



SIR Foundation Summer Medical Student Internship Program

Institution Name: **University of Illinois at Chicago**

Responsible mentoring physician: **Ron C. Gaba, MD FSIR**

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

A. 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:

Gaba Lab description: The long-term objective of our translational research lab is to improve the prognosis of patients with liver malignancies through the use of image-guided, minimally invasive locoregional therapies in Interventional Radiology (IR). Lab research interests span large animal models (the Oncopig Cancer Model) of liver disease and liver cancer (hepatocellular carcinoma, HCC), Interventional Oncology and innovative drug delivery approaches, and genomics. Current projects span *in vitro* and *in vivo* (mouse and pig) alcoholic liver cirrhosis and HCC development and characterization; preclinical (*in vitro*) screening and testing of novel chemotherapy agents as well as device based therapeutics; human cirrhotic liver and HCC genetic, transcriptomic, and epigenetic sequencing; *in vivo* (rabbit) quantification of cytotoxic/cytostatic drug delivery using innovative agents; investigation of driver mutations in liver cancer and cancer therapeutics through genome editing.

The lab has a solid track record for extramural funding (currently supported by the United States Department of Defense and medical industry), academic productivity (with more than 140 peer-reviewed literature publications), and mentorship (ten mentored research fellows including 6 mentored MS students). Our group works in an approximately 2,500 square foot, recently renovated and fully equipped (cell culture facilities with laminar flow hoods, carbon dioxide incubators, water baths, fume hoods, PCR thermocyclers, gel electrophoresis equipment, UV transilluminator with camera, centrifuges, vacufuge, vortexes, low temperature freezers, refrigerators, liquid nitrogen storage facilities, and other essential equipment) space in the Incubator Laboratory Facility (ILF) on the University of Illinois at Chicago campus (2201 West Campbell Park Dr., Chicago 60612). Current lab members include one MD PhD lab manager, one post-doctoral research associate, two MS students, and numerous undergraduate students.

UIC Interventional Radiology Medical Student Internship Curriculum

1. Textbook:

- a. Culture of Animal Cells, R. Freshney
(<http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118873653.html>)

- b. Gibco Cell Culture Basics Handbook
(<https://www.thermofisher.com/content/dam/LifeTech/global/promotions/global/images/aai-2015/aai-pdfs/GibcoCellCultureBasicsHandbook.pdf>)
 - c. Swine in the Laboratory: Surgery, Anesthesia Imaging, and Experimental Techniques, M. Michael Swindle (<https://www.crcpress.com/Swine-in-the-Laboratory-Surgery-Anesthesia-Imaging-and-Experimental/Swindle-Smith/p/book/9781466553477>)
2. Required Readings:
- a. Schachtschneider KM, Schwind RM, Newson J, et al. The Oncopig cancer model: an innovative large animal translational oncology platform. *Front Oncol* 2017; 7:190
 - b. Schachtschneider KM, Schwind RM, Darfour-Oduro KA, et al. A validated transitional and translational porcine model of hepatocellular carcinoma. *Oncotarget* 2017; 8:63620-63634
 - c. Schook LB, Collares TV, Hu W, et al. A genetic porcine model of cancer. *PLoS One* 2015;10:e0128864
3. Mandatory Lectures:
- a. Laboratory group meeting (weekly, Monday 9 am)
 - b. Interventional Radiology didactic lecture (weekly, Wednesday 7 am)
 - c. Multidisciplinary Hepatobiliary Cancer Conference (weekly, Thursday 7 am)
 - d. Oncopig Research Retreat (monthly, third Tuesday)
4. Weekly Schedule:
- a. Laboratory work (Monday through Friday)
 - b. Lectures and conferences, as scheduled above
5. Educational Resources:
- a. Administrative office, work, and conference space in the Westside Research Office Building (WROB), which lies in close proximity to both the ILF building and the Biological Resources Laboratory animal facility
 - b. Four conference rooms—housed in the Department of Radiology, in the University of Illinois Outpatient Care Center, in the ILF building, and in the WROB—available for research group meetings
 - c. Access to the UI Health Sciences Library in Chicago
 - d. Biostatistical services available via the University of Illinois Center for Clinical and Translational Science, as well as the University of Illinois Cancer Center
 - e. Access to statistical software including SPSS version 22 (SPSS Inc., Chicago IL) and SAS 9.4 (SAS Institute, Cary NC)

Mandatory elements:

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



Students will collaborate with the Principal Investigator and team researchers to develop objectives and design of research projects and proposals. In doing so, students will develop an understanding of basic research principles, concepts, practices, and methods.

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

Students will formulate and conduct scientific experiments and analyses to become familiar with and proficient in molecular biology and mammalian cell culture research techniques, and will develop experience with lab animal research. Students will develop and troubleshoot experimental protocols. Students will be involved in lab maintenance, including equipment maintenance. Students should demonstrate organizational skills and ability to work efficiently in a team environment.

3. Techniques in the basic science lab:

Students will perform complex laboratory techniques, data collection, and analyses; lab techniques include molecular biology (DNA, RNA, and protein-based) and mammalian cell culture techniques, as well as lab animal (mouse, pig) procedures.

4. Data collection, statistics, and meaningful analysis of data:

Students will collect and analyze data, including periodical/literature searches, and apply specialized skills to analyze data.

5. Constructing a well-written scientific paper:

Students will contribute materials, prepare results, and assist in the writing of research findings for publications, papers, presentations, and other documents for publication. Students can assist in grant writing. Students will develop good oral and written communication skills through weekly presentation at lab group meeting.

Suggested/optional elements:

1. Clinical trials design and regulatory approval/obstacles/legal considerations:

Student will be required to complete Animal Care Committee Training, animal facility training, Institutional Biosafety Committee training, Environmental Health training, and Laboratory specific orientation.

2. Design and conduct of animal research and observation of animal research:

Student will be intimately involved in lab animal (mouse, pig) procedures, such as liver resection, tumor



cell injection, and transarterial chemoembolization.

B. 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.

Current projects span *in vitro* and *in vivo* (mouse and pig) alcoholic liver cirrhosis and HCC development and characterization; preclinical (*in vitro*) screening and testing of novel chemotherapy agents as well as device based therapeutics; human cirrhotic liver and HCC genetic, transcriptomic, and epigenetic sequencing; *in vivo* (rabbit) quantification of cytotoxic/cytostatic drug delivery using innovative agents; investigation of driver mutations in liver cancer and cancer therapeutics through genome editing.

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