SIMULATING NUTRIENT PREFERENCES TO INFORM CO-CULTURE DESIGN FOR PROBIOTIC MANUFACTURING

SOCIOECONOMIC HEALTHCARE DISPARITIES IN PERSONALIZED MEDICINE

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SOCIOTECHNICAL SYNTHESIS

Health and healthcare disparities are prevalent in the United States and globally, and technology is a driving force in the quality of life and the availability of healthcare. To alleviate these disparities, accessibility of healthcare must be increased through both social and technical advancements. The technical project leverages genomic data and metabolic modeling to increase manufacturing efficiency of probiotics. The STS research paper uses a sociotechnical perspective to identify and explore how to mitigate potential negative impacts of personalized healthcare practices on socioeconomic healthcare disparities. Personalized medicine is the use of personal information to guide treatment protocols and reflects a new model for healthcare. Methods from the technical project can be used for advancements in personalized medicine. Thus, both projects address the burden of economic hardship on the quality of healthcare in personalized medicine.

The gut microbiome has been considered to play a key role in human health, and probiotics can be used in a pharmaceutical capacity to target the gut microbiota. To bring these next-generation probiotics to market, key obstacles to adoption have been identified to include high cost and poor scalability. The technical project helps to increase manufacturing efficiency, lowering cost and increasing scalability, by providing optimization methods to grow bacteria for next-generation probiotics. Increasing manufacturing efficiency will help to drive down costs and alleviate economic barriers to access of these drugs.

The overall aim of this technical project was development of a computational pipeline that can be applied to various probiotic strains to determine optimal strain combinations, so that bacterial strains for each probiotic can be grown together. The team was able to complete the first step of this pipeline: determining nutrient preferences for each strain. Nutrient preferences

were determined by generating metabolic network models from annotated genomes, and then using a variety of optimization techniques on these models to determine the nutrient preferences. These nutrient preferences can then be used in an algorithm to predict optimal combinations of strains for manufacturing. The methods generated from this project were an important first step in the development of the computational pipeline.

The STS research paper analyzed how barriers in personalized medicine accessibility may disproportionately burden low socioeconomic groups, and explored ways in which these barriers may be alleviated. Analysis was carried out using the Social Construction of Technology theory, developed by Wiebe Bijker and Trevor Pinch. Through this analysis, relevant social groups and problems associated with personalized medicine, within the scope of socioeconomic limitations, were identified. A simplified model of personalized medicine technology development was created and a potential solution to ease socioeconomic barriers was formed through literature review of publications from a wide range of sectors, including public health, ethics, government, and social science and medical research.

This simplified model helped to identify the need for a concerted effort to connect developers of personalized medicine, including engineers and researchers, with users. Potential methods for bridging this connection include diversifying research and design groups, incorporating community-based practices, and employing policies that encourage the recognition of the needs of all groups. These solutions could help to result in more equitable personalized medicine applications. As researchers and engineers become more aware of diverse user needs, personalized medicine technology may evolve to overcome socioeconomic barriers, and accessibility to personalized medicine may increase.

Healthcare disparities can have devastating impacts on marginalized groups, and healthcare technology has the opportunity to both alleviate or exacerbate these disparities. Engineers and researchers have the responsibility to be intentional about their work and to promote practices resulting in a more equitable society. Methods discussed and developed in this portfolio reflect a few of the ways this work may be practiced.

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