Protocol for blood tissue measurement using electrical bioimpedance technique

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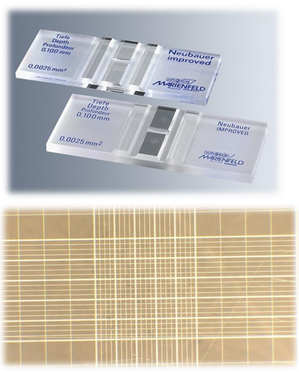
Abstract:

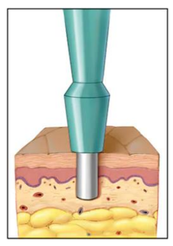
This study presents the development of a protocol for blood cell extraction and an imaging device using electrical impedance tomography (EIT). The protocol was validated for reproducibility, including sample preparation, cell extraction by centrifugation, and electrical bioimpedance measurement in different media. In addition, the integrity and functionality of an EIT device were experimentally validated. The results showed changes in measurement due to erythrocyte concentration, and challenges were identified in identify-ing cell types due to the need for redesign and use of electrode materials. Despite these challenges, the protocol for EIT measurements was successful-ly consolidated.

Introduction and problem description:

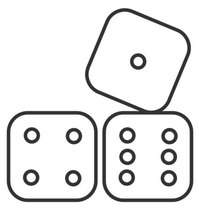


Neubauer Chamber

Microscope

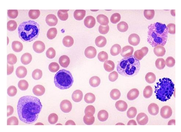


Invasive Techniques



Probability

PROCESS OPTIMIZATION



Diagnostics at the cellular or tissue level

Conclusions:

- A device for Electrical Bioimpedance measurements using dilutions of blood cells was successfully developed. However, identifying the different blood cell types could only partially be achieved due to the proposed redesign of the biocompatible leads and materials for the electrodes in the measurement device (future work addressed the use of old plating).
- The experimental protocol for Electrical Impedance Tomography (EIT) measurements was successfully consolidated. This protocol includes the extraction of cell samples and the setup of the MiniCore BioZ Pro.

Future work:

- the redesign of PCB tracks will be addressed, focusing on optimizing the measurement devices. This redesign will aim to equalize the track lengths to minimize errors caused by signal differences.

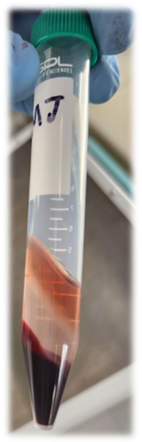
Materials and methods

Protocol:

