UNIVERSITY OF MINNESOTA ROCHESTER

Developing A Better Way To Diagnose Pancreatic Cancer

Jake Christopher Atencio; Spring Semester, 2022

A Quick Intro To My Work

Where?

- Currently, my undergraduate research experience (SRS) takes place in the Mayo Clinic Oncology Research Laboratories, located in the Gonda Building of Peace Plaza Campus.

What?

- The primary area of research my team and I focus on includes the understanding of pathology (total progression/life cycle) of pancreatic cancer. Our *aim* is to develop a catalog of precursor signs that will work as a programmable data base used to more accurately assess the condition of one's pancreas, and to provide an accurate cancer diagnosis much earlier than currently possible.

Who?

- My current lab is headed by our Principal Investigator (PI) Dr. Martin-Fernandez Zapico. My current Immediate Supervisor is Dr. Brooke Trader. My co-lab partner is UMR's very own, Brian Chang.

Why Research?

- Research has been a fundamental part of my aspiration for following medicine. Particularly in the way that I see research as the primary force pushing scientific exploration, forward; as the basis for all knowledge we have today, and as the epic to all things we will come to know tomorrow.
- Taking part in the research of Dr. Zapico's lab provides me with an excellent opportunity to gain valuable in lab experience. In addition, I have the opportunity to really see if the world, schedule, and pace of research is right for me, before having to make a commitment to research, when applying to Grad-School.

Outline Of General Responsibilities/Current Project

- As a student oncology researcher, my primary job is to listen and absorb. Taking the opportunity, now, to learn as much as possible in the general functionings and environment of the lab will better prepare me for a future of medical research hopefully in the making.
- In addition to benefiting from a general lab interaction, my primary work is currently focused on data analysis and processing. More specifically in having to quantify the volumetric size of the nuclei of each cell that has been collected from a specimen example of pancreatic cancer tissue.
- The Specific tissue we analyse is known as Pancreatic ductal adenocarcinoma, or PDAC for short. This is the most common type of pancreatic cancer, and is characterised by its bright white body and coarsely sharpen dark borders.
- Before a tissue sample can be collected, a specimen must be prepared. Laboratory mice with previously existing pancreatic cancer are prepared through inducing certain genetic minifications knows as inscription factors. These "factors" work as modifications to the collection of pancreatic cellular genes regulating specific organ function.
- By examining the volumetric size of these nuclei taken from our tissue samples, we are then able to compare those measurements to the predictions made when the certain inscription factors had been introduced.
- The known function of these inscription factors occurring intandem with certain trends in nuclear size allow us to make predictions about the future state of a patient's potential case. Even going so far as to possibly use nuclear size to predict these cases altogether (along with accompanying factors)

What's It All For!?

- Once the comparisons between all transcription factors and nuclear volume have been assessed, we must then process all of our data through the organization of spreadsheets, and eventually, a consolidated series of graphs.
- These graphs are important as they often times serve as the primary visual aid in delivering your data to your fellow colleagues during an in-lab presentation.
- In addition to understanding our data, these graphs also provide an excellent summary of your findings, to your PI. Allowing him or her to give you accurate, but quick, on the move advice for how your project may need to be course corrected.
- Once such data has been evaluated fully, we will either be left with a discernible trend in our data…or nothing at all. Depending on the outcome, a project will either be re-evaluated then continued OR tentatively disregarded.

What's Next?

- From a futuristic standpoint, my time with Dr. Zapico and his lab may only be the beginning. Although I don't see myself necessarily being drawn to pactratic research as a future career, this experience does provide me with an excellent first step on the path of developing a future career in research, altogether.

- As I currently serve as a laboratory member for my second year, I am happy to say that I hold strong in my aspirations to continue my current lab partnership well into the end of my undergraduate career. Depending on where med school takes me, I may have to end my time her at Mayo. But for now, I am excited to say I am still a part of the team!

