BIOMEDICAL ENGINEERING
COLLEGE OF ENGINEERING AND APPLIED SCIENCES

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: September 22, 2025

PROJECT TITLE: Engineering Methods to Reduce Human Milk Nutrient Loss During Enteral Feeding

Physical Requirement :
Must be able to work in person

Project's Technical Skills Requirement :
wet lab skills, chemical analysis, spectrophotometry, electrical circuit design, microcontroller programming, MATLAB, Python, C, C++

Project's Available Positions : 1

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Project Description

Preterm and critically ill infants depend on enteral feeding tubes and infusion pumps for delivery of nutrition. Human milk is the ideal nutrition for infants; however, human milk feedings delivered via infusion pumps are susceptible to nutrient loss, meaning these vulnerable patients may not be receiving their prescribed nutrition. There is a critical need to develop interventions to improve nutrient delivery to this patient population. As a result of this need, we have developed an approach that aims to address this critical gap in neonatal nutrition. Unlike other approaches that focus on milk fortification to offset macronutrient loss, ours focuses on reducing loss at the point of delivery to the infant via an engineering-based solution. The device is composed of a small, quiet servo motor housed in a lightweight enclosure. The enclosure has a holder designed to fit various sizes of screw cap bottles and feeding bags. The holder then attaches to a

servo motor programmed to rock the holder (and subsequently the milk bag) back and forth like a pendulum, dislodging macromolecules that have bound to the surface of the bag, without impacting the volume of milk delivered during the infusion. The device is powered using an Underwriters Laboratories (UL)-listed wall adapter, ensuring electrical safety. The device includes soundproofing to minimize noise, keeping the device to a mere +5.8 dBA above ambient, barely above a whisper in a room with ambient noise. Our device mounts to a standard infusion stand, allowing it to seamlessly integrate into the hospital environment, minimizing footprint in an already crowded space. By targeting efficient macronutrient delivery, our system will ensure that preterm infants receive their intended nutrition, consequently improving growth trajectories and long-term developmental outcomes. Moreover, our approach will be easily integrated into the existing neonatal intensive care unit (NICU) workflows with minimal workflow disruption, ensuring scalability and adaptability for NICUs worldwide.

Our central hypothesis is that novel engineer-based interventions can improve nutrient delivery with infused human milk feedings. We propose to test this hypothesis through two specific aims: Aim 1: Determine the improvement in macronutrient delivery with agitation via a servo motor. Aim 2: Assess the feasibility and staff perspective of incorporating milk agitation in a simulated NICU setting.