School of Chemical & Life Sciences

Thrust areas of research in the School are environment and health. The research objective is to understand the etiology of diseases at molecular level and inter-relationship between nutrients and drugs. Modern bio-medical research tools and developments in the fields of Genetic Engineering, Genomics, Proteomics and Bio-informatics are being used to understand the cellular processes associated with health and diseases. The emerging concept of role of elements in health, effect of chemicals on environment, health and ecosystem including mitigation of their toxicity and carcinogenicity are other areas of research. Scientific evaluation of the efficacy of herbal medicine is being extensively pursued. The effect of environment on growth, structure and chemistry of plants, relationship between structure and function of proteins and enzymes, development of bio-molecules by r-DNA technology, regulation of gene expression, development of new generation vaccines and diagnostic probes, enhancement of secondary metabolites in medicinal plants, metabolomics, molecular biology of diseases, biotransformation of medicinal plants for better yield of medicinal compounds and transgenics of valuable crops and medicinal plants are also being studied. Besides the departments, the Schoolhas the following facilities:

1. Central Instrumentation Facility
2. Central Animal House Facility
3. Herbal Garden
4. Transgenic Containment Facility

Departments/Centres

School consists of the following departments and centres

- Department of Biochemistry
- Department of Biotechnology
- Department of Botany
- Department of Chemistry
- Centre for Clinical and Translational Research
- Department of Medical Elementology and Toxicology

Department of Biochemistry

Biochemistry is the molecular logic of living system. It finds applications in diverse disciplines such as medical and agricultural sciences, environmental sciences, forestry, dietetics, food science and technology, hormone production, vaccine research, virology, immunology, microbiology, toxicology and in areas from marine biology to entomology, not just to carry out the R&D work and develop new products, but also to monitor the production, quality and safety of the product. Biochemists provide diagnostic service, carrying out tests on blood, urine and other body fluids, while researching the underlying causes of disease and methods of treatment, and have opportunities to work in hospitals, pharmaceutical industry and agrochemical companies, food brewing and biotechnology. The postgraduate degree in Biochemistry also enables students to teach in universities and colleges as well as the medical, dental and veterinary schools and consulting or allied work. The Department offers M. Sc. and Ph. D. programs in Biochemistry and over the years has gained reputation of being a center of quality education and training in Biochemistry both in India and abroad. The Department has been awarded UGC SAP and DST FIST, in addition to a number of grants from various sources including a DBT grant for creating Bioinformatics Infrastructure Facility. The Department has also successfully completed a UNICEF sponsored ICMR task force study, and several other schemes supported by CSIR, DST, DBT, ICMR, CCRUM and UGC.

Thrust areas include:

- Chronic inflammatory diseases
- Cell proliferation and cell death pathways
- Cancer etiology; Nutrigenomics
- Molecular Biology and Proteomics
- Natural products in diabetic complications
- Molecular immunology; Insulin resistance

Over the years, the Department has developed facilities for high precision analytical work and has acquired sophisticated equipments and tools for cellular and molecular research including the facility to work on cell lines. The Department regularly organizes seminars, workshops, brain-storming and interactive sessions for the students, besides providing training to students and staff from other institutes, universities and colleges. The faculty actively participates in international and national conferences, seminars, workshops, meetings, orientation and refresher courses, and is on the panel of experts in various academic and nonacademic bodies. The Syllabus is updated regularly and promoting emerging areas such as computational and systems biology, nanotechnology. Students are encouraged for creative learning and to deliver lectures/debates on topics of current interest in biological sciences. Students have high rate of success in various competitive examinations and many of them are working in premier institutes and companies in India and abroad. About 200 students of the department have qualified various national level tests since its inception in 1994. Students are working as scientist and academicians in government setups including DRDO, CSIR and Indian universities, besides taking up jobs in private sectors.

Department of Biotechnology

The Department is 4th top Biotechnology Schools of India as per survey made by Bio Spectrum (2013). It is supported by FIST (DST, Govt. of India) and SAP (UGC). The Department offers two formal programmes of study: a two year post-graduate course leading to M.Sc. in Biotechnology and doctoral research leading to Ph. D. degree. Besides, it also offers opportunity for post-doctoral research. The faculty members of the Department have been able to attract number of extramurally funded research projects from various funding agencies such as DBT, DST, CSIR, ICAR, ICMR, DRDO, UGC, DOEn, ISM&H, CCRUM, AYUSH and World Bank. M.Sc. Part II students are allowed to do an intensive project work with teachers of the faculty covering literature survey, experimentation (wet lab), data generation, writing and presentation skill.

