Clinical Cytogenetics & Molecular Genetics Training Program

Program Objectives

The fundamental aim of the GenaTi is to provide specialized training to physicians and medical laboratory technologists in the fields of:

- Medical Molecular Genetics
- Clinical Cytogenetics
- Molecular Cytogenetics

At the end of the training the applicant is expected to have a clear understanding of the following topics:

- Recent advances in cellular and molecular aspects of human genetics
- Chromosome karyotyping techniques, understanding the background of where and when to apply them
- Analysing DNA and RNA for diagnosing certain inherited diseases
- Detection and sequencing of common mutations responsible for diseases prevalent in Saudi population
- Patterns of genetic inheritance and process of anticipation in genetic diseases
- Concept of DNA banking system and bioinformatics, a national platform for successful genetic studies
- Implications of ethical and social issues based on Islamic values and legislations concerning genetic diagnosis of inherited diseases.
- Skillfully and professionally handling the following specialized platforms:
  - PCR
  - Real time PCR
  - DNA Sequencing
  - Micoarray Affimetrix
  - Gel Documentation
  - Applied Image Cytogenetic Workstation
  - Light Microscopy
  - Flourescent Microscopy
  - Inverted Microscopy

Training Period and Certification

The trainee will spend a total of two months at GenaTi labs, where four weeks will be spent at Cytogenetics and Molecular Cytogenetic laboratory and the remaining four weeks at the Molecular biology laboratory. After fulfilling all the training completion criteria including time spent in the laboratory and successfully passing the examination, the trainee will be granted a certificate of completion in the fields of Cytogenetics and Molecular biology.

Training Program Requirement

The applicant must fulfill the following criteria for acceptance:

- He / she must be a Saudi citizen or a valid Iqama holder.
- Applicant must hold a Bachelor degree from College of Medicine, Applied Medical Sciences or any equivalent college program.
- Minimum grade required is 'Good'
- Applicant must successfully pass an interview
- Show competency in both written and spoken English
- Submit the required tuition fees
- Comply with the overall rules and regulations of King Abdulaziz University

Supervisory and Consultancy Committee

The training is supervised by a professional group consists of specialized teaching staff from College of Medicine and Applied Medical Sciences. The members of this group have played key role in establishing the fundamental platforms for such activity to take place at GenaTi.

The vision is clear and the members are well focused to fulfill this vision. It is worth mentioning that basic work for carrying out 'hands on' workshops at GenaTi has been completed and apart from the training program, required documents for establishing a Masters program in Cytogenetics and human Molecular genetics have also been submitted to be approved by higher authorities within due course of time.

Training Facility

The training will take place at GenaTi based at King Abdulaziz University. GenaTi is composed of well equipped laboratories spanning region of 1700m^2. It further constitutes of 10 specialized satellite laboratories covering an area of 16m^2 each. There is a full size teaching and training laboratory equipped with latest platforms required for applied Cytogenetic and Molecular analysis.

Furthermore, the Center has dedicated staff that consists of laboratory supervisors, seniors, technologists, technicians and administrative personnel. The staff is fully trained in the above mentioned specialties to carryout the required technical and diagnostic tasks.

Training Course Outline

The duration of the program is two months, i.e. 8 weeks in Cytogenetics and Molecular Biology. During this period, the trainee will be supervised on day-to-day bases and will be allowed technical experimentation. The applicant will gain theoretical knowledge by attending specialized lectures delivered by professionals. Quizzes and practical assignments will be given throughout the course to properly monitor the progress of the trainee. Finally the applicant will have to successfully pass the final exam which will allow him / her to obtain the training certificate.

The applicant may join the training program 3 times per year, however, under certain circumstances the course could be taken during summer time.

Finally, it is worth mentioning that presence of such a training program in our Center is the first of its kind, it will be used as a knowledge seeking platform for scientists from all spheres whether they be health professionals, postgraduate students or researchers who will be able to apply what they have learned for the benefit of the Saudi community.

