

CERTIFIED FELLOWSHIP IN CANCER CYTOGENETICS

[Syllabus Approved by Board of Studies, Medical & Health Sciences]

Programme Code	:	HLTH14A02
Programme Details	:	2-YEARS HBNI CERTIFIED FELLOWSHIP IN CANCER CYTOGENETICS
Programme Learning Outcomes (PLOs / PSOs)	:	MENTIONED [COMMON FOR ALL 2 YRS HBNI CERTIFIED FELLOWSHIPS OFFERED AT TMC]
Eligibility Criteria	:	MD/DNB IN ANATOMY/PATHOLOGY OR PH.D. (OR EQUIVALENT); THE PH.D. DEGREE MUST BE IN GENETICS OR A RELATED FIELD WITHIN THE BIOLOGICAL SCIENCES. MD/PH.D. APPLICANTS SHOULD PREFERABLY HAVE WORKED ON HUMAN CYTOGENETICS RELATED SUBJECT WITH HAVE ATLEAST ONE YEAR POST-DOCTORAL LABORATORY EXPERIENCE IN THE FIELD OF CYTOGENETICS.
Duration of the Course	:	2 YEARS
Programme Structure (Credit-Based)	:	NA
Detailed Course Syllabus	:	ATTACHED
Teaching–Learning Methodologies	:	2 YEARS PROGRAM
Examination & Evaluation System	:	ANNUAL APPRAISAL FOLLOWED BY UNIVERSITY FINAL EXAMINATION
Internship / Project / Dissertation Guidelines	:	NA
Program In Charge	:	PROF. TANUJA SHET (<i>tanujashet5@gmail.com</i>)

CERTIFIED FELLOWSHIP (CANCER CYTOGENETICS)

Programme Code: HLTH14A02

Programme Outcome:

- The HBNI Fellowship Programmes at Tata Memorial Centre are designed to develop competent, ethical, and academically oriented healthcare professionals with advanced knowledge and skills in their respective specialties and subspecialties.
- At the completion of the fellowship, candidates are expected to demonstrate excellence in clinical practice, patient-centered care, multidisciplinary teamwork, communication, professionalism, and evidence-based decision-making.
- Fellows shall acquire the ability to independently evaluate, diagnose, plan, and manage patients while adhering to institutional protocols, quality standards, patient safety practices, and ethical principles in healthcare delivery.
- The fellowship programmes also aim to foster academic growth, research aptitude, lifelong learning, and leadership qualities among trainees.
- Fellows are expected to actively participate in teaching, seminars, journal clubs, conferences, audits, and research activities, thereby contributing to the advancement of medical science and institutional development.
- Upon successful completion of the programme, the fellow should be capable of functioning independently as a skilled specialist/subspecialist with competence in clinical services, academics, research, and collaborative healthcare practice in tertiary care and oncology-focused settings.

DETAILED SYLLABUS

▪ **Prospects of the proposed Programme, outcome and job opportunity**

- Prospect: The proposed Post-Doctoral Cytogenetics Fellowship Program at the Dept. of Cancer Cytogenetics, Advanced Centre for Treatment, Research and Education in Cancer aims to prepare candidates who wish to specialize in the field of clinical and cancer cytogenetics and are keen to establish and direct cytogenetic facility in future. Such specialized training programme is essential as there is a dearth of nationalized programs in the niche field of cytogenetics.
- Outcome: The programme will provide broad range of knowledge, technical skills and expertise in all aspects of diagnostic clinical and cancer cytogenetic testing as well as exposure to molecular genetic testing and advanced cytogenomic methods including microarray, to enable the candidate to become a competent cytogeneticist able to function in a supervisory capacity in a cytogenetics laboratory. At the end of the fellowship the candidate will be able to analyze and interpret cytogenetics and molecular cytogenetics test results relevant for diagnosis and management of genetic disorders and haematological malignancies and sign out reports.
- Job opportunity: There is an increasing need for professionals in the field of clinical and cancer cytogenetics. The program is designed to prepare candidates as laboratory cytogeneticists able to establish, direct and supervise cytogenetic laboratories specialized in diagnosis of a broad range of chromosomal disorders both inherited and acquired as well as haematological malignancies or solid tumors. The programme will provide ample opportunities in diagnostics as lab directors, supervisors and consultants in advisory position as well as academia.

▪ **Total duration of the programme**

- The duration of the course will be 2 years.
- The first year will focus on laboratory training, clinical rotations and didactic component. The focus will be on building a foundation in cytogenetics: techniques, analysis and reporting as well as completion of clinical rotations and didactic components. The second year will be focused on reporting, training in non-specialty laboratory and research component.

