



SIR Foundation Summer Medical Student Internship Program 2019

Institution Name: **Cleveland Clinic**

Responsible mentoring physician: **Gordon McLennan, MD**

Length of proposed curriculum: The internship should be **8 weeks** and **at least 40 hours per week**.

A. Please provide a brief description of how each of the following curriculum elements will be demonstrated/taught through your program.

Provide details of the instructional setting and methodology (laboratory, classroom), description of any educational resources (PowerPoint presentations, textbooks, selected readings), and assessment techniques (question and answer sessions, tests) to be used in the process of instruction: The Interventional Radiology Research Laboratory at the Cleveland Clinic offers summer interns the opportunity to learn basic biological assays associated with investigations into the mechanisms of liver cancer development & local/regional drug delivery. The Student will be introduced to the basic biological assays used to characterize HCC cancer development in animal models.

Specific educational activities are planned to teach the concepts of study design, statistical analysis, & research ethics involving animal & human subjects.

Interventional Radiology Medical Student Internship Curriculum

Mandatory elements:

1. Concept development – distillation of a clinical question into elemental components:

The student will meet with the sponsor & the Research Associate during the first week of the internship & be oriented to the lab & the safety training required to work in the institution. The elements of the ongoing research that are available will be reviewed & a project will be chosen & broken into hypotheses.

2. Experimental design and statistics, including proof of concept, steps in validation of new technique:



The student will meet with the sponsor & the Research Associate during the first week of the internship & be oriented to the lab & the safety training required to work in the institution. The elements of the ongoing research that are available will be reviewed & a project will be chosen & broken into hypotheses.

3. Techniques in the basic science lab

Aseptic cell culture techniques, Immunohistochemistry, Co-Immunoprecipitation assays, Western blot, Flow cytometry, Proliferation assay, Con-focal microscopy, Application of IR in animal HCC models Data collection, statistics, and meaningful analysis of data

4. Constructing a well-written scientific paper:

Abstract preparation & manuscript preparation are expected as part of this program

B. Please provide a brief outline of available research topics, one of which the student will select for completion as part of the program. Projects should be of a scope appropriate for completion within the limited time frame provided.

Curriculum is available online and in-person teaching and includes:

- a. Investigation of novel cellular and molecular targets for HCC detection and therapy - Using human and rat HCC samples and techniques such as Immunohistochemistry, western blotting and flow cytometry the goal is to detect targets in HCC samples and compare it with other reported cancer types.
- b. Regulation of HSP 70 and AIF expression in tumor cells by tumor associated fibroblasts (TAF) - DNA repair is critical in cancer progression and therapy. HSP 70 modulates endonucleases which in turn regulates DNA repair. This project aims to elucidate mechanisms involved in HSP 70 mediated DNA repair in HCC and thereby develop better therapy or improve efficiency of existing therapies.
- c. Role of copper and SOD1 in TAF activation, function and cancer progression - Copper and tumor associated fibroblasts (TAF) play important role in tumor generation and progression, however not much is known how they affect each other or crosstalk to promote cancer progression. This project aims to understanding the role of copper and copper containing super-oxide dismutase 1 in fibroblast activation and function in HCC.

The student may be asked to make an oral presentation at the Medical Student Brunch at the SIR Annual Scientific Meeting in 2020.