

# **Report of the Workshop on**

## **“Understanding Neurological Disorders: Technical Approaches and Advancements”**

**(20<sup>th</sup> December – 26<sup>th</sup> December, 2022)**

**under**

**Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI) program  
(Department of Science and Technology)**

**Organized by**

**JAMIA HAMDARD (PMU)  
Hamdard Nagar, New Delhi 110062**

## **A BRIEF REPORT ON DST-STUTI SPONSORED HANDS- ON TRAINING HELD AT DEPT OF TOXICOLOGY, SCLS, JAMIA HAMDARD**

The Department of Science & Technology under the aegis of Synergistic Training Programme Utilizing the Scientific & Technological Infrastructure (DST-STUTI), sponsored one-week Hands on training programme on “Understanding Neurological Disorders: Technical Approaches and Advancements” from 20th December to 26th December 2022. Synergistic Training Program utilizing the Scientific and Technological infrastructure (STUTI) is an initiative of Department of Science and Technology. It is a two-fold program and is designed to create awareness among school students by means of short training and popular science events and capacity building training program for Scientists, Professors, Ph.D. Scholars and Post Doc Fellows involved in research areas for maximal utilization of the existing facilities in the country. There are 13 Project Management Units and each PMU is organizing 22 trainings throughout the year. Jamia Hamdard is one of the PMUs and the nodal centre.

The Department of Medical Elementology and Toxicology is one of the few departments in India having full – fledged academic programme at Undergraduate/ Postgraduate and Doctoral levels in Toxicology. The department has made its mark in toxicological research and has been supported by the Department of Science & Technology through Fund for Improvement of S&T Infrastructure in Universities & Higher Educational Institutions FIST programme and University Grant Commission Special Assistance Programme The week-long training programme on “Understanding Neurological Disorders: Technical Approaches and Advancements” is part of the series of STUTI training programme. This programme gathered attendance from 26 states of PAN India and 30 participants were shortlisted based on their credentials.

The workshop was aimed at highlighting the issues and challenges faced by researchers in exploring brain disorders and their mechanisms through rigorous discussions and talks, and provide a compact platform for brainstorming dynamic approaches. The primary objective of the workshop was to enrich the young enthusiastic neuroscientists with insights of brain functioning from cellular to systemic level and to provide them hands-on training which will help imbibe an academic, technological and translational approach towards neuroscience research. The students were exposed to multidisciplinary approaches to understand the most complex organ of the human body. The workshop imparted both theoretical and practical knowledge of molecular techniques used for addressing research problems as well as their applications in molecular medicine. In addition to hands-on exposure to surgical models of neurodegenerative diseases on animals, the different techniques of molecular biology including Molecular docking, Electron Microscopy, Western Blotting, RT-PCR, and Flow Cytometry were covered during the workshop in a systematic manner. Moreover, the workshop aimed to enhance the knowledge on the most efficient use of materials, reagents and interpretation of the results.

The inaugural function was held on 20<sup>th</sup> December 2022 at Convention Centre, Jamia Hamdard. The function was attended by **Dr. Prof. Rajpal Singh Kashyap** – Director, Research and Sr. Scientist, CIIMS Nagpur (Chief Guest), **Dr. Arindam Bhattacharyya** – Scientist ‘F’, DST, Govt. of India (Guest of Honor), **Prof. (Dr.) Afshar Alam** – Vice Chancellor (Jamia Hamdard), **Prof. Sarwar Alam** – Proctor, Jamia Hamdard, **Prof. (Dr.) S. Raisuddin** – Dean SCLS, **Prof. (Dr.) Suhel Parvez** – Coordinator DST-STUTI PMU, Jamia Hamdard. The function began with the recitation of Holy Quran.

