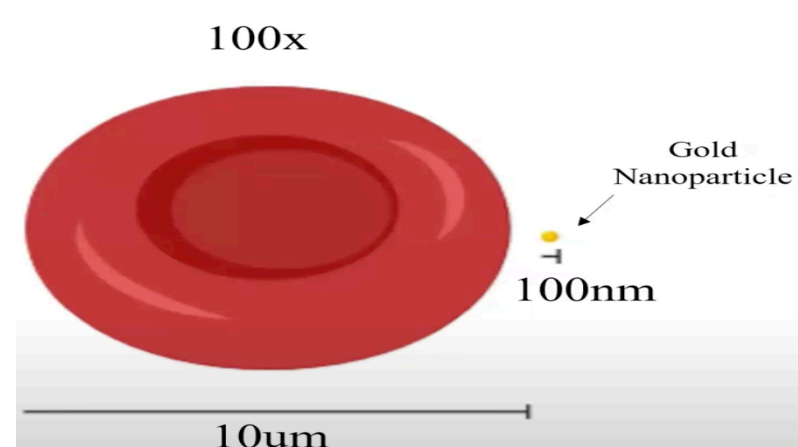


## Introduction

The revolutionary research being explored by Dr. Cristina Zavaleta is groundbreaking in the Imaging Technique Realm. The underlying goal is to utilize nanoparticles as contrast agents for the purpose of improving cancer detection and localization. Specifically, nanoparticles are of importance because of their size and their ability to bind with cells.

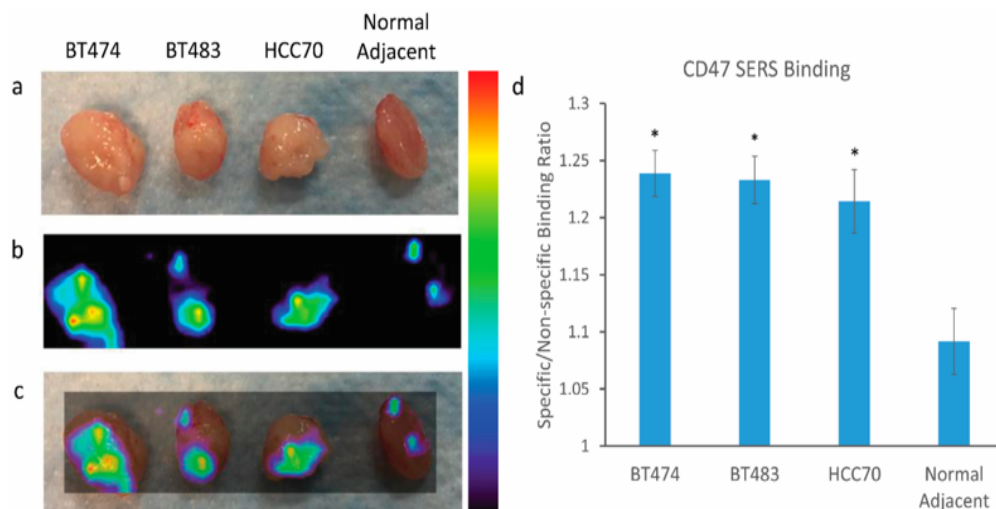


**Figure 1**

## Impact of Professor's Research

This new imaging modality would allow for several benefits for all parties involved in the screening and evaluation of images. The known Magnetic Resonance Imaging (MRI) scans are able to distinguish between soft tissue, however they are not fully capable of differentiating between healthy and infected tissue. These images would allow for precision during a surgical procedure, eliminating the need for a second resection procedure if there were any remains of the tumor. Below is a study of SERS nanoparticles used to detect cancer cells. The areas that are illuminated show the overexpression of nanoparticles, indicating the presence of malignant cells.

