Engineering Better Medicines for Endometriosis
## Grand Challenges Scholars Program 2021

Research Experience

Endometriosis is a chronic disease that affects more than 200 million women of reproductive age worldwide. Endometriosis is characterized by the aberrant growth of endometrial-like tissue outside of the uterine cavity, resulting in severe symptoms such as dysmenorrhea, menorrhagia, and infertility. There are currently no diagnostic methods available for endometriosis except for exploratory laparoscopic surgery – an expensive procedure which is only available to a subset of patients suffering from this condition. I spent nine months conducting research on the International Genetically Engineered Machine (iGEM) competition team at the University of Rochester with the goal of identifying a novel, noninvasive diagnostic for endometriosis. This experience included conducting a thorough literature review on all data available on the condition and piecing it together in a unique way to create a novel diagnostic tool. Through this research experience, six promising biomarkers for endometriosis in menstrual effluent were ultimately identified that could be used to create a non-invasive diagnostic. Additionally, modeling analysis of the selected biomarkers and methods indicated promising future research in the application of immune molecules in menstrual effluent to diagnose issues regarding female reproductive health.

ENDOMETRIOSIS AT THE CELLULAR LEVEL
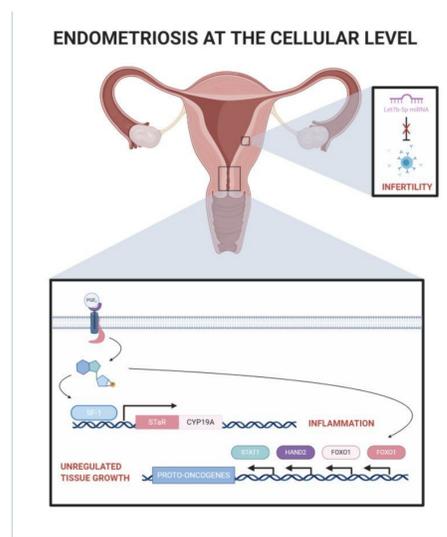
Virtual abstract designed for the BioRender competition in July 2020 depicting the suggested molecular pathophysiology of endometriosis. This image was constructed as a result of a comprehensive literature review, connecting together different ideas explored in previous research studies.

Interdisciplinary Approach

There is almost a ten year diagnostic delay for endometriosis due to the gender disparities employed by the current healthcare system. Federal funding in the United States for women's health has decreased over the past four years, resulting in less research and attention being brought to reproductive illnesses such as endometriosis (National Institute of Health, 2019). This is in part due to a lack of sufficient training for medical professionals on this condition as well as the stigmatization of female reproductive healthcare across the globe. To work toward ameliorating these issues, educational material was created for both the public and medical practitioners to raise awareness for endometriosis and call attention to racial and gender biases in healthcare. The educational materials were distributed to various clinics across the world and published online in an accessible format. Furthermore, a panel was hosted to discuss the impact of gender disparities in healthcare with several experts in the subject area including a bioinformatics professor, philosophy professor, and gynecologic surgeon. Overall, the goal of these initiatives was to facilitate better diagnosis of endometriosis through education and outreach in addition to the research of creating a novel, noninvasive diagnostic tool.

Example of educational materials created to raise awareness for endometriosis

Screenshot of event raising awareness for disparities in healthcare
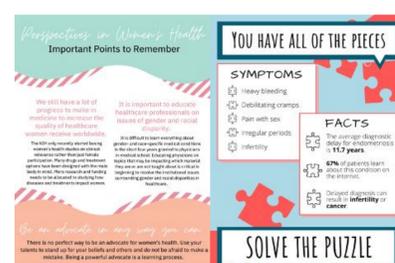
Global Dimension

An important aim of our diagnostic design was to increase accessibility to different areas of the world as gender inequalities in healthcare and the under diagnosis of this condition pervade geographic, racial, and socioeconomic barriers. We consulted with Dr. Douglas Stockman, a global health physician, to learn more about which areas of the world could most greatly benefit from our diagnostic design and how we could potentially address issues with implementation in less developed areas. Dr. Stockman provided key insight into how to alleviate the use of equipment in our design – focusing on the application of a lateral flow assay which required minimal laboratory supplies. Additionally, he recommended emphasizing the increase in awareness of female reproductive healthcare for the public in rural and under-developed areas as individuals may have limited access to highly trained medical professionals. These ideas were discussed in collaboration with other global iGEM teams to ensure the feasibility of the diagnostic design across the world and globally raise awareness for this condition.
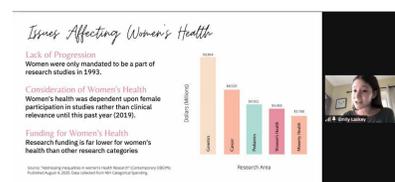

Global collaboration with an iGEM team from SDU Denmark, which was working to raise awareness for male reproductive health care (prostate cancer). The teams worked together to raise awareness for each other's work and share educational materials in clinics in our respective areas of the world.

Community Service

All materials designed for the diagnostic project were made freely accessible on the internet and translated into different languages. As education was an important, interdisciplinary component of the project it was critical that others could easily learn about endometriosis and symptoms of normal reproductive health. All informational and educational material was made available through the Rochester iGEM Team Wiki for anyone to access.

The team also worked closely with endometriosis organizations such as the Endometriosis Foundation of America to raise funds and awareness for endometriosis research. Partnering up with larger organizations helped increase knowledge about the diagnostic delay for endometriosis and the gender gap in healthcare.

Entrepreneurship and Innovation

From start to finish, the diagnostic design was discussed in detail with different stakeholders in the field of reproductive health. Marketability remained a large issue of creating a successful diagnostic product as female reproductive health can be a highly stigmatized issue. Learning about how products were made and sold was important for understanding how to best design the diagnostic tool for endometriosis. By the end of the iGEM competition, a complete plan for creating the diagnostic test strips was created to be marketed in a way to raise awareness for female reproductive healthcare.

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