Prof. (Dr.) S. Raisuddin – Dean SCLS welcomed the distinguished guests, participants and all gathered for the function. He stated that for this training programme an era of good scientists and faculties have been arranged for the talks and that the participants should have enough discussions with the resources. Dr. Arindam Bhattacharyya in his speech stated that the various Science & Technology Infrastructures has been established across the country but optimal is how best we can exploit the instruments and thus DST STUTI training programme was initiated early this year. The target is to benefit around 7500 researchers across PAN India through 13 PMU’s. As of now 190 trainings has been organised benefiting around 6500 researchers. Prof Rajpal Singh Kashyap stated that this programme is definitely going to give a very good outcome in the next 5-6 years. This kind of workshop are being arranged with good talks of various experts and this will convert into positive way further. Prof. M. Afshar Alam, Vice Chancellor, Jamia Hamdard thanked the distinguished guests for accepting the invitation and gracing the occasion with their presence. He stated that Jamia Hamdard was recognised as implementing agency for STUTI and he is proud to declare that through STUTI programme 700 students from 11th and 12th classes of various schools of Delhi NCR benefited through the Science Awareness programme and also young scientists, scholars and faculties are gaining capacity building knowledge through the various week-long training programmes being organised across the country. He thanked DST for providing such a great programme which will benefit the Nation’s young budding scientists.

Vote of thanks was delivered by Prof. (Dr.) Suhel Parvez Coordinator DST-STUTI PMU. He thanked the distinguished guests, organising committee and the 30 participants who have come from 26 institutes across the country and wished that they benefit by the expert lectures and hands on training. The function concluded with National Anthem followed by High Tea.

The vast arrays of topics covered by the different invited speakers from the Day 1 to the Day 7 of the workshop are as follows:

SL NO	DATE	NAME	INSTITUTE	TITLE OF THE LECTURE
1	<b>20<sup>th</sup> December 2022</b>	<b>Prof. Rajpal S. Kashyap</b>	Central India Institute of Medical Sciences, Nagpur	Blood-Brain Barrier: Please look at the door
2		<b>Dr. Dinesh Bhatia</b>	North-Eastern Hill University, Shillong	Study effects of neuro-modulatory techniques in the assessment and management of children with disability
3		<b>Dr. Pravir Kumar</b>	Delhi Technological University	Ubiquitin proteasome system and PTMs in neuronal disorders
4	<b>21<sup>st</sup> December 2022</b>	<b>Dr. Imtaiyaz Hasan</b>	Jamia Millia Islamia	Targeting Microtubule affinity-regulating kinase 4 (MARK4) signaling in the development of effective therapeutics against neurodegenerative diseases
5		<b>Prof. Sushil Jha</b>	Jawaharlal Nehru University	Sleep, Memory, and Ageing
6	<b>22<sup>nd</sup> December 2022</b>	<b>Prof. S Raisuddin</b>	Jamia Hamdard	Biomarkers of Neuroinflammation
7		<b>Dr. Somenath Ghatak</b>	Carl Zeiss India	Application of microscopy in neuroscience research

8	<b>23<sup>rd</sup> December 2022</b>	<b>Dr. Vinay Gupta</b>	BD-FACS Academy	Exploring nature at cellular level
		<b>Dr. Iype Cherian</b>	Institute of Neurosciences, KIMS, Malkapur	Innovations in Neuro Surgery
9	<b>24<sup>th</sup> December 2022</b>	<b>Dr. Heena Tabassum</b>	ICMR	Modulation of Neuronal injury induced Mitochondrial Alterations: A Drug Repurposing Perspective
10				
11				<b>Dr. Sumit Aggarwal</b>
12	<b>25<sup>th</sup> December 2022</b>	<b>Dr. Shruti Vishnoi</b>	ToxMinds India Consulting Pvt. Ltd	Adverse Outcome Pathway Framework in Neurotoxicity
13		<b>Dr. Ozair Alam</b>	Jamia Hamdard	UPLC-MS: A powerful technology and its application in Neuroscience Research
14	<b>26<sup>th</sup> December 2022</b>	<b>Dr. Yasir Hasan Siddiqui</b>	Aligarh Muslim University	Importance of Drosophila as a research model to study the neurodegenerative disorders
15		<b>Prof. D.K. Agarwal</b>	Krishna Institute Of Medical Sciences , Malkapur, Maharashtra	Importance of IPR with Special Emphasis on Medical Domain