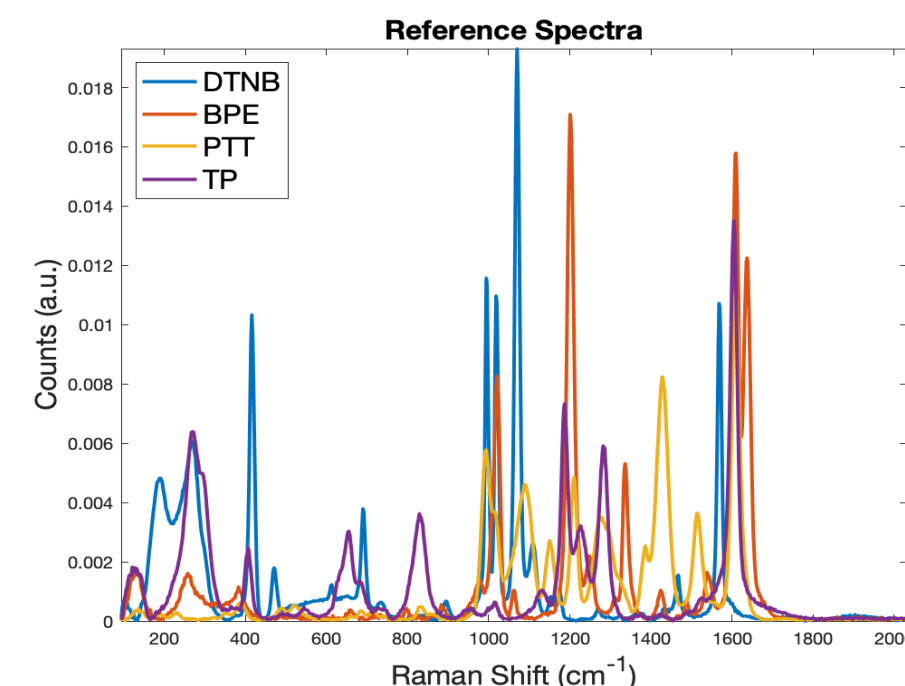
**Figure 2**



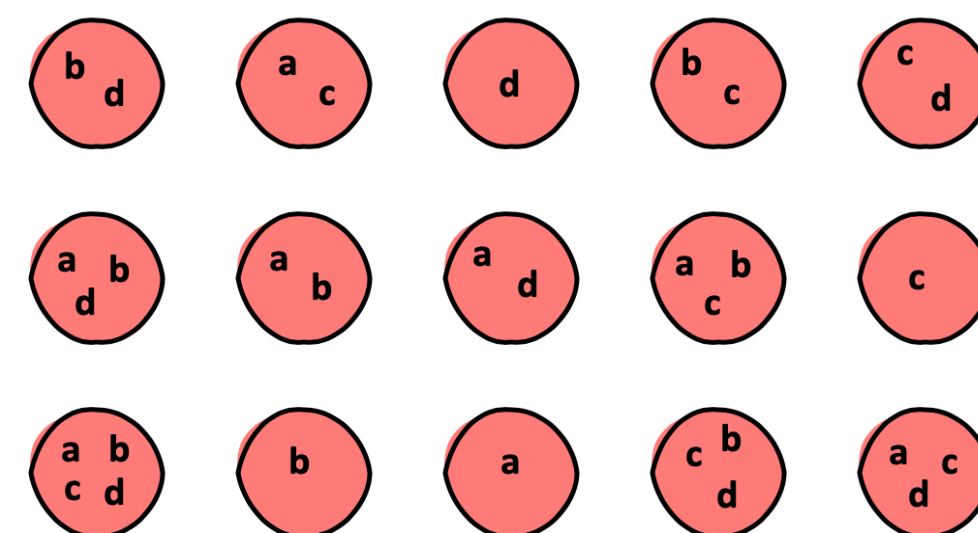
## Skills Learned

### ➤ Raman Spectroscopy

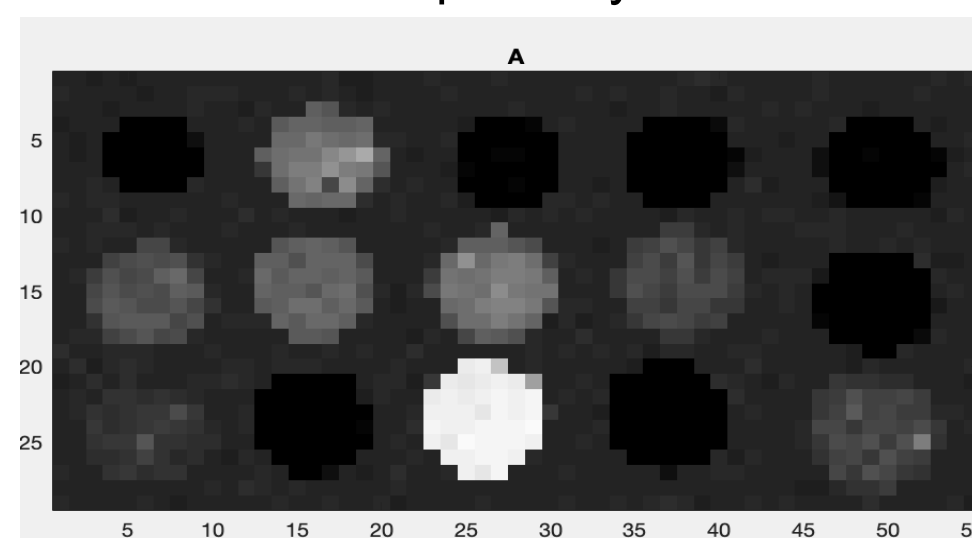
1. Taking different flavored nanoparticles, they were pipetted onto samples and went through imaging to see the Raman peaks where the flavors were most absorbed.
2. Next, we pre-processed the data in MATLAB and created a code to visualize the flavors.
3. Once seeing the data, we compared it to the Reference Spectra of which mixture of flavors were present.
4. Using ImageJ, we had to determine the average of each flavor and how equal they were distributed.