The current research interest of the faulty members include: development of biomolecules by r-DNA technology, regulation of gene expression, Development of diagnostic tests, molecular virology; human viruses, vaccine development, genomics/proteomics of cancers and development of biomarkers for their early detection, Molecular biology of non-infectious diseases, proteomics of host-pathogen interactions, enhancement of secondary metabolites through genetic engineering and *in vitro* culture, metabolic engineering of medicinal plants for better yields of medicinal compounds, in vivo and in vitro conservation of medicinal plants and transgenics of vegetables, floriculture and oil crops.

The Department has inter-institutional collaboration with ICGEB (New Delhi), AIIMS (New Delhi), NII (New Delhi), Dabur Research Foundation (Ghaziabad), National Institute of Communicable Diseases (New Delhi), National Centre for Biological Sciences (Bangalore), CDRI (Lucknow), TERI (New Delhi), IARI (New Delhi), JNU (New Delhi), University of Delhi South Campus (New Delhi), Institute of Genomics and Integrative Biology (New

Delhi), CDFD (Hyderabad), CDRI, IITRC (Lucknow), IIIM (Jammu), DRDO (New Delhi), Talwar Research Foundation (New Delhi), THSTI (Faridabad), NIGPR to name a few.

The students of biotechnology have high rate of success in NET/GATE/ ICMR/ DBT test for JRF. They have been selected in reputed institutions such as JMI, Delhi University, CCMB, CDFD, AIIMS, IISc, ICGEB, NII, NCCS, NCBS etc., besides placements abroad.

Recently the Department has developed international research programs (Indo-US Vacine action program) with the Emory University, USA and Centre for Disease Control (CDC), USA on infectious diseases.

Centre for Transgenic Plant Development

The Centre is a unit of Department of Biotechnology. It is equipped with the state of the art facilities to train Ph. D. and post doctoral students and to carry out research in various disciplines of plant and microbial biotechnology. The major R & D activities being pursued include cloning and characterization of novel genes linked with tolerance to biotic and abiotic stresses and quality traits of medicinal and crop plants, authentication and standardization of crude components of herbal formulations and nano vehicle assisted gene delivery in plants. The thrust areas of centre also include improving the quality of medicinal crops through genetic engineering of metabolic pathway; *miRNA and RNAI approaches*, conservation of medicinal plants; developments of easy, rapid, sensitive, cost effective method for aflatoxigenic mould detection in the groundnut kernels and soil and identification and quantification of aflatoxins in the food and feed. The centre has received grants from government agencies such as DST, DBT, Department of AYUSH, CCRUM, CSIR, ICMR, DRDO etc. for R & D projects carried out at the Centre. The consultancy projects from biotech companies are also carried out in the centre.

Department of Botany

The Department of Botany, which came into existence in the year 1989, has developed strong research programmes in the fields of stress physiology, structural & developmental botany, environmental botany, systematics, medicobotany, plant biotechnology and molecular biology. The first registration for Ph.D. was done in 1991. The post-graduate teaching programme started in 1994 leading to the award of M.Sc. degree. The first Ph.D. degree in Botany was awarded in 1995 and the first batch of students got M.Sc. degrees in 1996. So far 19 batches have successfully passed out from this department. A Post-graduate Diploma in Environmental Monitoring and Impact Assessment is also run by the department through distance mode of learning.

During the last 26 years as many as 90 students have been the recipients of Ph.D. degree. Alumni of the department have distinguished as teachers and scientists occupying important position in Indian universities, research institutions, colleges and non-governmental organizations. The department has been acknowledged for its excellence and creativity by various agencies of National/ International repute.

Thrust areas of research

Plant response to heavy metal and environmental stresses

- Air pollution impact on plant form, function and medicinal properties
- Characterization of medicinal plants
- Ethnobotany and plant systematic
- Meristematic behavior and radial growth in plants
- Tissue culture studies for alkaloid production, clonal multiplication and preservation of

endangered species
- Proteomics of nitrogen-efficient and nitrogen-inefficient rice and wheat
- Development of nanosensors for measurement of in vivo flux of metabolites

Research Facilities

The Department has well equipped laboratories for research. The available equipments include Growth chambers, BOD incubators, Refrigerated microfuges, Laminar air flow, Shakers, Environmental shaker incubator, Double beam spectrophotometer, PCR, High speed cold centrifuge, Deep freezer (-20, -80,), IRGA (Photosynthesis System), Leaf area meters, Flame photometer, Sliding and rotary microtomes, Gel documentation system and Nikon's Phase contrast microscope with photography attachment, Weather station attached with gas monitoring sensors, Spectrophotometers, Chlorophyll Fluorometer, Plant Canopy Analyzer, Rotavapor, Sound level meter, Gas & dust analysing system and Inverted fluorescent microscope. A modest Green House and an environmentally controlled Glass House is also available.

