



Startup: Rhaeos

Startup Website: <https://www.rhaeos.com/>

Startup Description:

Rhaeos creates wearable medical devices that directly monitor the flow in surgically implanted CSF shunts using principles of convective heat transfer. Hydrocephalus is a common and costly condition caused by the accumulation of cerebrospinal fluid (CSF) in the brain, with symptoms that include headaches, lethargy, seizures, coma, or death. It particularly afflicts children (occurring in 1 out of every 770 births) but has no cure and will require treatment throughout the child's life. Hydrocephalus is most often treated with the surgical implantation of a catheter, known as a ventricular shunt, which diverts the excess CSF in the brain to a distal absorptive site, such as the abdomen. Shunt related surgeries are the most common neurosurgical procedures performed on pediatric patients. Unfortunately, shunts have extremely high failure rates due to a diverse set of factors including occlusion, mispositioning, or kinking. Non-specific symptoms like headaches and nausea make diagnosing shunt malfunction extremely challenging. An accurate tool for diagnosis would directly improve the lives of patients with implanted shunts as well as reduce the daily worry of their loved ones. Rhaeos creates wearable medical devices that directly monitor the flow in surgically implanted CSF shunts using principles of convective heat transfer.

Project Title:

Wearable medical device design and development to support children in need of brain surgery

Project Description:

In the research and development of flow monitoring devices, Rhaeos uses multiple in-lab benchtop setups to mimic an implanted shunt underneath skin with flowing CSF fluid. The benchtop system is vital to the development of new sensors and algorithmic models. This project will involve characterizing the performance of both existing and prototype Rhaeos sensors on a benchtop model under various conditions through data collection and analysis. The main goal of this internship is to contribute to the understanding of key benchtop data-based takeaways for the research and development of novel Rhaeos sensors and algorithms.

In addition to benchtop data, Rhaeos is constantly collecting in-vivo data through clinical trials. The engineering team at Rhaeos is responsible for the fabrication and maintenance of novel flow sensors used in trials. The internship will include learning and using Rhaeos fabrication techniques to build cutting-edge wearable medical devices from a team of experienced staff medical device engineers.



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Project Expectations:

The student will be responsible for data collection using Rhaeos sensors and data analysis. Additionally, the student will be expected to be a contributing member of the R&D engineering team. This will include: regular lab work on characterizing the benchtop flow model by taking and analyzing data, device and device accessory fabrication, daily 15 minute standup meeting attendance, weekly 1 hour R&D planning meeting attendance, and weekly 1-on-1 supervisor meeting attendance. The student will also be expected to make a final report on their findings deliverable to their supervisor and a detailed presentation on their project presented to the R&D team.

Principal responsibilities:

- Collecting data using different flow sensor and flow phantom iterations
- Maintaining a record of experimental protocols, results, and analysis
- Fabrication of Rhaeos sensors, adhesive patches, and benchtop systems
- Collaborating with engineering team to design experiments
- Succinctly presenting results and analysis with recommendations for future steps

Desired Candidate Experience:

Necessary:

- Currently enrolled in an undergraduate or graduate program in engineering
- Demonstrated Matlab or Python data analysis proficiency
- Lab experience
- Technical writing experience

Nice to have:

- Understanding of fluid mechanics
- Understanding of heat conduction and convection in biological systems
- Understanding of SolidWorks
- Understanding of 3D printing for rapid prototyping

Training & Mentoring Opportunities:

The student will be mentored by the company's Chief Executive Officer, Dr. R. Chad Webb, and one of the engineering team's Product Development Engineers, Blake Parsons. Dr. Webb will serve as a development and career mentor, while Blake will serve as the day-to-day mentor and engineering development coordinator for the student. Blake is a biomedical engineering Northwestern graduate with multiple years of full-time engineering project work as well as extensive mechanical design and lab experience. He will mentor the student during planned weekly 1-on-1 meetings, involving both feedback from the mentor and questions from the mentee. The R&D team at Rhaeos maintains a collaborative environment focused both on successful work output and personal engineering development; this environment will extend to the mentee. Beyond just communicating with the mentor, the student will also be expected to work collaboratively with other engineering team members, resulting in gained experience from multiple knowledgeable full time staff engineers.

Feedback will be given informally regularly during the internship, as well as with two formalized sessions, occurring halfway through the internship and at the end of the internship, both containing a performance review of the intern's progress and work. The development of the intern will focus on improving problem solving skills in a professional engineering context, solidifying verbal and written technical communication, and emphasizing collaborative engineering work.