Different sessions from Day 1 to Day 7 of the workshop are summed up in the following report:

## Day 1

### INAUGURAL FUNCTION:

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### Technical Session

The inaugural function was followed by High Tea, after which there were presentations of three invited speakers viz. **Prof. Rajpal S. Kashyap**, Central India Institute of Medical Sciences, Nagpur, **Dr. Dinesh Bhatia**, North-Eastern Hill University, Shillong, and **Prof. Pravir Kumar**, Delhi Technological University.

**Prof. Rajpal S. Kashyap is the Director of Central India Institute of Medical Sciences. He** delivered a talk on the topic of **Blood-Brain Barrier: Please Look at the Door**. During his talk, Prof. Kashyap cited reports which are in agreement that dissemination to the CNS by Bacteria, virus or parasite may be due to production of virulence and other factors which are different from one to other strain which enables its invasion of blood brain barrier (Host) to establish CNS disease. His talk addressed the pathogenesis of the blood-brain barrier (3B) and the virulence and pathogenesis of M-TB strains.

**Dr. Dinesh Bhatia**, North-Eastern Hill University, Shillong, enlightened attendees on the topic of **Study effects of neuro-modulatory techniques in the assessment and management of children with disability**. Neuro-modulatory techniques are non-invasive stimulation techniques provided to the human brain by generating a brief, high-intensity magnetic field by passing an electric current through a magnetic coil which can be useful in excite or inhibit a small area of brain below the coil. R-TMS has been used successfully in treating Cerebral palsy children and those affected with Migraine to an extent. In his talk, Dr. Bhatia described how his group successfully studied the positive effects of TMS and NFB in children with Cerebral palsy. Further, TMS has successfully proven to improve the prognosis of the Migraine. Considering that Vestibular Migraine and Migraine have common pathogenesis, there is high possibility that TMS will be effective in understanding the pathophysiology of Vestibular Migraine more clearly and possibly help in managing or decreasing the different vestibular symptoms such as headache, swaying sensation and vertigo along with the headache.

This talk was followed by Lunch, after which the participants were divided into groups and given hands-on training of animal surgical models of neurological diseases. To increase the knowledge on the etiopathogenic mechanisms of neurodegenerative diseases, a series of animal models is currently being used. These models aim to reproduce the causes, the pathological lesions, or the symptoms of a given disease. Besides providing insights into the pathophysiology of the diseases, animal models are of paramount importance to assess the efficacy of potential treatments before conducting clinical trials in humans.

In the training session, various surgical procedures were used to induce different neurodegenerative disorders. To induce Alzheimer's disease in rodents, intracerebro-ventricular injection (ICV) of Amyloid  $\beta$  was used; participants had hands-on training on ICV injection with help of Stoelting stereotaxy apparatus. To mimic ischemic stroke condition in rodents, a sophisticated procedure of Middle cerebral artery occlusion (MCAO) was demonstrated. The middle cerebral artery was occluded with intraluminal monofilament size 4-0 to block the blood supply to the brain for 90 min which imitates the ischemic stroke conditions. For demonstrating hemorrhagic stroke, SAH model was prepared with endovascular perforation technique. Briefly, the internal carotid artery was perforated with intraluminal monofilament size 4-0 for just 15 sec to reproduce hemorrhagic condition. Controlled Cortical Impactor (CCI) model is more accurate, easier to control, and most importantly, produces traumatic brain injuries similar to those seen in humans. Hatteras Pinpoint PCI3000 Precision Cortical Impactor was used to demonstrate traumatic brain injury.

