A diagnostic test for ME/CFS based on cell electrophysiology

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Background

There is currently no widely available, accurate diagnostic marker for ME/CFS. However, growing evidence suggests that the electrical characteristics of white blood cells could form the basis of a low-cost, reliable diagnostic test for the disease.

In 2019, Prof. Ron Davis and his team developed a nanoelectronics test that found a difference in the impedance of white blood cells taken from people with ME/CFS compared with those from control subjects.

In 2023, this work was continued by Prof. Robert Dorey, Dr Fatima Labeed, Krista Clarke and colleagues at the University of Surrey, in a study jointly funded by ME Research UK and the ME Association.

White blood cells from people with ME/CFS, people with multiple sclerosis and healthy volunteers were put into a salty solution for one-and-a-half hours. The change in the electrical properties of these cells after the salt treatment was significantly different in the ME/CFS samples compared with the other groups, supporting their potential as a diagnostic tool.

Two biomarkers showed particular potential for distinguishing ME/CFS patients from other groups: cytoplasm conductivity and zeta potential. Very simply put, cytoplasm conductivity is an indicator of how easily electrical current can flow within a cell, while zeta potential is related to the elec-

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Infectious diseases; how chronic conditions affect immune responses to pathogens; immunological changes in ME/CFS and tuberculosis.

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trical force needed to move a charge across the cell membrane.

Objectives

This new study (also jointly funded by ME Research UK and the ME Association) moves the research to Brunel University London, but still involves some core members of the original team. The researchers plan to refine and expand the initial work, to give deeper insights into the biology of ME/CFS, and to move us closer to a reliable and low-cost diagnostic test.

They aim to:

- test a larger, more diverse group of patients;
- improve how samples are prepared and tested to make the results more accurate and easier to obtain;
- compare blood cells from people with ME/CFS, those with long COVID, those with multiple sclerosis and healthy volunteers; and
- explore how ion channels and plasma ions affect these differences, and test the effects of low-dose naltrexone treatment.

The researchers will use frozen blood samples from the UK ME/CFS Biobank at the London School of Hygiene and Tropical Medicine, collected from people with ME/CFS (including some with long COVID), people with multiple sclerosis and healthy controls. Fresh samples will also be collected from people with ME/CFS. Additional analyses will compare samples from people with ME/CFS post-COVID collected at baseline and after treatment with low-dose naltrexone, to assess any impact of this treatment.

Potential benefits

The team hopes this work will bring us closer to a diagnostic biomarker for ME/CFS, "allowing reliable identification of the disease at an early stage".

Optimising the methodology will mean testing more samples more efficiently, allowing even larger trials in the future to assess sensitivity and specificity, and bringing us closer to a low-cost, reliable diagnostic test.

The research will also look at the reasons behind the electrical changes seen, advancing our understanding of the underlying biology of ME/CFS.