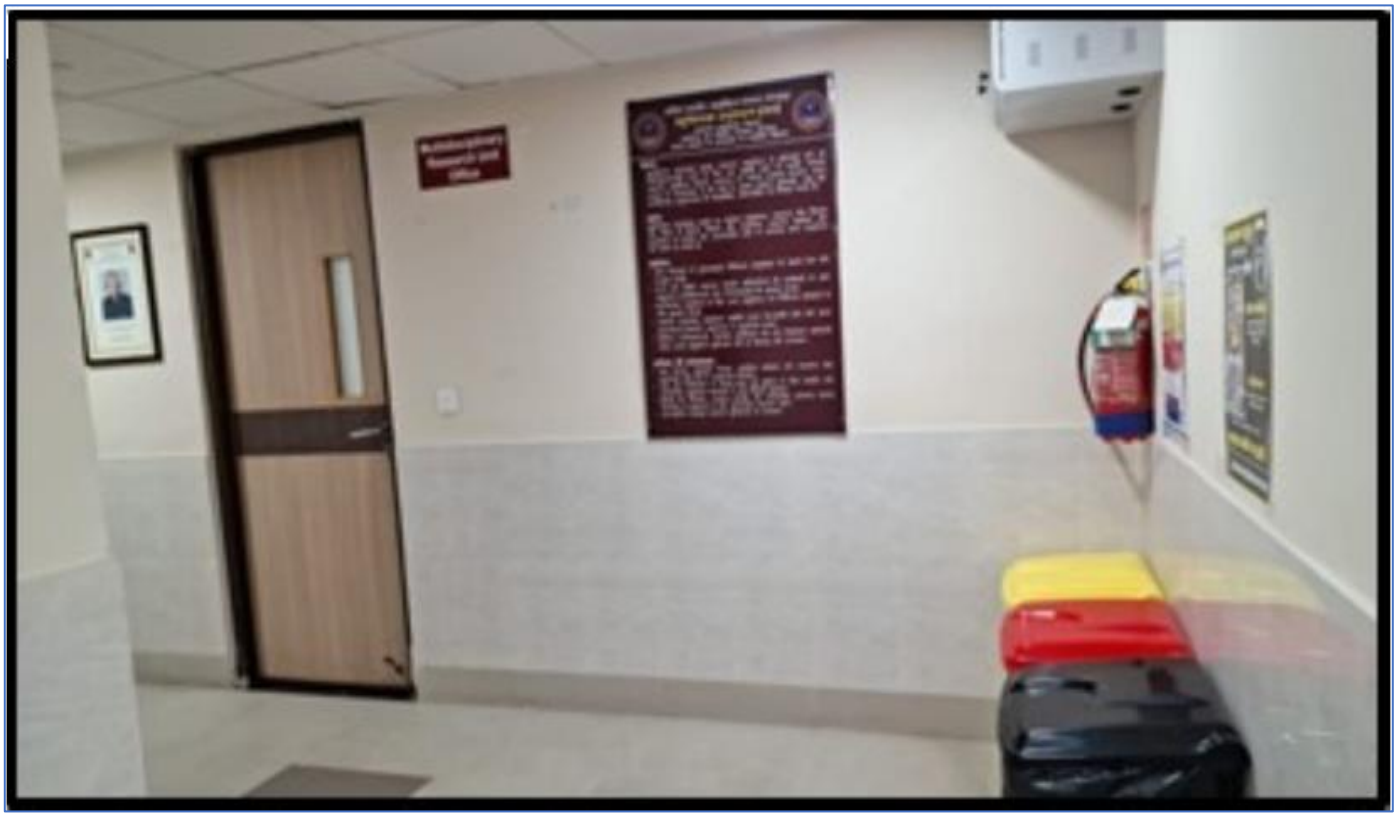

Fig 2 MRU Lab Entrance

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

Fig 3 MRU Administrative Office

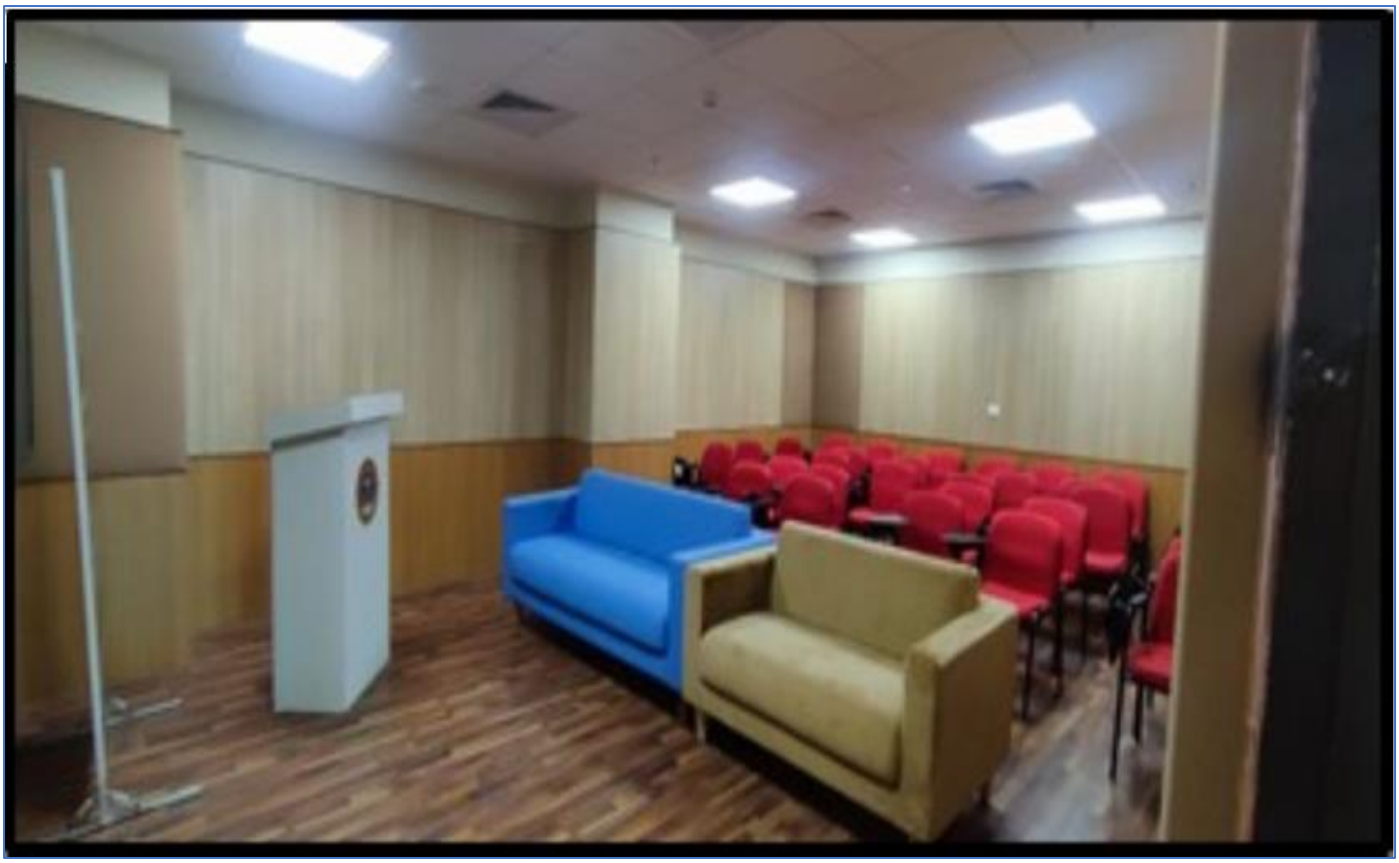

Fig 4 Demonstration room for conducting conferences and workshops