After the completion of the workshop, the participants were able to:

- Set the co-ordinates of the stereotaxic apparatus according to the brain atlas and give ICV injection.
- Understand the circulatory system of the rat, learn to expose common, external and internal carotid artery and insertion of filament. Further, students also learnt to insert suture in the internal carotid artery to occlude middle cerebral artery as well as perforation to induce hemorrhage.
- From CCI model demonstration, participants learnt to expose and drill skull to hit the brain with impactor probe.

**Following this, Prof. Pravir Kumar, Delhi Technological University** talked about **Ubiquitin proteasome system and PTMs in neuronal disorders**. The ubiquitin proteasome system (UPS) has a decisive mechanism in clearing the toxic metabolites and by products from the cells. In his talk, Prof. Kumar unravelled the intricate mechanism of different amino acid residues that participate in UPS mediated clearance together with several post translational modifications through which toxic metabolites are released from the cells.

The day was ended by a welcome dinner for all participants at Scholars House, Jamia Hamdard. The welcome dinner was graced by the presence of Prof. (Dr.) M Afshar Alam, Vice Chancellor, Jamia Hamdard along with eminent faculties of the institute and STUTI training resource persons.





## Day 2

Prior to lunch, the participants were given hands on training on Alternative Models to study Neurodegenerative Disorders: Cell Culture, *C. Elegans* and *Drosophila*.

### *Cell Culture*

Cell culture has enabled numerous discoveries in molecular and cellular biology. It has revealed, for example, basic information about cells regarding their composition and form; biochemical, metabolism, signalling pathways in various in vitro toxicity models. In the workshop, the participants were made to practice the preparation of cell culture media and maintaining mammalian cells in culture (aseptic technique, thawing, counting, expanding, and freezing). Students also learnt cell viability/cytotoxicity assay after different neurotoxicants exposure. Further cell lysate preparation for western blot analysis was also demonstrated during the hands on.

The training program also focused on the alternative models to animal experiments. With an increase in the number of researches worldwide, there is a need for the development of alternative models in view of animal ethics. Alternative models have proved to be more precise and accurate in terms of translational results in light of human relevance. Thus, keeping in view the recent trends in research, participants were demonstrated following alternative models:

### *Caenorhabditis elegans*

Apart from short life cycle, easy to maintain, hermaphrodite and high progeny rate: the major advantages of *Caenorhabditis elegans* system are:

- First multicellular organism completely sequenced genome and 60-80% homology with human genome
- 42% genes orthologous to human disease genes such as autism, cancer, Alzheimer's Disease etc.
- A nervous system with 302 neurons of 118 classes neurotransmitter system similar to the mammalian system such as acetylcholine, glutamate, GABA, etc.

By the end of the workshop, the participants were able to culture and maintain *C. elegans*. Students were able to prepare the Nematode growth medium (NGM) plates along with the *E. coli* OP50 stain culture as *C. elegans* food. Also, the students were able to transfer the worms from old plate to freshly made plates. Further Embryo isolation from the mixed population of worms using Bleach method and synchronization of different life stages of *C. elegans* was done. The physiological response of the *C. elegans* in terms of Growth assay and reproduction assay was also exercised during the training.

## *Drosophila melanogaster*

*Drosophila melanogaster* is a widely used versatile model organism to understand many molecular and developmental processes common to higher eukaryotes. A prerogative for a good model system is to share higher physiology within the molecular pathways with humans, and it is remarkable that approximately 75% of genes associated with human diseases have *Drosophila* homologs and share similarities in their functions, which is of particular interest for medical researches. It shows other technical advantages over vertebrate models; such as easy to handle and inexpensive to culture in laboratory conditions, have a much shorter life cycle, high brood size and they can be genetically modified in numerous ways. On the basis of showing these features, the fly has been proven tremendously valuable as a model organism for understanding the pathogenesis involved in human disorders.