Twenty three research projects from different funding agencies are successfully completed / going on in the department.

The University Grants Commission has granted assistance to the Department of Botany, Jamia Hamdard at the level of DRS-1 for 5 years 2011-2016 under the Special Assistance Programme (SAP).

Centre for Clinical and Translational Research

The Centre was established as a Department of Clinical Research in the year 2009 with an objective to train human resources in clinical research. In the year 2012 it was transformed into a Centre and scope of its activities was also expanded by including component of translational research. The Centre envisages imparting theory and practical training in all aspects of clinical research and clinical trails. It provides opportunity to young aspirants desirous of pursuing a career in expanding healthcare sector in India and abroad. According to industry sources, the clinical research industry in India will require a large number of professionals trained in various aspects of clinical research in the coming years. Importance of clinical research has got recognition in recent years due to commendable growth in domestic pharma industry. Global pharma giants have shown interest to conduct clinical trials in India. Moreover, a number of contract research organisations (CROs) has been set up in India. In view of all this developments demand for clinical research professionals in India is expected to grow exponentially. Therefore, personnel involved in clinical research needs training in Good Clinical Practices (GCP) and ethics.

The Centre offers a four semester full-time M.Sc. programme in Clinical Research which takes care of all aspects of clinical research. The study programme is comprehensive based on both course work and hands-on research experience in leading clinical research organization. It is a broad-based multi-disciplinary study programme to prepare professionals in clinical research with training in the principles and methods of clinical research, clinical trials, epidemiology, health economics, biostatistics, bioethics, GCP, translational research and application of these principles to clinical trails. The Centre has established collaboration with Sun Pharmaceuticals Ltd., Max Health Care Institute Ltd. INCLEN Trust International, Apollo Hospitals Educational and Research Foundation and other leading clinical research organizations for practical and hands-on training of the students. The Centre also envisages to organize communication skills workshop, and regular seminars for the students to train them in writing and presenting research data, clinical reports, grant applications and case study reports. Students are also provided exposure to Instructional Review Board (IRB) meetings.

Placement opportunities for M.Sc. Clinical Research students are very bright. Passed out students have been placed in Novartis, Panacea Biotec, Troikaa Pharmaceuticals, Fortis, Jubiliant, Indgene, Auriga, Max Neemam, Max Healthcare Institute Ltd., SRL-Sun Pharmaceuticals Ltd., Relegare, Totipotent, Baxter, Sir Gangram Hospital, Escort Hearth Institute, Medanta Pushpawati Singhania Research Institute (PSRI), Tranlational Health Science and Technology Institute (THSTI, DBT), Jamia Hamdard (in Ph.D programme), and BIT, Mesra (in Ph.D programme). Centre regularly organizes workshops on the contemporary topics in Clinical Research. Centre also undertakes consultancy projects on clinical trials.

Department of Chemistry

The mission of the Department is to provide knowledge in Chemistry that offers opportunities for a high quality and comprehensive learning experience for students. The Department offers a M. Sc. programme in Chemistry of standard UGC apporoved syllabus with the option of specialization in: (a) Organic Chemistry and (b) Industrial Applications in the third and fourth semesters. The M. Sc. Students are assigned intensive project assignments on topics of current research interest coupled with innovation in the fourth semester. The students are exposed to sophisticated instruments such as UV-Vis, FT-IR, NMR, UP-LC mass, Nano-LC mass spectrometers and confocal microscopy during the practicals and their project work. The students are also allowed to go to other nearby institutes through proper channel to analyse their samples by TEM, SEM and X-ray crystallography. The exposure gives them the idea of high quality research in their budding stage itself. With WiFi facility in the department and hostels, the students have access to internet, most of research journals and e-contents round the clock.

With expertise distributed over different areas in Chemistry highly qualified faculty are engaged in teaching and research that prepare the students for market driven opportunities and coach them to qualify in NET examination. It further helps students for employment in reputed pharmaceutical companies like Sun Pharmaceuticals Ltd., Jubiliant Organosys, Glenmark, Wockhardt, Rexin, Indian Oil and other allied industries in addition to placement in universities colleges for teaching and research institutions for doctoral & postdoctoral research positions. The Department also offers a programme in PG Diploma in Chemoinformatics under Open and Distance Learning mode.

