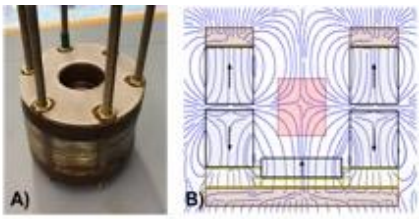

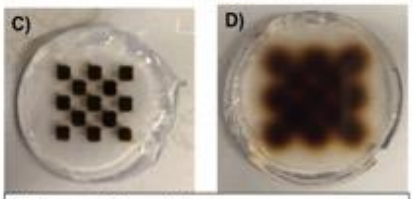

A) Targeted Magnetic Device
B) Computer model of zero point.
C) Nanoparticles in agarose before placing them in the zero point.
D) Nanoparticles' dispersion through agarose after being in the zero point for 14 hours.

Targeted Magnetic Device for Enhanced Drug Delivery in Tumors and Organs
Carolina Ferrari (EAS 2019)
Advisor: Andrew Tsourkas

My summer experience in Dr. Tsourkas's Lab, under the Penn Undergraduate Research Mentorship Program, was amazing. All goals and expectations I had before applying to PURM were reached and exceeded; I definitely encourage everyone to apply.

Since I had no prior research experience, my first weeks at the lab were challenging but intellectually satisfying. I learned basic laboratory rules, safety protocols, how to use several machines such as DLS and UV-VIS, where reagents were located, and last but not least, I learned the name of everyone who worked at the lab (or at least I tried to do so).

Then, my first task was to perform the SPION (super-paramagnetic iron oxide nanoparticles) synthesis reaction which involved mixing chemical reagents, sealing with nitrogen using the Shclenck line, heating to reflux, cooling and cleaning over a period of two days. Unfortunately, the reaction was very sensitive and I could not obtain the desired yield of nanoparticles; I felt discouraged and disappointed.

As a result, I was encouraged to pursue another task and fortunately, I fell in love with it. My job was to demonstrate that the lab's targeted magnetic device could be used to disperse magnetic entities through 0.6% agarose. In order to do so, I understood how a specific configuration of static magnets creates a zero point with a strong magnetic gradient. Then, I realized that when magnetic entities such as nanoparticles, clusters and micelles were placed in the zero point they moved radially outward. Finally, I had to come up with the best method in which to show that our device worked.

Consequently, I designed and then laser cut 1. An acrylic model to place nanoparticles to observe the magnetic effect; and 2. Agarose models in which nanoparticles, clusters and micelles were placed to observe their dispersion through the gel. The results were very promising because we

clearly saw how the magnetic entities dispersed radially outward through the agarose gel. Therefore, our next direction is to try our device in a mouse's brain to see how particles behave in tissue.

Eventually, this work might be really useful because it could help solve and improve medical conditions and procedures:

1- Drug dispersion in tumors in which the enhanced permeability and retention effect is low would be greatly enhanced.
2- Patients with glioblastoma would benefit from our device because they would receive immediate post surgery treatment that does not interferes with the healing process. (Nowadays, with current technologies, patients with glioblastoma who go through surgery have to wait approximately one month to receive chemotherapy and radiotherapy).
3- Safe and easy drug dispersios throughout organs such as the brain might be possible.