**Top: Figure 4-Bottom: Figure 5**

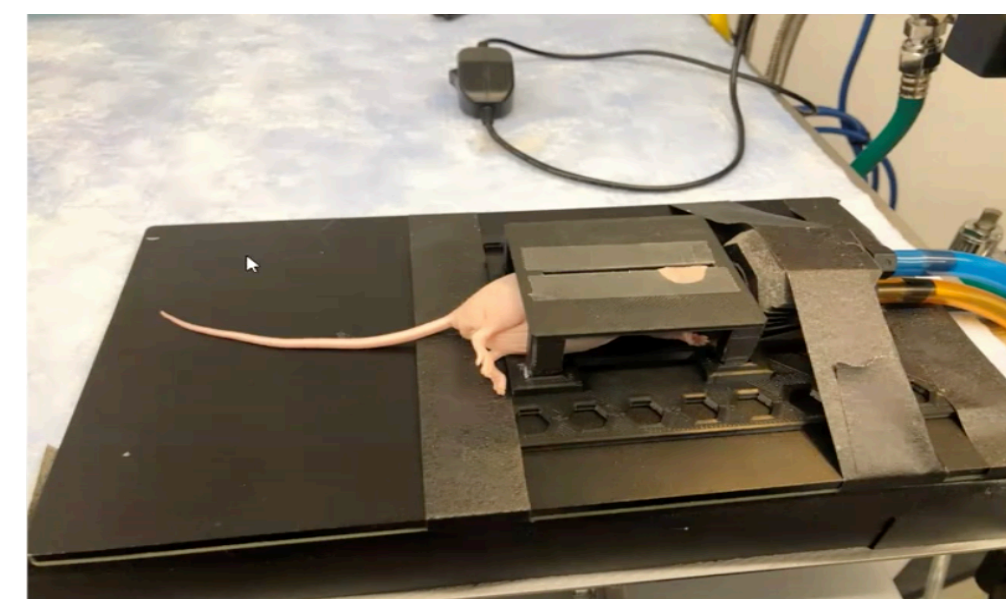
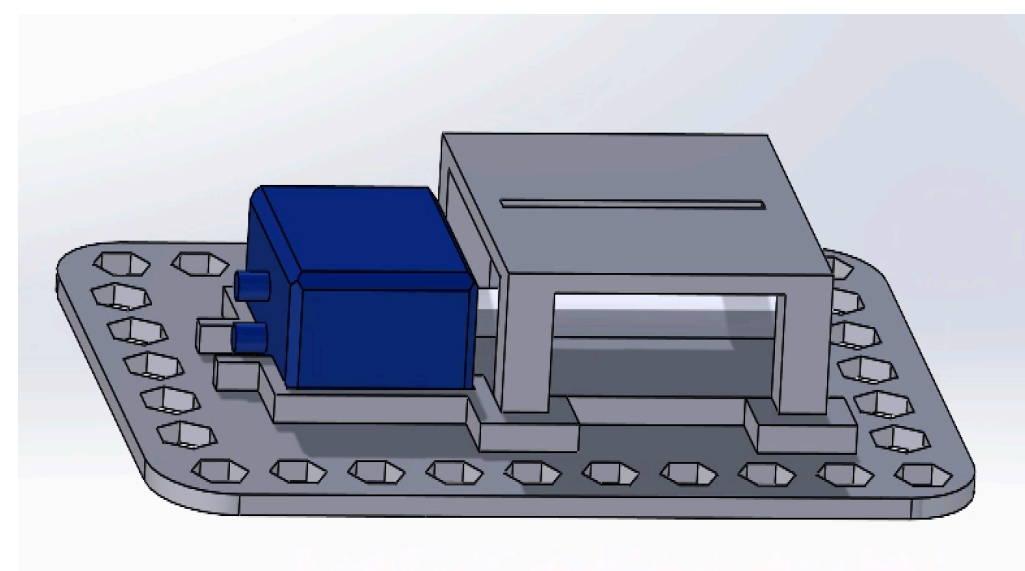


