

# The Postgraduate Certificate Course in Personalized and Molecular Medicine

This certificate course aims to equip students with critical knowledge and understanding of genomic medicine. Students will be able to apply knowledge for direct clinical research and future studies. This course also caters to the educational needs of a primary and secondary care audience, and is the only one of its kind that is completely accessible online. This course has been designed for general medical practitioners, specialists (General Medicine, Pediatrics, Obstetrics, Medical Oncology, Ophthalmology *etc.*) and allied health professionals (clinical psychologists, occupational therapists and physiotherapists). In addition, the course would be of interest to those with related postgraduate degrees (Biomedical Sciences, Biosciences, Pharmacy and Dietetics) or equivalent professional qualifications and background experience.

## **Broad Objectives:**

- Gain a global perspective of clinical and basic molecular medicine.
- Integrate knowledge about the basics of genomics in his/her studies.
- Understand the patho-physiology of a wide range of genetic disorders.
- Identify the role of genetics in the treatment of various diseases.
- Assess the available options for research, diagnosis and treatment in the area of personalized and molecular medicine.
- Discuss the need for improvement of health-care delivery in the field of personalized and molecular medicine in India encompassing preventive, diagnostic and curative services.
- Relate to molecular biology, proteomics such that he/she can explore the fields of genetics, environment, medicine and drugs. Further, this would enable him/her to undertake OMICS approach on explore the interaction amongst genetic, environmental, medicine and drugs. In addition,, this would enable him/her to undertake the OMICS approach on human physiology (diabetes mellitus, cancer, cardiovascular, metabolic, neuroendocrine and immune function) with application to public health and safety.

## **EXISTING INSTITUTIONAL SCENARIO:**

Department of Personalized and Molecular Medicine first of its kind in India was established on 15<sup>th</sup> March 2019 under the able leadership of Prof. Farzana Mahdi, Hon'ble Vice Chancellor, Era University with the aim to ENSURE BETTER PATIENT CARE by enabling

each patient to receive early diagnosis, risk assessments, and optimal treatment. It will help clinicians to provide better treatment, management of different diseases such as Type2 diabetes mellitus, cancer, cardiovascular, neurodegenerative diseases etc. In this course work participants shall learn a new concept of medicine, novel trends in healthcare and biomedical education.

**RESEARCH AREA OF DEPARTMENT:**

- ✓ Type 2 Diabetes mellitus
- ✓ Gestational Diabetes
- ✓ Cervix Cancer
- ✓ Glaucoma
- ✓ Breast Cancer
- ✓ Alzheimer disease
- ✓ Celiac disease
- ✓ Polycystic Ovarian syndrome
- ✓ Tuberculosis

**OUR COLLABORATING DEPARTMENT/INSTITUTES:**

- ✓ Lambe Institute for Translational Research, Discipline of Pathology, School of Medicine, National University of Ireland Galway (NUIG), Galway, Ireland.
- ✓ Department of Endocrine Surgery, SGPGI, Lucknow.
- ✓ Department of Surgical Oncology, King George's Medical University, Lucknow.
- ✓ Department of Radiation Oncology, King George's Medical University, Lucknow.
- ✓ Department of Medicine, Era's Lucknow Medical College and Hospital, Era University, Lucknow.
- ✓ Department of Gynecology, Era's Lucknow Medical College and Hospital, Era University, Lucknow.
- ✓ Department of Ophthalmology, Era's Lucknow Medical College and Hospital, Era University, Lucknow.
- ✓ Department of Dentistry, Era's Lucknow Medical College and Hospital, Era University, Lucknow.

## **THE NUMBER OF TRAINEES**

For every admission year only 20 candidates shall be admitted.

## **ELIGIBILITY CRITERIA**

Candidate must have Ph.D./M.D./M.Sc. in Biochemistry, Bioinformatics, Biotechnology, Botany, M. Pharm, Chemistry, Environmental Science, Genetics, Mathematics, Medical Lab Technology, Microbiology, Veterinary Sciences, Zoology or M. Tech in Biotechnology/Bio-medical as one of the subject(s) and with a minimum aggregate of 55% marks in degree or any other equivalent examination approved by UGC/ICMR.

## **SELECTION CRITERIA:**

Candidates will be called for an interview conducted by Era University to get admission for this course. Based on the marks in the interview, candidates shall be selected for admission to this course.

## **1. DURATION OF THE COURSE**

\*The duration of the course would be six months.

## **AIMS AND OBJECTIVES OF THIS COURSE:**

On completion of the course, candidates would gain an insight into the following:

- A systematic understanding of genomics.
- A critical awareness of current issues affecting the management of inherited human diseases.
- A thorough knowledge of genetics and genomic factors in human diseases.
- Ability to critically integrate current research in applied and translational molecular medicine.
- An advanced knowledge of clinical genomics that will facilitate decision-making in unpredictable and/or complex situations.
- An ability to deliver management strategies for the investigation and treatment of patients.
- A basic understanding of the scope and effect of genomics on treatments including horizon scanning of potential new targeted treatments for wider population.