Nuclear imaging; Discovering the Connections Between Nuclear Volume and the Diagnosis of Early-stage Subtyping in the Morphology of Pancreatic Cancer

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Background

- Pancreatic cancer has a mortality rate of 93% within the first five years of diagnosis 1.
- Early detection of pancreatic subtyping can improve the rate of early intervention, leading to a decrease in pancreatic related fatalities 2.
- Variations to nuclear size and shape have been observed in cancerous cells 3.
- Proton microscopy in nuclear imaging, along with nuclear staining allows for quantification of nuclear volume.

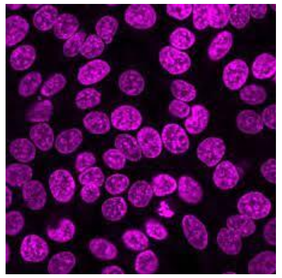
Aim:

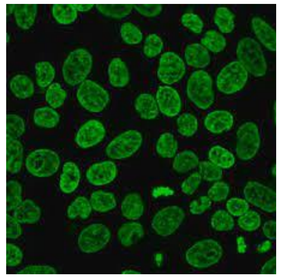
We aim to develop a better understanding of pancreatic cancer subtyping and morphology in order to improve early diagnosis rates; provided through the phenotypic classification of nuclear size.

Methods

Cancer model system	Data collection	Data analysis
Mouse models were employed to represent canonical pancreatic cancer	Nuclei volume quantified with validated software instrument: Figi	These quantifications are then processed into graphs in further analysis of the data.

Results





Figures 1 and 2: Fluorescent color staining “highlighting” the nuclei of each cell.

These fluorescent images are uploaded onto the quantification software (Fiji) where the volumetric value of each nuclei is measured using microscopic imaging that includes three dynamics: An X, Y, and Z oriented plane; allowing for an accurate three-dimensional analysis of the nuclei itself.

The software provides a layout of each individual quantification of each nuclei. An average can be calculated of these volumes, and is displayed typically using a paragraph that has been broken into its subcategories of “knockout groups”

References

- Bio-render Images LLC.
- Department of Oncology and Medical Pathology; Mayo Clinic - Rochester Campus
- Principal Investigator (PI) Dr. Martin-Fernandez Zapico
- Immediate Supervisors Dr. Luis Flores, and Graduate Student Brooke Trader.

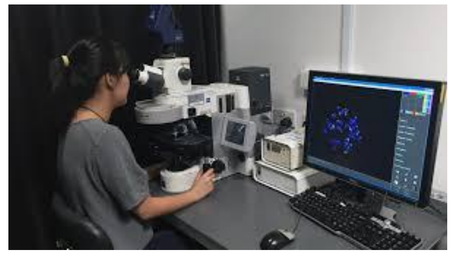
Images:

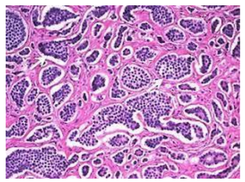
Nuc Spot® Live Cell Nuclear Stains. Biotium. (2022, March 1). Retrieved March 23, 2022, from https://biotium.com/product/nucspot-live-cell-nuclear-stains/

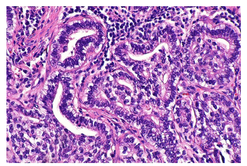
Nuc Spot® Live Cell Nuclear Stains. Biotium. (2022, March 1). Retrieved March 23, 2022, from https://biotium.com/product/nucspot-live-cell-nuclear-stains/

Conclusions & Future Directions

- This software is used to identify certain fl recently colored stains of nuclei that are “tagged for certain genetic factors” or “Knockouts”
- Observations of nuclear size can help us determine patterns in nuclear morphology as they are related to cellular subtyping.







What Is My Role In The lab?

- My primary role include quantification and processing of data. This includes utilizing the tools of nuclear images, combined with a computer mapping formatting known as FIJI, allowing us to quantify nuclear volume/size.