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

Fig 5 MRU Lab Corridor

Fig 6 Molecular Biology Lab- I Entrance

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

Fig 7 RNA Extraction room in Molecular Biology Lab I

Fig 8 Master mix preparation room in Molecular Biology Lab I

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

Fig 9 PCR- Room in Molecular Biology Lab I

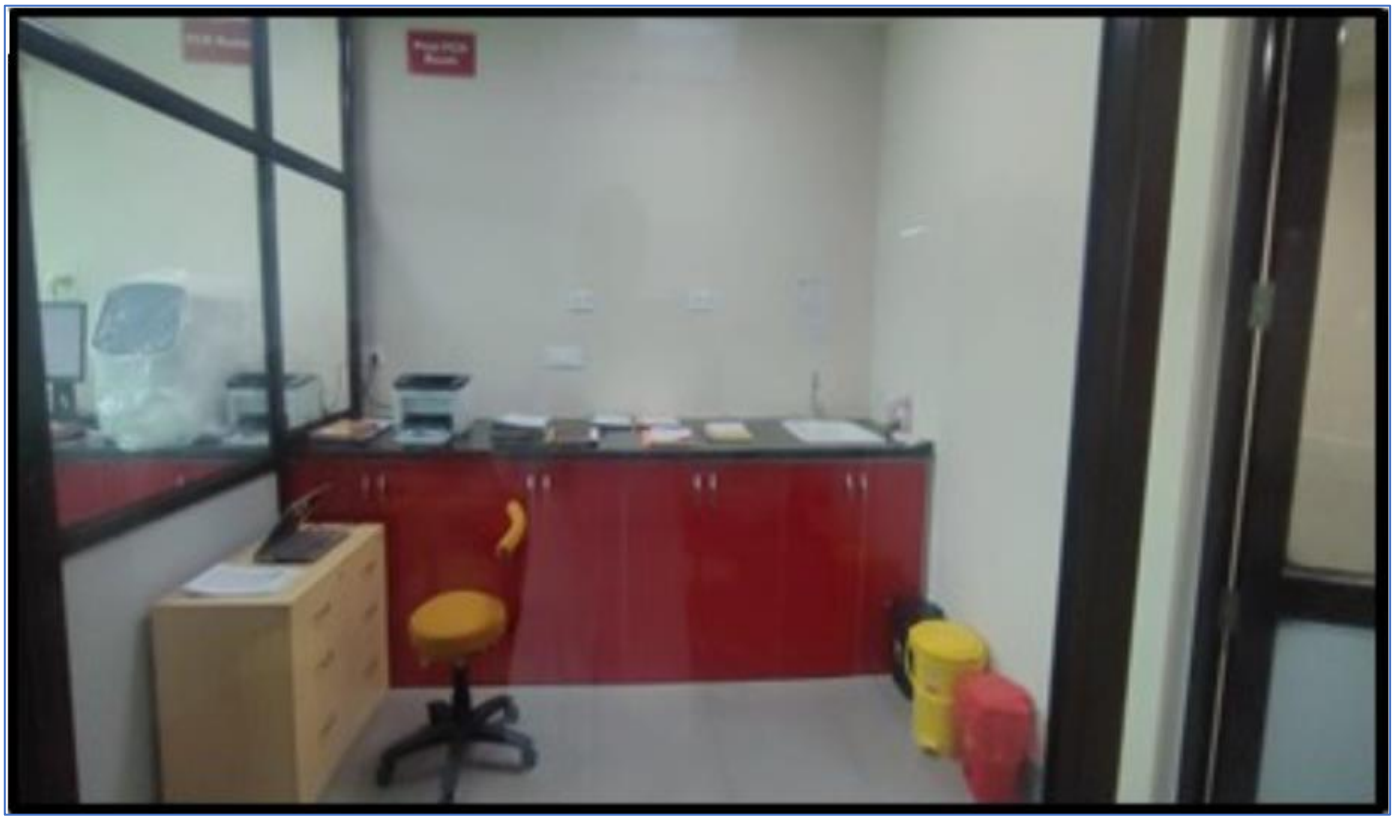

Fig 10 Post PCR analysis room in Molecular Biology Lab I

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun839

Fig 11 Molecular Biology Lab -II in MRU