In the training, the participants learnt to culture and maintain *Drosophila melanogaster*. Students were made to practice the preparation of culture medium as *Drosophila melanogaster* food. The students learnt and practice the sex differentiation at pupae and fly stage and brain dissection of larvae and fly. Further, participants also learnt the neurobehaviour parameters such as climbing and jumping assay in flies. Neurobehaviour at larvae stage was also performed during the hands on.

The post lunch sessions were taken by **Dr. Imtaiyaz Hasan, Jamia Millia Islamia** and **Prof. Sushil Kumar Jha, Jawaharlal Nehru University**.

**Dr. Imtaiyaz Hasan, Jamia Millia Islamia** delivered a talk on **Targeting Microtubule affinity-regulating kinase 4 (MARK4) signalling in the development of effective therapeutics against neurodegenerative diseases**. Microtubule affinity-regulating kinase 4 (MARK4) is a member of Ser/Thr protein kinase, which phosphorylates the microtubule-connected proteins and plays a vital role in several cancers. MARK4 is dysregulated in cancer, suggesting its participation in the cell cycle and consequent cell division. This kinase modulates multiple signaling pathways, including mTOR, NF- $\kappa$ B, and Hippo-signaling, presumably responsible for cancer and neurodegenerative diseases. In his study, his group investigated binding affinity of various dietary phytochemicals including, ursolic acid, capsaicin, DL- $\alpha$  tocopherol acetate, quercetin, vanillin, citral, ellagic acid, limonin and simvastatin with different kinases pertaining to be the potential drug target for MARK4. Docking studies revealed that all these compounds bind to the active site cavity located in the kinase domain with varying affinities. In silico observations were further corroborated with fluorescence binding and isothermal titration calorimetric measurements. Among all compounds, quercetin, ellagic acid and capsaicin bind to these kinases with an excellent affinity.

**Prof. Sushil Kr Jha, Jawaharlal Nehru University**, delivered a talk on Sleep, Memory and Ageing. In his talk he explained both Non-Rapid Eye Movement (NREM) sleep and REM (Rapid Eye Movement) sleep which promotes memory consolidation. His group found that NREM sleep dramatically increased at a particular time window after fear conditioning, whereas REM sleep significantly increased after learning appetitive conditioning. With ageing, the

structure of sleep also alters. Age-related most notable changes occur in amount of NREM sleep. REM sleep amount also decreases however the changes coincide with shorter sleep durations.



### Day 3

The invited speakers for the Day 3 were **Dr. Somenath Ghatak, Carl Zeiss India & Prof. (Dr.) S. Raisuddin, Jamia Hamdard.**

In the morning session, Dr. Somenath Ghatak, Carl Zeiss India, delivered a talk about **Application of microscopy in neuroscience research.** He has been supporting users in all aspects of advanced light microscopy, as well as correlative microscopy experiments. In his talk he addressed about the sample preparation, introduction to the imaging technology, assistance and troubleshooting during imaging and data collection, data management as well as data analysis.

This was followed by a hands-on session of Microscopy and Neurobehaviour techniques. Learning and memory are the fundamental processes of brain and are one of the most intensively studied subjects in the field of neuroscience. Learning and memory is an essential element to study the brain cognition and processing mechanisms. Also, it has often been studied to detect the development of neurodegenerative diseases like Alzheimer's disease and Parkinson's disease. The test for learning and memory is generally referred as neurobehavioral experiments in rodents. Various kinds of neurobehavior paradigms have been established over time to examine the motor coordination of rats, brain cognition, and memory formation as it has high translational application in light of human relevance. By the end of the workshop, students had fundamental concept of various neurobehavioral paradigms namely,

- Motor Coordination Tests: Rota-Rod Test, Grip Strength Test, Stride Length Test, Open Field Test
- Spatial Memory Test: Morris Water Maze Test
- Cognitive Memory: Novel Object Recognition Test, Inhibitory Avoidance Test, Contextual Fear Conditioning Test, Elevated Plus Maze Test

Further, participants were able to use ANY-maze software after the completion of the training.