Cytogenetics and Molecular Cytogenetics

Knowledge

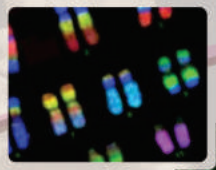
Trainees must demonstrate an understanding of the following topics:

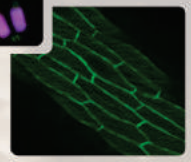
- Safety in Cytogenetic laboratory
- Quality control regulations affecting cytogenetic work.
- Clinical indications for cytogenetic testing and clinical implications of the test results.
- Ethical issues in genetics.
- Principles of prenatal cytogenetic diagnosis, and cancer cytogenetic.
- Types of samples and methods of collections.
- Major techniques used in clinical cytogenetic, including culture of peripheral blood, fibroblasts, amniotic fluid and chorionic villi, chromosome staining, and karyotyping.
- Cell cycle, including mitosis and meosis.
- Chromosome structure and function.
- Chromosome band Nomenclature.
- Aneuploidy-numeric abnormalities of autosomes and sex chromosomes, Chromosome structural abnormalities-micro deletions, markers, rearrangements and segregation; rearrangements and segregation.
- Major syndromes due to numerical aberration and chromosomal imbalance.
- Chromosome breakage/instabiity syndromes/fragile sites.
- Principles and applications of techniques and stains used in diagnostic Cytogenetic. For example, solid banding, high resolution banding, C banding, R-banding, Distamycin A/DAPI, NOR, late replication and sister chromatid.
- Principles and applications of fluorescence in situ hybridization techniques.
- Genetic counseling.
- Gamete or genomic imprinting and uniparental disomy.

Skills

Trainees must demonstrate the ability to:

- Perform routine cell culture and chromosome preparation techniques from blood and specialized procedures such as fragile site induction, Chromosome breakage/instability syndromes and high resolution banding.
- Observe routine cell culture from hematopoietic tissue, solid tumor tissue, amniocytes, chorionic villi and fibroblast.
- Perform routine staining techniques (solid, and G).
- Karyotype and identify normal and abnormal chromosome complements by microsopic and print analysis.
- Perform computerized karyotyping;
- Perform fluorescence in situ hybridization(FISH) procedures of metaphase.
- Chromosome and interphase nuclei for cytogenetic diagnosis.
- Assess whether further work is required on a case and write a report with a review of the literature if appropriate;





Molecular Genetics

Knowledge

Trainees must demonstrate:

- General knowledge of molecular biology;
- Advanced knowledge of molecular genetics,
- General knowledge of the pathophysiology of inherited disorders, particularly those amenable to molecular diagnosis;
- Advanced knowledge of human genome, structure of genes, the nature of mutation at well recognized human loci and the correlation between genotype and phenotype at these loci;
- Advanced knowledge of methods for direct analysis of mutations;
- Advanced understanding of the estimation of genetic risk by inferential methods including linkage analysis and lod scores, Bayesian probability, pedigree analysis and risk calculation in familial or potential new mutation situations using linked polymorphisms. Candidaes will be expected to be familiar with a board spectrum of disorders representing all modes of inheritance, as well as an understanding of the relationship between physical and genetic maps of chromosomes; and
- Advanced knowledge of the human genome project.

Skills

The trainee must demonstrate competence in the theory and practice of Techniques used in the molecular analysis of genetic disease, including an awareness of the variables that contribute to the quality of results and ability to "trouble-shoot" successfully. These should include (but are not limited to) the following:

- DNA and RNA isolation from various biological samples.
- Polymerase Chain Reaction and Gel Electrophoresis.
- Confirmatory strand gel electrophoresis (CSGE).
- Restriction fragment length polymorphism (RFLP) application of restriction enzymes, and interpretation of the data.
- DNA sequencing by the capillary method and finding sequence variations.
- Real time quantitative PCR (qPCR).
- Bioinformatics and use of electronic resources in molecular biology research.