Integrating Research Based Project in the Cytogenetics and Cytogonemias
Track of the Diagnostic Genetics and Genomics Program
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Background
Cytogenetics has been one of the important areas of practice in Cancer and Human genetics. It has been helpful in evaluation of several human disorders and cancers associated with specific chromosomal abnormalities. Some of the recurrent abnormalities have been instrumental in providing information in diagnosis, prognosis and in identifying therapeutic targets for cancers. At the same time, advances in cytogenetics has changed the visualization of chromosomal using a microscope to the molecular level using arrays, scanners and suitable software for analysis which has transformed Cytogenetics to Cyrogemcolistics. The Diagnostic Genetics and Genomics (DGG) graduate program is a MS thesis based program with two tracks, Molecular Genetics and Genomics track (MGG), Cytogenetics and Cytogenomics track (CGG). We implemented the research based project in the first-year fall semester of 2019 in order to provide an outline for the students entering the Cytogenetics and cytogenomics track. The Research Based project (RBP) is designed to teach fundamental concepts and laboratory skills for them to apply and perform the project independently. The project is learning process at lectures and is designed to improve their learning process, critical thinking and communication skills among the students. At the end of the project the student will be able to characterize a given cell line and update new information that can be useful for future research projects.

Project description
The project is developed and designed for CGG track students to learn cytogenetic techniques and its applications in diagnosis and research. A comprehensive 11 to 13 week project is designed for students to independently perform cytogenetics and cyrogemcolistics techniques. CGG students will have hands on experience to use a cell line individual cell line for characterization. The project involves use of basic cell culture and molecular techniques to prepare chromosomes for analysis and Florescence in situ hybridization (FISH) experiments and extract DNA for Array Comparative Genome Hybridization (aCGH) experiments. At the end of the project, students will get familiar to differentiate from complex chromosomal alterations to cryptic copy number variations using aCGH technique.

Project timeline
Research based Project DGG CGG Masters program 1st year FALL SEMESTER 11 -13 weeks

Results and Outcome
The Research based project was first implemented in the fall of 2019 and three batches have successfully completed the project. Two batches have submitted abstracts and presented their data at the national meetings. Third batch (2021) has also submitted the abstract.

Project provides several opportunities
a. Hands on experience with cell culture techniques setting up cultures, maintaining, splitting of cells and refreezing techniques.

b. Improve chromosome identification skills analyzing some complex chromosomal abnormalities seen in cell lines of different origins.

c. Use of appropriate FISH probes to further explore the regions of complex rearrangements.

d. Prepare aCGH experiment to view cell line chromosomes at a higher resolution in identifying copy number abnormalities.

e. Experience to prepare chromosomes and construct Genetic DNA from different sources

f. Microscopic skills to identify complex rearrangements in the given cell line.

g. DNA quality control procedures and steps in aCGH experiments.

Discussion
The diagnostic program is a 11-13 week comprehensive project designed for students to independently perform cytogenetic and DNA analysis of a given cell line. The hands on experience will equip students to keep updated with the latest cytogenomic skills.

Student learning experience
a. To learn the importance of cell culture techniques in diagnosis and research.

b. Experience to prepare chromosomes and construct Genetic DNA from different sources

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Dr. Ralf Krahe - Department of Genetics

First year Students - DGG/CGG track
Batch 2019-21
Mr. Nimmakayalu Manjunath
Ms. Caner Akdemir Kadir
Ms. Liu Xiaojun
Mr. Sfamenos Steven
Batch 2020-22
Mr. Sfamenos Steven
Mr. Sfamenos Steven
Ms. Liu Xiaojun
Ms. Liu Xiaojun
Ms. Liu Xiaojun
Mr. Sfamenos Steven
Ms. Liu Xiaojun
Ms. Liu Xiaojun
Ms. Liu Xiaojun

Batch 2021-23
Mr. Sfamenos Steven
Ms. Liu Xiaojun
Ms. Liu Xiaojun
Mr. Sfamenos Steven
Ms. Liu Xiaojun
Ms. Liu Xiaojun
Ms. Liu Xiaojun

Summary:
1. Research based project in the CGG track was implemented in the fall of 2019.
2. Students have successfully completed projects and have submitted 6 abstracts, 5 poster presentations and won one best poster award in 2020.

- Batch 2019-21 (4 students) – All students used same cell line and performed independently. One abstract was submitted, awarded best poster at the 2020 virtual ACLS/AGT Joint meeting
- Batch 2020-22 (4 students) – Separate cell lines used. Four Abstracts submitted and presented individually at the 2021 SAKLS, AGT, SAFMLS Joint meeting
- Batch 2021-23 (4 students) – Separate cell lines used. One abstract was submitted.
3. CGG track will continue the project and add newer technologies that will help students to keep updated with the cytogenomic skills.