## *Microscopy*

### *Inverted Microscope*

Inverted microscope is a phase contrast microscope widely used to evaluate and document label-free live cell cultures, transfected live cell cultures, cell and tissue morphology and its growth state where sample from thin tissue slices or small organism. Also, to study mechanical manipulation of cells and recording changes while injection of dyes and or other biological substrates, fast densitometric, ratiometric and electrical signals in living neuronal or muscular cell culture or tissue slices, for identification, quantification and qualify cell types, cell -, tissue and protein markers in 2D and 3D samples and to study identification and characterization of cell wall, cell cycle and host-parasite interaction in microbiomes, bacteria, yeast. In the STUTI training program, participants were demonstrated with the use and working of Zeiss phase contrast inverted microscope in neurological disorder studies.

### *Live Cell Imaging*

Live cell imaging microscopy is a high end tool to study short-term or long-term observation of physiological and morphological parameters in 2D/3D multi-labelled living tissue section, organs, organotypic-spheroid or in cell culture preparation. It is also used to evaluate and document cell culture from multi-well plates at different magnifications and resolutions, transfection rate and transfection stability using fluorescent markers. Pharmacological, chemical or drug screening is also done using this technique. Live cell imaging also helps to analyse and observe the stimulus-induced responses of cells, tissue or organism with disturbing the environmental control. In the STUTI training program, participants were demonstrated the live cell imaging as an advanced tool to study the neurodegeneration in brain tissues and cells using Zeiss Cell Discoverer 7 Microscope for live cell imaging.

Post lunch, a session was delivered on **Biomarkers of Neuroinflammation** by **Prof. (Dr.) S. Raisuddin, Jamia Hamdard**. Neuroinflammation is a pathological feature of a wide range of central nervous system (CNS) diseases, including classic neuroinflammatory disorders, such as multiple sclerosis (MS); neurodegenerative diseases, such as Alzheimer's disease (AD) and Huntington's disease (HD); disorders induced by brain injury; and neuropsychiatric disorders, such as depression and schizophrenia. In his talk, Prof. Raisuddin said that similar cell types and inflammatory mediators are induced across the range of these disorders, yet the consequences vary from toxic processes, such as the release of proinflammatory cytokines or reactive oxygen species, to reparative processes, such as the release of anti-inflammatory cytokines or stimulation of neuroprotective and angiogenic factors. As suggested by the speaker, these inflammatory mediators and other cellular markers could all potentially represent biomarkers of neuroinflammation, which in turn could be used to elucidate mechanisms.

This was followed by a hands-on session of molecular biological techniques including Western Blotting, RT-PCR, Fluorimetry and TTC staining. For this session, a preference survey was conducted among the participants for the molecular techniques in which Western Blotting and

Spectrofluorometer was most preferred technique for the demonstration followed by RT-PCR and TTC staining in which the participants were divided into four groups according to their preference.



## Day 4

The morning session of Day 4 was taken by **Dr. Vinay Gupta, BD-FACS**. He talked about **Flow cytometry and its applications in molecular biology**. Flow cytometry is a powerful tool that has applications in immunology, molecular biology, bacteriology, virology, cancer biology, and infectious disease monitoring. It has seen dramatic advances over the last 30 years, allowing unprecedented detail in studies of the immune system and other areas of cell biology. Dr. Gupta pressed the importance of flow cytometers as they utilize lasers as light sources to produce both scattered and fluorescent light signals that are read by detectors such as photodiodes or photomultiplier tubes.

Post lunch, **Dr. Iype Cherian, Institute of Neurosciences, KIMS, Malkapur** delivered a talk on **Innovations in Neuro Surgery**. He talked about his contribution to the field of neurosurgery, which includes neurosurgical procedures such as craniotomy, skull-base and vascular neurosurgery, the cooling and cleaning theory and the design of modern microsurgical equipment like the hyperscope, the water knife, etc.