## **CAREER/JOB OPPORTUNITIES**

The goal of this course is to equip the students in the field of Pharmacogenomics culminating to better job opportunities in:

- R & D division of growing reputed pharmaceutical and biotechnology industries in India and abroad.
- Universities/Colleges as well as in research institutes.
- Genetic, diagnostic and counseling centers for genetic diseases.

| S.No. | Course contents  | Teaching/Practical   |
|-------|--|----------------------|
|       | <b>Introduction:</b> an overview of Personalized and Molecular Medicine  |                      |
| 1     | <b>Medical Genetics:</b> <ul style="list-style-type: none"> <li>• Introduction To Human Genetics</li> <li>• Human Chromosomes</li> <li>• Karyotyping</li> <li>• Chromosome Structure and Function</li> <li>• Patterns of Inheritance</li> <li>• Pedigree Analysis</li> <li>• Clinical Application</li> </ul>                       | Theory               |
| 2     | <b>Genome Organization:</b> <ul style="list-style-type: none"> <li>• Genome Organization</li> <li>• Gene Expression and Regulation</li> <li>• Epigenetics</li> <li>• The Human Genome Project</li> <li>• Functional and comparative genomics</li> </ul>  | Theory               |
| 3     | <b>Population Genetics:</b> <ul style="list-style-type: none"> <li>• Genetic Polymorphism</li> <li>• Allele Frequency</li> <li>• Genetic Drift</li> <li>• Hardy–Weinberg Equilibrium</li> <li>• Population Specific Diseases and Protections</li> <li>• Clinical Aspects of Population Genetics</li> <li>• Epidemiology</li> </ul> | Theory               |
| 4     | <b>Genomic Variations:</b> <ul style="list-style-type: none"> <li>• Single Base Variations</li> <li>• Multi Base Variations</li> <li>• Copy Number Variations</li> <li>• Structural Variations</li> <li>• Clinical Significance</li> <li>• Gene conversion</li> </ul>  | Theory               |
| 5     | <b>Genotyping:</b> <ul style="list-style-type: none"> <li>• Isolation of DNA from Human Specimens</li> <li>• Polymerase Chain Reaction</li> <li>• Restriction Fragment Length Polymorphism</li> </ul>  | Theory and Practical |

|    |  |                      |
|----|--|----------------------|
|    | <ul style="list-style-type: none"> <li>• Variable Number Tandem Repeat (VNTR) markers</li> <li>• Single nucleotide polymorphism (SNP)</li> <li>• Amplification-Refractory Mutation System (ARMS)-PCR</li> <li>• DNA Fingerprinting</li> <li>• Restriction Digestion</li> <li>• Electrophoresis (Agarose, Native PAGE)</li> </ul>   |                      |
| 6  | <b>Genetic Mapping:</b> <ul style="list-style-type: none"> <li>• Gene Identification using Positional and Functional Cloning Approach</li> <li>• Fluorescence In Situ Hybridization</li> <li>• Comparative Genome Hybridization</li> <li>• High Resolution Mapping</li> <li>• Genomic Library</li> <li>• cDNA Library</li> <li>• Genome-Wide Association Studies</li> <li>• Applied Significance of Genetic Mapping Methods</li> </ul> | Theory               |
| 7  | <b>Expression Analysis:</b> <ul style="list-style-type: none"> <li>• Isolation of mRNA from Blood Sample.</li> <li>• cDNA conversion and quantification</li> <li>• Expression with Real-Time PCR.</li> <li>• Protein Isolation</li> <li>• Protein Estimation</li> <li>• SDS-Poly Acrylamide Gel Electrophoresis</li> <li>• Western Blot</li> </ul>   | Theory and Practical |
| 8  | <b>Gene silencing and miRNA's:</b> <ul style="list-style-type: none"> <li>• RNA Interference</li> <li>• Types of Small Non-coding RNAs: miRNA, siRNA, shRNA, piRNA, rasiRNA, tasiRNA</li> <li>• miRNA Biogenesis Pathway.</li> <li>• miRNA in Disease Diagnosis and Treatment.</li> </ul>  | Theory               |
| 9  | <b>Sequencing:</b> <ul style="list-style-type: none"> <li>• Types of Sequencing and its applications: <ul style="list-style-type: none"> <li>✓ Sanger Sequencing</li> <li>✓ Next Generation Sequencing (NGS)</li> <li>✓ Size defined chromosome specific library and sequencing</li> </ul> </li> </ul>   | Theory and Practical |
| 10 | <b>Pharmacogenomics:</b> <ul style="list-style-type: none"> <li>• Drug Toxicity Estimation</li> <li>• Drug Response Efficacy</li> <li>• Drug Dosing Recommendations</li> <li>• Strategies for Deciding Treatment Options</li> <li>• Counseling Patient and Family Members</li> </ul>   | Theory               |
| 11 | <b>Nutrigenomics:</b>  | Theory               |