1

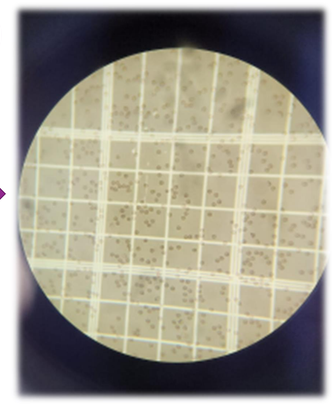
Sample Extraction

2



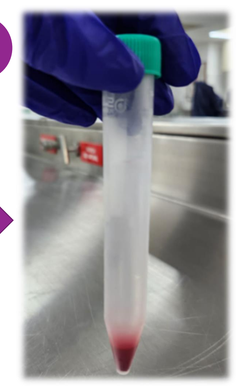
Spin

3



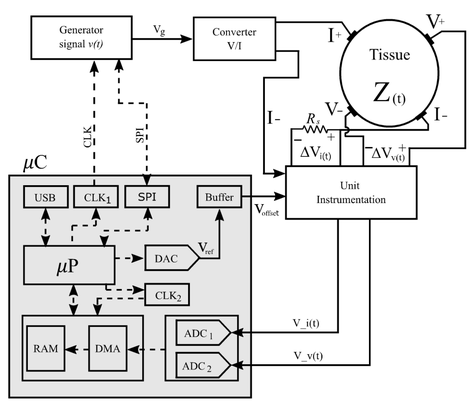
Cell count

4



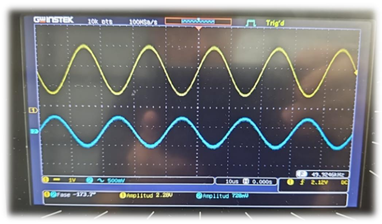
Preparation solutions

5



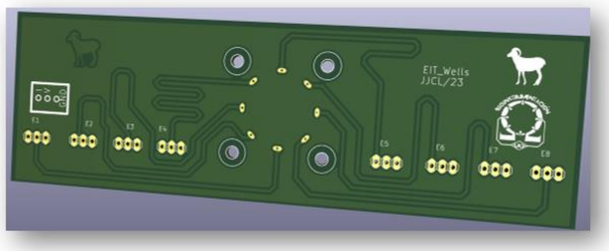
Measurements hardware device

6

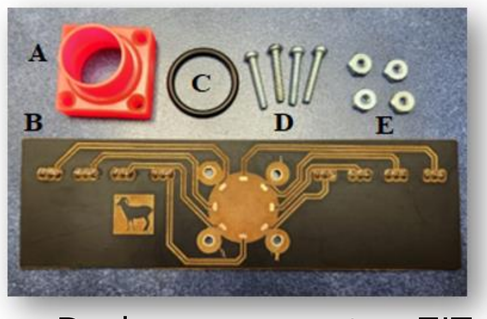


Analysis results

Device measurement design:

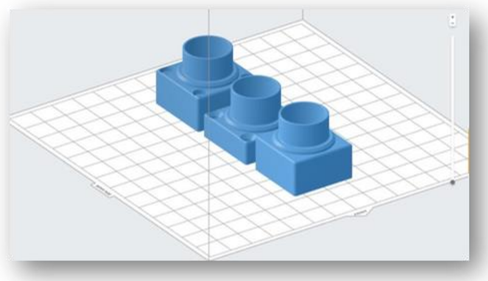


PCB design in free software CAD

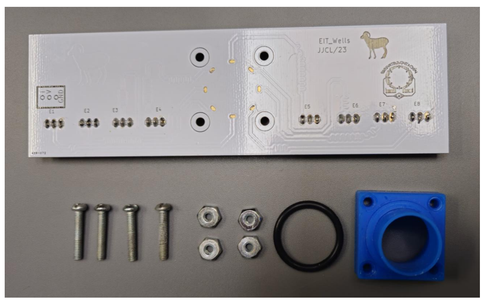


Device components – EIT

A) Well B) PCB C) Oring D) Screws and E) Nuts.

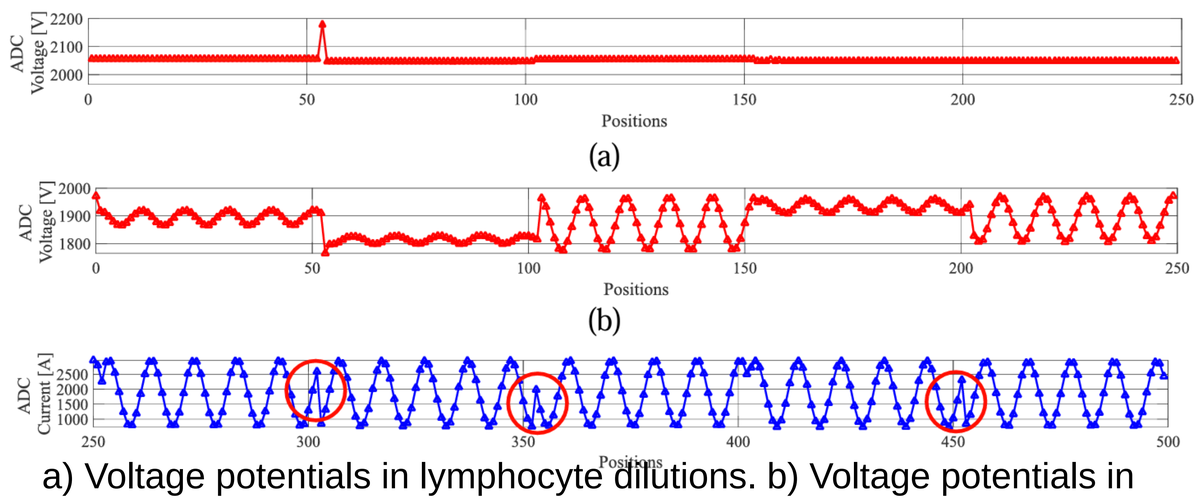


3D Modeling of Dilution Containers in SolidWorks Software



Final device with gold electrodes

Results:



a) Voltage potentials in lymphocyte dilutions. b) Voltage potentials in erythrocyte dilutions. c) Injected current signals during electrical bioimpedance measurements.

References