Followed by the scientific talks, participants were divided into groups and given a hands-on tour of NMR and Herbal Garden. Nuclear magnetic resonance (NMR) is a physical phenomenon in which nuclei in a strong static magnetic field are perturbed by a weak oscillating magnetic field (in the near field and therefore not involving electromagnetic waves) and respond by producing an electromagnetic signal with a frequency characteristic of the magnetic field at the nucleus. This process occurs near resonance, when the oscillation frequency matches the intrinsic frequency of the nuclei, which depends on the strength of the static magnetic field, the chemical environment, and the magnetic properties of the isotope involved; in practical applications with static magnetic fields up to ca. 20 tesla, the frequency is similar to VHF and UHF television broadcasts (60–1000 MHz). NMR results from specific magnetic properties of certain atomic nuclei. Nuclear magnetic resonance spectroscopy is widely used to determine the structure of organic molecules in solution and study molecular physics, crystals as well as non-crystalline materials. NMR is also routinely used in advanced medical imaging techniques, such as in magnetic resonance imaging (MRI).

The workshop was focused on exploring the application of NMR to study the brain networks dynamics and applications of its results in mathematical and computational neuroscience. Jamia Hamdard has its own NMR facility working towards the establishment of high-end research.

Keeping in view the importance of herbal garden Jamia Hamdard has established an Herbal Garden spread over 6 acres of land where more than 200 rare, threatened and commercially important medicinal plants have been introduced from various regions of Northern India for cultivation and propagation. The main aim of the garden is to conserve all the accessions of Plant Germplasm for repository and Germplasm Banks. Herbal Garden at Jamia Hamdard serves an important tool for teaching and research in other related faculty of science and pharmacy.



## Day 5

In the morning session, **Dr. Heena Tabassum, ICMR** delivered a talk on **Modulation of Neuronal injury induced Mitochondrial Alterations: Drug Repurposive Perspective**. Mitochondria and autophagy/mitophagy are emerging as therapeutic targets in neuronal injury. Ongoing research in has shown that, when administered early, mitochondria-targeted agents afford neuroprotection in preclinical rat models of neuronal injury. In her talk, Dr. Tabassum stated that repurposed drugs have been shown to induce various cellular signaling pathways for autophagy/mitophagy, anti-inflammatory, and immunomodulatory effects that are implicated as therapeutic mechanisms in neuronal injury.

This was followed by a hands-on training session of Liquid Chromatography-Mass spectroscopy (LC-MS) and Cryo – Transmission Electron Microscopy (TEM). Liquid Chromatography–Mass Spectrometry (LC-MS) is an analytical chemistry technique that combines the physical separation capabilities of liquid chromatography (or HPLC) with the mass analysis capabilities of mass spectrometry (MS). Coupled chromatography - MS systems are popular in chemical analysis because the individual capabilities of each technique are enhanced synergistically. While liquid chromatography separates mixtures with multiple components, mass spectrometry provides structural identity of the individual components with high molecular specificity and detection sensitivity. This tandem technique can be used to analyse biochemical, organic, and inorganic compounds commonly found in complex samples of environmental and biological origin. The training program aimed at exploring the applications of LC-MS in neurochemistry research. After the session, participants were able to perform proteins and neurotransmitter analysis with the help of LC-MS as a tool. The University has high end Water's UPLC system with MS detector which is being widely used in biochemical assay analysis and neuroscience research.

Electron microscopy is used to obtain the high-resolution images of biological and non-biological samples. It has a wide application in the field of biomedical research to study and analyse the detailed structures of tissues, cells, macromolecular complexes and to observe tissue damages in various pathological conditions. Jamia Hamdard is has a well-established electron microscopy facility having TECNAI 200kv electron microscope for TEM. Along with it, tissue preparation facility is also available having Leica Ultramicrotome. The participating students were demonstrated the electron microscopy technique with the aim of exploring its applications to examine the neuropathogenesis.

