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N.I.C.O.L.A.S (Non-Invasive Continuous Optical Lactic Acid Sensor)
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Progress Report 3

1. **Background on the project itself**

   The Non-Invasive Continuous Optical Lactic Acid Sensor (N.I.C.O.L.A.S.) is a smart lactate sensing modality developed for continuous, noninvasive blood lactate level monitoring in clinical settings. It will be a vast improvement on the intermittent blood draws currently employed for blood lactate monitoring due to its ability to sample lactate levels continuously and noninvasively in a small package that will be less resource-intensive on hospitals. Our sensor will utilize near IR spectroscopy (NIRS) and ratiometric analyses to detect fluctuations and alert healthcare professionals of any rapid spikes in lactate levels. This will help healthcare providers better utilize lactate as an early indicator of sepsis, organ failure, and hemorrhage, allowing for earlier preventative intervention in these cases leading to improved patient outcomes. At last reporting, we gave updates on the following fronts:

   - Circuit Optimization and Data Processing
   - Lactic Acid Absorbance
   - Alternative Methodologies
   - Proposed New Strategy

2. **Achievements since last reporting**

   Since the last report, we have made progress in completing our project. Due to the impact of COVID-19, we have been unable to do any updates with regard to prototyping and testing of our device since last reporting. Because of that, we are continuing with the assumption that our non-invasive, optical device as intended, instead of the microfluidic device we were prototyping concurrently. Based on this, we have spent time working on the transition to the Course Modification Plan (CMP) for the class and adjusting to teleworking and communicating via zoom. In this time, we have formulated our predictive failure model and foreseen all anticipated failures with solutions. Additionally, we have formalized our safety analysis and the ways in which we plan to
   We have also contacted VAPR, Vanderbilt Antibody and Protein Resource, to see if we could find a compound that could bind to lactate for potential fluorescence analysis. For this reason, we decided to discuss prototyping a secondary tag for lactate or LDH to make it more distinguishable for our IR spectrophotometer.

3. **Problems that have arisen**

   With regard to the circuit, we have had trouble filtering out 60Hz noise in our system. We are currently able to focus on the signal and see the attenuation, but we would like to see our signal without this process. The spectrum of lactate in water gave inconclusive data. This required us to go back into the lab and try to get cleaner spectrums with different solvents, which still was not very distinguishable. Of course, we cannot fail to mention that with the outbreak of COVID-19, our biggest task for this week was transitioning to a remote designing capability while avoiding contamination. Since we only had three days before the university transitioned to this, we tackled this issue by awaiting instruction by the instructor for reorienting our project to paper design.

4. **Work that lies ahead**

   Ahead, we will continue following the CMP and all that it entails. We need to continue formalizing our predictive failure model and safety analysis to add to our presentation. Additionally, we need to formulate a specific business model canvas and marketing analysis. Lastly, we have to make our poster to present. This will require formalizing all aspects of the project in order to package them in an easy to understand presentation.

5. **Assessment of objectives relative to proposed schedule and budget**

   Our schedule is completely shifted, due to COVID-19. All other prototyping/testing is unable to be completed for the semester. In terms of staying on track with the CMP, we are set to complete our predictive failure model, safety analysis, business model canvas, marketing analysis, and poster. In addition, we will reach out to local resources to achieve access to prototyping capabilities when COVID-19 issues decrease.