**Figure 3**

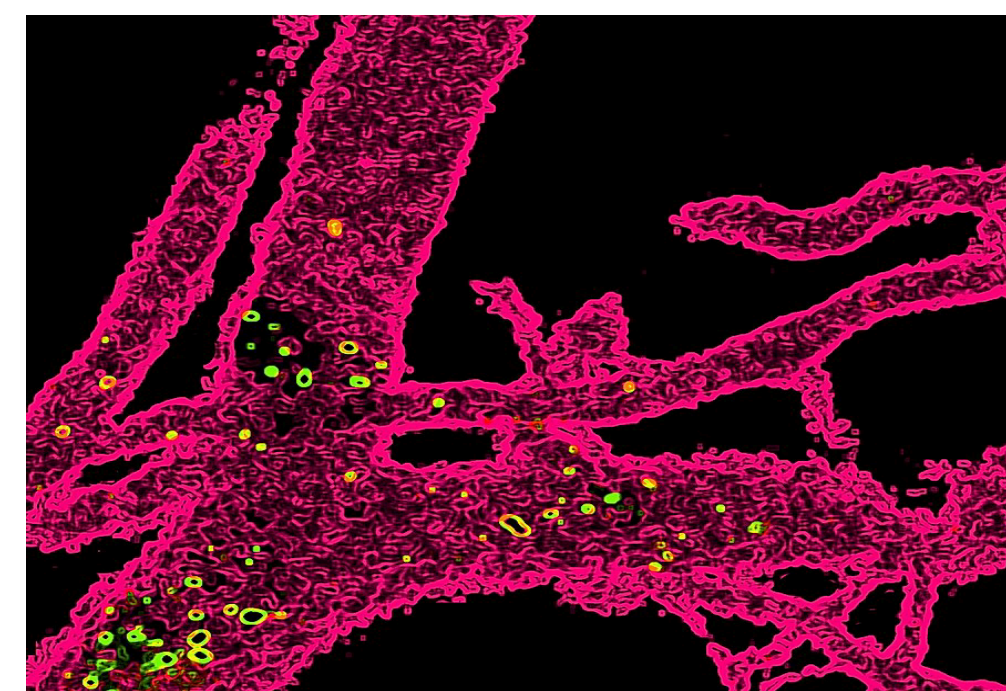


### ➤ Multi-Photon Imaging

**Figure 6**



**Top: Figure 7-Bottom: Figure 8**



1. We used SOLIDWORKS to create a sample holder where the mouse would lay on.
2. Our task was to manipulate the dimensions to improve some minor issues with the model.
3. This holder allows for the ear of the mouse to lay flat against a surface, for an imaging of the ear.
4. To the right, is a visual of gold nanoparticles streaming through the blood vessels of the mouse's ear.

## Advice for Future SHINE Students

My advice to future SHINE students is one of two things. The first one is the cliché of being a sponge and soaking up all the information you can, because it is so amazing that as high school students, you are learning of next level research. The second thing is to not be a perfectionist. There were times where I was frustrated with myself for not fully understanding the research that these professors and students have spent over 3 years learning about and working towards. It is completely okay to be lost.

## References

**Figure 2** - Davis, R., Campbell, J., Burkitt, S., Qiu, Z., Kang, S., Mehraein, M., . . . Zavaleta, C. (2018). A Raman Imaging Approach Using CD47 Antibody-Labeled SERS Nanoparticles for Identifying Breast Cancer and Its Potential to Guide Surgical Resection.

<https://www.mdpi.com/2079-4991/8/11/953>

**Figure 4**- PC: Alexander Czaja

**Figure 5**- PC: Olga Eremina

**Figure 7**- PC: Sean Burkitt

**Figure 8**- <https://www.zavaleta-lab.com>

## Acknowledgements

In all, I want to thank Dr. Zavaleta for selecting me to be a part of her lab. I also want to thank Sean and Alex who mentored me for these past 7 weeks. I thank the entire Z lab for the laughs on Friday's at 4 p.m. I want to thank my partner, Alexis for remaining patient with my endless questions. I thank Dr. Mills for giving me the greatest advice on days when I most needed it. Finally, I'd like to thank TELACU for awarding me this scholarship to attend USC SHINE.