The hands-on was followed by a lecture on **Funding, Ethics, Research Grant Proposals** by **Dr. Sumit Aggarwal, ICMR**. The need for ethics in intradisciplinary research and interdisciplinary research is vast along with available funding opportunities. Dr. Aggarwal delivered a detailed talk on the process of research funding, grant applications, types and several do's and don'ts for the same.





## Day 6

The morning session was taken by **Dr. Shruti Vishnoi, ToxMinds India Consulting Pvt. Ltd** who talked about **Adverse Outcome Pathway Framework in Neurotoxicity**. Adverse outcome pathways (AOPs) are the central element of a toxicological knowledge framework. In her talk, Dr. Vishnoi explained that AOP framework is a systematic process that uses the available mechanistic information concerning a toxicological response and describes causal or mechanistic linkages between a molecular initiating event, a series of intermediate key events and the adverse outcome. The AOPs and AOP network enable deeper understanding of mechanisms involved in toxicity and provide a strategy for the development of alternative test methods for hazard and risk assessment. A large number of cellular and molecular processes are known to be crucial to proper development and function of the central (CNS) and peripheral nervous systems (PNS). Therefore, it is critical to develop AOPs for neurotoxicity.

Second session was taken by **Dr. Ozair Alam, Jamia Hamdard**, who delivered a talk on **UPLC-MS: A powerful technology and its application in Neuroscience Research**. UHPLC-MS/MS is connected in various research facilities for the qualitative and quantitative investigation of a pharmaceutical substance, pharmaceutical items, and biological specimen. Dr. Alam discussed in detail, the application of UPLC-MS in neuroscience research by explaining the fundamentals of the technology.

Post lunch, participants were taken for Delhi site seeing. Participants enjoyed the Delhi ambience during their visit to India Gate, Jantar Mantar, Safdarjung Tomb and Qutub Minar.





## Day 7

In the morning session, **Dr. Yasir Hasan Siddique**, Aligarh Muslim University delivered a talk on **Importance of Drosophila as a research model to study the neurodegenerative disorders**. In his talk, Dr. Siddique emphasized that to study the pathogenesis of neurodegenerative diseases Drosophila has been established as a most successful model. The brain of Drosophila can be easily access and various cognitive parameters can also be performed easily which further makes this model ideal to study the cognitive dysfunctions associated with various neurodegenerative disorders. It has been also recommended by the European Centre for the Validation of Alternative Methods (EVCAM) for its use in research. This model is widely used for the study of various pathological processes associated with human diseases.

This was followed by a session on **Importance of IPR with Special Emphasis on Medical Domain** by **Prof. D.K. Agarwal**, Krishna Institute of Medical Sciences, Malkapur, Maharashtra. In his talk Prof. Agarwal emphasized on the importance of IPR in research. He explained the need for innovation and patent filings to support the scientific growth and development of the country.

Following this, there was a valedictory session and Qawwali followed by dinner.

### Valedictory Programme:

The valedictory of the 7 days training program was conducted on 26<sup>th</sup> December, 2022 at the Convention Centre, Jamia Hamdard. The program was presided over by the presence of **Hon'ble Chief Guest Prof. D.K. Agarwal**, Krishna Institute of Medical Sciences, Malkapur, Maharashtra and **Hon'ble Guest of Honour Dr. Pratishtha Pandey**, Scientist F, Department of Science and

Technology, Ministry of Science and Technology, Govt. of India. Participation certificates were awarded to the participants. In addition, few participants gave testimonials about their experience and learning during the training program.

Apart from the technical and scientific sessions, a soulful Qawwali by Hussain Nizami brothers was organized in the evening after the valedictory session, which gave the cosmopolitan audience a taste of North Indian culture. This cultural event was heartfully sponsored by Universal Biotechnology Pvt. Ltd. The event was culminated with a Gala Dinner.