▪ **Detailed academic curriculum with syllabus and semester wise distribution of courses**

- This programme comprises of simultaneous hands on training, clinical rotations and didactic phase followed by non-specialty laboratory directed training at affiliated departments and research. Outline of Training over the course of two years:

Component	Training	Year	Duration
Didactic	Lectures, Case presentations, seminar or conferences		10 months
Diagnostic FISH/Conventional Karyotyping Training	Understanding the indications for the test, sample collection, sample receiving and rejection criteria. Hands on experience in cell culture and harvesting, slide preparation, GTG banding, image acquisition, analysis and nomenclature of karyotypes. Understanding the principles of GTG banding, conventional karyotyping and troubleshooting. Understanding the principle of fluorescence microscopy and probe design. Technical aspect of FISH and troubleshooting. Interpretation of various genetic alterations and nomenclature of abnormality. Suggestions for further improvements		10 months
Clinical Rotations (1 st and 2 nd Year)	Pediatric haematolymphoid Adult haematolymphoid	1st	15 days
			15 days
	Haematopathofogy Molecular Haematopathology		15 days
	Molecular Haematopathology		15 days
	Pathology, and Molecular Pathology	2nd	1 month
	Cancer Genetics Clinic	2nd	1 month
Other Lab Rotations (Clinical genetics — Ped and Gyn/ IVF)	2nd	1 month	

Research (2 nd Year)	Application of scientific method: Generation and testing of hypotheses, fundamentals of experimental design, statistical analysis and designing a research project. Preparation of written reports of findings for publication, or presentation of research data at scientific meetings.	2nd	6 months
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- Basic hands on training, clinical rotations and didactic component
 During the course of training, fellows will participate in daily diagnostic activities of the Cytogenetics Laboratory, monthly laboratory meetings, conferences and seminars. The first year will focus on completion of clinical rotations in pediatric, adult haematolymphoid clinics, didactic components and hands on training in cytogenetics techniques and interpretation of test results. During their first year of fellowship, trainees are expected to progress from passive observation to taking increasing responsibility for workup of clinical cases. During the 2nd year training period, each fellow is expected to demonstrate proficiency in daily diagnostic activities of the Cytogenetics Laboratory, assume greater responsibility for signout of cytogenetic cases (both constitutional and acquired chromosome disorders), present at seminars and attend various conferences with clinical colleagues from other disciplines (all under the supervision of the Cytogenetics faculty).
- Scope and Hands on training at Cancer Cytogenetics Laboratory include:
 - Understanding all aspects of pre-analytic workflow appropriate for the Cytogenetics Laboratory to ensure orders are entered correctly, specimens collected are appropriate for the test ordered and are correctly processed/transported.
 - Independently processing biological specimens (i.e. bone marrow, peripheral blood and lymph node) for cytogenetic testing, which includes cell culturing, harvesting, slide making and banding.
 - Screen G-banded slides, focusing on chromosome analysis for the diagnosis of acquired malignancies.
 - Construct Karyotypes, recognizing abnormality of different origins and interpret findings.
 - Report findings according to ISCN nomenclature.
 - Preparation and validation of FISH reagents.

- Quality control of FISH specimens and controls
 - Preparation of paraffin-embedded tissue, peripheral blood, and enriched bone marrow specimens for FISH analysis.
 - Review and interpretation of all lab processed FISH specimens, which may include the use of automated digital image analysis systems.
 - Utilization, evaluation and maintenance of digital fluorescent image analysis systems.
- Analyzing clinical laboratory specimens, reporting and maintaining records of patient test results following the laboratory's policies and procedures, including safety measures.
 - Performing, assessing and/or reporting patient specimens, quality control or proficiency testing samples in an accurate and timely manner.
 - Adhering to the laboratory's quality control program.

Month	Didactic Training Topics
1	Basics in human genetics and genomics Human Chromosome: classification, structure and number Cell cycle- mitosis and meiosis. DNA as genetic material Genetic history taking- Clinical photography, dermatoglyphy Pedigree charting Principles of Mendelian inheritance. Polygenic inheritance Multifactorial trait, Genetic Susceptibility & risk factors Variations in pedigree analysis (variable expressivity, heterogeneity, penetrance, anticipation, epigenetics, Mosaicism, genomic imprinting, UPD, X chromosome inactivation)
2 and 3	Conventional and molecular cytogenetics Basics of cell culture & lymphocyte harvesting Chromosome Banding analysis (Type of Banding) Chromosomal abnormalities- Numeric and structural Investigating autosomal and sex linked abnormalities Molecular Cytogenetics: FISH/aCGH/SKY/m-banding Genotype phenotype correlation- Down Syndrome, Edward Syndrome, Patau