The thrust areas of research of the Department are:

- Natural Products Chemistry
- Medicinal Chemistryincluding
  - Anticancer agents & anti-inflammatory agents
  - Anti-hyperglycemic agents
  - Antimicrobials (anti-tubercular, anti-leishmanial etc.)
- Nanosynthesis and Drug Delivery
- Nanocomposites of carbon nanotubes, graphene, catalysis and H_2 evolution
- Gadolinium(III)-oligopeptides and anticancer activity

The competent chemistry faculty has reputation in the above mentioned areas of research with publications in standard research journals of decent impact factors such as American Chemical Scoiety journals, Wiley interscience and Royal Society of Chemistry. The faculty is mainly working in the area of medicinal chemistry *viz.*, synthesis of natural products, small molecular high affinity ligands, gadolinium(III)-peptides and evaluation of antidiabetic and anticancer activities. Ethnopharmacological investigations of rare plant extracts are also carried out inorder to identify new drug candidates from nature. Polymer based nanomedicines composites of carbon nanotubes, their delivery to the tumor targets and to the

brain with the vision of curing neurological disorders is another focus of research in the department of Chemistry.

Diversity oriented synthesis of natural products inspired bioactive ligands as tubulin inhibitors, GSK-3-inhibitors, aldose reductase inhibitors, anti-hypoglycemic agents and anti microbials another frontier areas in the Chemistry department. The Chemistry faculty is also engaged in the synthesis of novel iron-sulfur cubane type clusters which are found in the active sites of hydrogrnases and their composites with carbon nanotubes and graphene. These catalytic materials are evaluated for their catalytic activity for hydrogen gas evolution which is considered as an environmentally clean and alternative fuel.

Many projects in the department are sponsored by the Department of Science and Technology for example, DST-EMR and DST-Fast Track. The Universiy is also funding the faculty through Research Promotion Grants for the beginners. Funds for research have also been received from funding agencies like Department of Biotechnology (DBT), Defence Research & Development Organisation (DRDO) and University Grant Commission (UGC).

Department of Medical Elementology and Toxicology

The Department of Medical Elementology and Toxicology is one of the few Departments in India having full-fledged academic programme at Postgraduate and doctoral levels in Toxicology. The Department has made its mark in toxicological research and has been supported by the Department of Science and Technology (DST) through Fund for Improvement of S&T Infrastructure in Universities & Higher Educational Institutions (FIST) programme and University Grants Commission (UGC) Special Assistant Programme (SAP). Ph.D degree in Toxicology is being awarded in different fields of toxicology. The Department has collaborative programmes with many reputed institutes such as Indian Institute of Toxicological Research (CSIR), Lucknow; Central Drug Research Institute (CSIR), Lucknow; Indian Institute of Integrative Medicine (CSIR), Jammu; Institute of Nuclear Medicine and Allied Sciences (DRDO), New Delhi etc

Thrust areas

- Chemoprevention of cancer by plant products/indigenous medicines and standardization of such drugs.
- Targeting the molecular mechanism and elucidation of their plausible role in induction of carcinogenesis in prostate, liver, kidney and skin at preclinical stage.
- Toxic effects of endocrine disrupting chemicals (EDCs).
- Neurodegenerative disorders and their protection.
- Role of trace elements in the manifestation of diseases.
- Ecotoxicity of environmental pollutants and their interactive effects.
- Immunotoxicity of drugs and environmental chemicals and its prevention.
- Molecular mechanism of nanoparticles in toxicity manifestation.
- Animal models of arthritis for study of mechanism of action of protective agents.

The Department has received funding support from agencies such as Council of Scientific and Industrial Research (CSIR), Central Council for Research In Unani Medicine (CCRUM), Department of AYUSH, Department of Biotechnology (DBT), Department of Science and Technology (DST), Indian Council for Medical Research (ICMR), Ministry of Environment and Forests and UGC. Every year a good number of students qualify fellowships offered by government agencies. Students who have obtained degree in toxicology have got placements in various companies and R&D institutes such as Sun Pharmaceuticals Ltd., CDRI, IITR, Dabur, Torrent, Cadila, Lupin, Dr. Reddy's Laboratory, Sri Ram Institute of Industrial Research, Nestle, Himalaya etc. The Department’s distinguished Alumni as faculty or post-

doctoral fellows are spread all over the globe. More emphasis is given to develop academic and research skills of the students. M.Sc. programme has integral component of dissertation work in the fourth semester. After completion of the course students have job opportunities in industry and research organizations. A good number of students qualify NET examinations conducted by UGC-CSIR in life science and forensic science streams. The Department is fully-equipped with sophisticated equipment to perform research in all major fields of toxicology including *in vitro* toxicity.

