Predictive Model for Baseline Serum Estradiol Concentration of Female Laboratory Mice

Beyond the Binary: The Influence of Gender and Sex Understandings on Hormone Therapy

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

William J Davis, Department of Engineering and Society

Sociotechnical Synthesis
(Executive Summary)

Bridging Biomedical Precision and Gender Equity in Health

"At the heart of inclusive care is that an individual is truly seen." – Drs. Baligh Yehia and Todd Levin

As I explored the worlds of biology and society, I discovered my academic passion in a project that challenged my scientific knowledge and aimed to uncover the widespread health disparities related to reproductive health. My journey began with a physiology class on women's health that unveiled the stark landscape of health disparities, igniting a passion to delve deeper into the barriers and gaps in care that plague our medical system. This revelation led me to embark on two distinct yet interconnected projects: a technical endeavor to model serum estradiol levels in female mice and an exploration of gender diversity in healthcare. My technical research goes beyond the examination of hormones as it addresses that the intricacies of female physiology should be given ample attention and comprehension. Its objective is to devise a tool that predicts estradiol levels, ultimately refining the precision of medical investigations and potentially advancing women's health outcomes. My STS research, inspired by the stories of transgender, non-binary, and gender-diverse individuals, is a collection of human experiences. It is an examination of how societal constructs of gender influence access to hormone therapy, a critical aspect of healthcare for many in the gender-diverse community. This synthesis reflects my commitment to understanding and addressing health disparities and describes how engineering must engage with the societal implications of its practice. By placing these actors at the center, I aim to shed light on the complexities of health equity and the role of engineering in fostering a more inclusive world.

At a capstone fair, where UVA laboratories and local companies were showcasing their projects, I found my passion in a project that not only challenged me but also promised to contribute to a better understanding of health disparities in reproductive health. In a chaotic hour of ambition and aspiration, every student vied to find their place in a project that resonated with them. The project I chose—a blend of animal work involving blood collection and vaginal cytology—was daunting at first and was a venture into the unknown. Over the course of eight weeks, my research employed vaginal cytology and submandibular blood sampling to ascertain the estrous cycle stages and estradiol concentrations in mice. Vaginal cytology enables the identification of all four estrous stages by analyzing cell proportions in the vaginal canal, while Giemsa staining provides a quick visualization of the cells. Concurrently, blood samples drawn from the submandibular vein—selected for its minimal invasiveness and ease of collection—allow for the measurement of estradiol concentrations through average absorbance values. This comprehensive data collection is pivotal for training and validating a predictive model that estimates estradiol levels based on the estrous stage alone. Such a model promises to significantly expedite research by providing swift and precise estradiol estimates, thereby reducing the reliance on time intensive E2 ELISA tests. Ensuring the model's accuracy through rigorous statistical testing is a crucial step in achieving our goal of predicting baseline serum estradiol concentrations effectively.

The principles that emerged from this work advocate for a more inclusive approach to medical research, where female physiology is no longer sidelined but is understood with the same rigor as its male counterpart. The potential significance of these results lies in their application to hormone replacement therapy and other areas of women's health, where personalized and precise treatments are crucial.

In my STS research, I delve into how gender perceptions affect the development and use of hormone therapy technologies. The binary understanding of gender limits the design and availability of these therapies, excluding non-binary and gender-diverse individuals from receiving adequate care. This led me to explore a more inclusive healthcare approach that recognizes and values the spectrum of gender identities. Transgender, non-binary, and gender-diverse individuals, along with healthcare providers and policymakers, drive the evolution of medical practices and inclusive healthcare policies. Hormone therapies affirm gender identity and enhance the quality of life, and the availability and design of these therapies are influenced by societal norms and cultural perceptions of gender. My work aligns with my passion for social justice and my commitment to contributing to an equitable and validating healthcare system for all.

In my research, the integration of technical, organizational, and cultural elements has unveiled various insights that are pivotal for ethical engineering practice. By considering these elements, we gain a multifaceted understanding of how technologies are not only products of scientific endeavor but also artifacts embedded within a social matrix. The technical aspect of my thesis is intrinsically linked to the organizational structures of research institutions and the cultural narratives that shape gender norms. The organizational element examines how research agendas are set and how resources are allocated, revealing the systemic biases that have historically excluded female physiology from research. Meanwhile, the cultural element explores the societal constructs of gender, which influence both the perception and treatment of individuals within medical systems.

By embracing STS perspectives, engineers are equipped to navigate the complex ethical terrain where technical prowess must be balanced with social responsibility. It is through this

lens that we can appreciate the true value of diversity and inclusivity in engineering, recognizing that the technologies we develop must serve all segments of society equitably. In essence, STS perspectives foster a culture of ethical responsibility in engineering, ensuring that our technical solutions are not only innovative but also just and compassionate.

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