	<p>Syndrome</p> <p>Sex chromosomes (Turners, Klinefelter, Jacob, XXX)</p> <p>Common Microdeletions (William, Cri du chat, Digeorge, Ip36, Angelman, PWS etc.).</p>
4	<p>Developmental genetics</p> <ul style="list-style-type: none"> • Intellectual disabilities
5	<p>Reproductive genetics</p> <ul style="list-style-type: none"> • Recurrent pregnancy losses (RPL) • Infertility: Primary/Secondary ° Bad Obstetric history (BOH) • Assisted Reproductive Techniques (OI/UI/IVF/ICSI/GIFT/ZIFT) • Implications of ART for genetic conditions (Biological/Donor/Surrogacy) • Pre Implantation Genetic Screening/Diagnosis
6	<p>Pre-natal genetics</p> <ul style="list-style-type: none"> • Prenatal screening and Diagnostic Techniques (Invasive: CVS, Amnio, PUBS/Non Invasive: USG, Biochemical, NIPS) • Indications for Prenatal Diagnosis • Termination of Pregnancy- PCPNDT Act 1994 • Maintenance of records
	<p>Cancer Genetics</p> <p>The genetic and molecular basis of Cancer</p> <p>Chromosomal abnormalities in haematological malignancies</p> <ul style="list-style-type: none"> • Chromosomal abnormalities in solid tumors. <p>Inherited cancer predisposition.</p> <p>Stress Cytogenetics/Chromosome Fragility testing.</p> <p>Chimerism</p> <p>Oncology microarray</p>

9	<p>Genetic Counseling</p> <p>Causes and factors for seeking counselling</p> <p>Protocol for counselling- Discussing the options,</p> <p>Pre-/Post- test counselling, Communication and Support</p> <p>Multifactorial trait, Genetic Susceptibility & risk factors</p> <p>Confidentiality</p> <p>Ethics in counselling</p> <p>Psychosocial and emotional</p>
10	<p>Use of cytogenetic nomenclature (ISCN) report karyotype and FISH results.</p>

- Clinical Rotations and Research Components

The first year will focus on completion of clinical rotations at pediatric and adult haematolymphoid units to understand clinical indications for cytogenetic testing and the second year will be focused on monthly rotations in Haematopathology, Molecular Haematopathology, Molecular Pathology, Cancer Genetics Clinic, Clinical genetic- Ped/ Gyn/IVF Clinics to understand specialized areas of cytogenetics, genetic counseling as well as exposure to molecular techniques.

- **Meeting of credit requirements (if applicable):**

- Not Applicable

- **Student selection procedure:**

- The eligibility criteria would be M.D./DNB in Anatomy/Pathology or Ph.D. (or equivalent); the Ph.D. a degree must be in Genetics or related field within the biological sciences. Applicants must have passed Medical Post Graduate degree course recognized by the Medical Council of India.
- M.D./Ph.D. applicants should preferably have worked on human cytogenetics related subject and or have at least one year post-doctoral laboratory experience in the field of cytogenetics.
- After an advertisement, selection of candidates will be based on a multiple choice questions (MCQs) based entrance test of 100 marks conducted by TMC. Shortlisted candidates with min 50% marks will be further interviewed.

▪ **Total intake per year:**

- One Students will be selected every year

▪ **Availability of Faculty members for the programme at CI/OCC:**

- The primary faculty members in this programme will be

Dr. Navin Khattry Dy Director- CRC, ACTREC (Programme Director)

Dr. Dhanlaxmi Shetty, Officer In-Charge Cancer Cytogenetics Dept., ACTREC (Programme Co-ordinator).

e Ms. Hemani Jain, Scientific Officer 'D' Cancer Cytogenetics Dept., ACTREC.

e Ms. Purvi Mohanty, Scientific Officer 'C' Cancer Cytogenetics Dept., ACTREC. Faculty members delivering lectures from other Dept. across TMC and other national and international institutes will be incorporated to expand knowledge in other disciplines.

- Faculty from other Dept.:

Dr.PG Subramanian Officer In-Charge Hematopathology lab, ACTREC

Dr.Prashant Tembhare Clinician Scientist and Assoc Professor, Hematopathology lab, ACTREC

Dr.Nikhil Patkar Clinician Scientist and Assoc Professor, Hematopathology lab, ACT

REC Dr.Omshree Shetty Scientific Officer E, Molecular Pathology, Tata Memorial

Hospital. Dr.Rajiv Sarin Professor Radiation Oncology; In-Charge Cancer Genetics Unit & Principal Investigator SARIN Lab, ACTREC.

▪ **Availability of stipend/scholarship for the students:**

- The fellow will be paid a stipend as per existing structure for Year 1 and 2 fellowship students at Tata Memorial Centre. The total scholarship will be as per existing norms.

▪ **Annual tuition fees:**

- The students will have to pay an annual tuition fee as per existing structure for fellowship students at Tata Memorial Centre.

▪ **Examination pattern:**

- The fellow will be evaluated after 12 months of training through internal assessment and annual report will be sent to HBNI University. The final examination will be held at the end of the 2nd year including subjective as well as objective based questions of 100 marks to test theoretical as well as practical knowledge. The fellow will have to complete a 50 case log book (100 marks) followed by viva voce (100 marks). The examiners will be the faculty members of the programme.

▪ **Declaration of results:**

- Results will be declared by the Academics office of Tata Memorial Centre as per existing norms applicable to HBNI fellowship programmes.

▪ **Draft Ordinance:**

- As per existing norms applicable to HBNI fellowship programme.