Courses offered:

1. **BSc-MSc Integrated programme:**

   Duration: Three years (Six semesters)
   Seats: 120 (SFS)

   Eligibility: A candidate seeking admission to the BSc-MSc Integratedprogram must have passed Senior Secondary (12th / Intermediate) examination with Biology /Mathematicsfrom CBSE or any other Board recognized by JH as equivalent thereto, securing at least 50% marks or equivalent CGPA in aggregate.

   Selection procedure: Selection will be based on merit in NEET2017/ Paper-1 of JEE (Main) 2017. Non NEET/ Non JEE candidates may also apply. *In case of non-availability of sufficient number of applicants from NEET 2017/JEE 2017, University has the right to admit candidates on the basis of merit of qualifying examination or the merit of internal test and/or Interview conducted by Jamia Hamdard.*

2. **Post Graduate Programmes:**

   - **M.Sc. Biochemistry**

     Duration: Two years (Four semesters)
     Seats: 25 [20* General Category+05 SFS Category]

     Eligibility: Passed B.Sc. in Biochemistry or equivalent examination in Biological Sciences with Biochemistry or Chemistry as one of the subjects securing at least 45% marks in aggregate.

   - **M.Sc. Biotechnology**

     Duration: Two years (Four semesters)
     Seats: 40 [20* General Category+20 SFS)-Seats include the seats for NRI/sponsored category candidates

     Eligibility: Passed B.Sc. examination from a recognized University in Biological Sciences/B.Sc. (Agriculture)/B.V.Sc with a minimum of 45% marks in aggregate.

   - **M.Sc. Botany**

     Duration: Two years (Four semesters)
     Seats: 30 [25* General Category + 05 SFS)

     Eligibility: Passed B.Sc. or equivalent examination of a recognized university with Botany/Plant Sciences as one of the subjects securing at least 45% marks in the aggregate.

- **M.Sc. Chemistry**

  Duration: Two years (Four semesters)
  Seats: 25 [20 general +05 SFS]

  Eligibility: Passed B.Sc. or equivalent examination from a recognized University with Chemistry as one of the subjects securing at least 45% marks in the aggregate.

- **M.Sc. Clinical Research***

  Duration: Two years (Four semesters)
  Seats: 25 [SFS]

  Eligibility: Passed MBBS/ BDS/ BAMS/ BUMS/ B.V.Sc./ B.Pharm/ B.Sc. Nursing /BOT/ BPT/ B.Sc. Medical Lab. Techniques/B.Sc. With Biochemistry/ Biotechnology/ Microbiology/ Zoology /Bioinstrumentaion or any other life sciences/allied health sciences securing at least 45% marks in the aggregate

- **M.Sc. Toxicology**

  Duration: Two years (Four semesters)
  Seats: 30[25 General + 05 SFS)

  Eligibility: Passed B.Sc. with any three of the following subjects: Botany, Chemistry, Zoology, Biochemistry, Biotechnology, Microbiology, Environmental Biology or a subject of Life Sciences securing at least 45% marks in the aggregate.

  Having studied Biology at 10+2 level and having B. Pharm./B.V.Sc./B.Sc. (Agriculture)/BMLT and other paramedical or allied sciences degree securing at least 45% marks

Selection procedure: Selection for PG programs will be based on the merit in the qualifying examination and interview conducted by Jamia Hamdard. In case where result is awaited, merit for shortlisting the candidates for interview will be considered on the basis of average of marks obtained in all the years except the last year in the qualifying examination.

3. **Doctoral**

- Ph.D in Biochemistry
- Ph.D in Biotechnology
- Ph.D in Botany
- Ph.D in Chemistry
- Ph.D in Clinical Research
- Ph.D in Toxicology

Eligibility and selection procedure:

Allpicants seeking admission to PhD are advised to read JH PhD Bylaws 2016 before applying.
Briefly, candidates shall have a Master's Degree or a professional degree declared equivalent to Master's degree by the corresponding statutory body, with atleast 55%

marks in aggregate or its equivalent Grade'B' in the UGC 7-point scale. The University shall admit Ph.D. students through an Entrance Test comprising of 2-stage selection process to be conducted at the School level.

The selection will be based on performance in interview and previous academic record as per the following weightage:

Criteria	**Weightage**
Personal Interview	35%
JRF/NET (INSPIRE, 30, JRF=20, NET=10)	30%
Performance in Post graduate examination	20%
Performance in Undergraduate examination	10%
Teaching experience/publication	05%