|    |  |                      |
|----|--|----------------------|
|    | <ul style="list-style-type: none"> <li>• Bioactive Food Components</li> <li>• Understanding of Intra Individual Variation in Diet Response</li> <li>• Effects of Nutrition on the Expression of the Genome</li> <li>• Personalized Nutritional Counseling for Health Maintenance and Disease Prevention.</li> <li>• Super nutraceuticals with low glycemic index</li> </ul>  |                      |
| 12 | <p><b>Statistical and Computational Methods:</b></p> <ul style="list-style-type: none"> <li>• Measures of Central Tendency and Dispersion</li> <li>• Probability Distributions</li> <li>• Sampling Distribution</li> <li>• Difference between Parametric and Non-Parametric Statistics</li> <li>• Confidence Interval</li> <li>• Errors</li> <li>• Levels of Significance,</li> <li>• Regression And Correlation,</li> <li>• T-Test,</li> <li>• Analysis of Variance.</li> <li>• NCBI database</li> <li>• FASTA,</li> <li>• BLAST,</li> <li>• ENSEMBL,</li> <li>• Primer deigning.</li> <li>• Variant annotations of SNP.</li> <li>• OMIM database</li> <li>• Genbank</li> <li>• Swissprot</li> <li>• EMBL database</li> </ul> | Theory and Practical |
| 13 | <p><b>Personalized Approach in Disease Management:</b></p> <ul style="list-style-type: none"> <li>• Type 2 Diabetes,</li> <li>• Cancer</li> <li>• Alzheimer</li> <li>• Cardiovascular Diseases</li> <li>• Bone Disorders</li> <li>• Chronic myeloid leukemia</li> </ul>  | Theory               |

## 2. CURRICULUM TO BE COVERED

### LEARNING OUTCOMES

In depth knowledge of the core concepts of genomics from molecular to cellular to population level genomic variation.

- ❖ Critical appraisal of methods of laboratory analysis, interpretation and clinical utility of genomic data.
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- ❖ Critical appraisal of the principles of genetic counseling to complex clinical situations.
- ❖ Selective appraisal of relevant ethical, moral and legal issues to the diagnosis, testing and counseling of patients.

### **3. PRACTICAL SKILLS TO BE GAINED**

#### **3.1. CLINICAL SKILLS**

It is envisaged that at the end of the training, the candidate would have acquired the following skills. To diagnose, evaluate and effectively plan treatment of different diseases.

#### **4. RESEARCH SKILLS TO BE GAINED**

- The candidate would be actively involved in the on-going research activities of the unit. The candidate would be expected to complete at least one short term project during diploma.
- It is hoped that the candidate would gain insight into the methodology of basic and clinical research including the design and planning, analysis of data, simple statistical methods and finally the logical presentation of the data in a scientific communication.
- The candidate is expected to present research paper which would enable him/her to gain an insight.
- In addition, candidates would participate in regular seminars and group discussions to demonstrate his/her academic prowess and skills.

#### **5. OTHER EFFECTIVE SKILLS**

- ✚ How to communicate with patients and their attendants.
- ✚ How to explain prognosis of disease.
- ✚ How to explain the procedure.
- ✚ How to take informed consent.
- ✚ How to remain positive even under most challenging conditions.
- ✚ How to avoid gracefully sticky situation

**CHAIRMAN:** PROF. FARZANA MAHDI, Vice Chancellor, Era University, Lucknow

**MEMBERS OF ADVISORY COMMITTEE:**

- ❖ Prof. Farzana Mahdi, V.C, Era University, Lucknow
- ❖ Prof. Abbas Ali Mahdi (KGMU)
- ❖ Prof. Sher Ali, Era University, Lucknow
- ❖ Prof. Syed Tasleem Raza (ELMC, Lucknow)
- ❖ Prof. Hari Sharma (Netherlands)
- ❖ Prof. Pradeep Kumar (Trivandrum)
- ❖ Prof. Dr. Lindsay C. Brown(Australia)
- ❖ Dr. Sharon Glynn(Ireland)
- ❖ Dr. Namakkal S. Rajasekaran (USA)
- ❖ Dr. Susan Branford (South Australia)
- ❖ Dr. Swati Tiwari (Lucknow)
- ❖ Dr. Pallavi Somvanshi (New Delhi)

**Impact of the certificate course:**

The course will provide a unique platform for the clinicians, researchers, educators and postgraduate students to become aware of the most recent innovations, trends as well as practical challenges encountered and solutions adopted in the field of Personalized Medicine & Pharmacogenomics. It will help clinicians to provide better treatment management of different diseases such as Type 2 diabetes mellitus, cancer, cardiovascular, neurodegenerative diseases etc. More than that, all the participants are envisaged to develop a higher level of confidence and achieve skills at par with any International organization.