

Supplementary materials:

Peripheral blood mononuclear cells (PBMCs). PBMCs heterogeneous population consists of lymphocytes (T cells, B cells, NK cells) and monocytes, and can be further purified to isolate individual cell types of interest, through several well-developed methods.

Impedance. Given a voltage (V) represented as a complex exponential sinusoid, with amplitude $|V|$, angular frequency ω , and phase ϕ_v , as defined in eq. 1., and a current I represented as a complex exponential sinusoid with amplitude $|I|$, angular frequency ω , and phase ϕ_i defined in eq. 2., magnitude and phase of the impedance can be calculated from equations 4. and 5.

$$V = |V|e^{j(\omega t + \phi_v)} \quad (1)$$

$$I = |I|e^{j(\omega t + \phi_i)} \quad (2)$$

$$Z = \frac{V}{I} = \frac{|V|}{|I|} e^{j(\omega t + \phi_i)} \quad (3)$$

$$|Z| = \frac{|V|}{|I|} |e^{j(\phi_v - \phi_i)}| = \frac{|V|}{|I|} |1| = \frac{|V|}{|I|} \quad (4)$$

$$\angle Z = \angle \frac{|V|}{|I|} + \angle e^{j(\phi_v - \phi_i)} = 0 + (\phi_v - \phi_i) = \phi_v - \phi_i \quad (5)$$

Sample preparation. All the ME/CFS selected patients for this study were previously diagnosed by a physician, using the Canadian Consensus Criteria. Written consent was obtained following Stanford IRB-40146 before any testing or analysis began. Recruited healthy controls (except blood center samples), were not diagnosed with ME/CFS or similar condition diseases, and had no diagnosed ME/CFS blood relatives. For each subject, blood was collected in an 8 mL Sodium Citrate CPT tube (Becton Dickinson, Franklin Lakes, NJ) and a 6 mL Lithium Heparin tube (Becton Dickinson, Franklin Lakes, NJ). To obtain plasma, the Lithium Heparin tube was inverted five times and spun at 1200 x g for 10 minutes at room temperature. The top plasma layer was aspirated into a 5 mL round-bottomed tube (Corning, Corning, NY) and combined with the cells following cell isolation. Peripheral Blood Mononuclear Cells were isolated from whole blood with the following protocol. CPT tubes were inverted five times after collection and spun at 1500 x g for 20 minutes with the brake on low. The top two-thirds of the plasma was aspirated and discarded. With the CPT tube held at a 45-degree angle, the remaining cells and plasma were transferred to a new 15 mL round-bottomed tube (Corning, Corning, NY). The volume was brought to 12 mL with Phosphate Buffered Saline (PBS, Thermo Fisher Scientific, Waltham, MA). The tube was inverted five times and spun at 300 x g for 15 minutes. The supernatant was poured into the waste and the remaining pellet was gently re-suspended in 1 mL PBS using a P1000 wide-orifice tip. The cells were transferred to a 5 mL round-bottomed tube. If multiple CPT tubes were used for collection in combination with other experiments, the cells from each 15 mL tube were all transferred to the same 5 mL tube. The volume was brought to 3.5 mL with PBS and the tube was inverted five times followed by a spin at 300 x g for 10 minutes. The supernatant was poured off as in the previous step and, while inverted, the tube was blotted on a lint-free Kimwipe (Thermo Fisher Scientific, Waltham, MA) to remove any residual liquid. The remaining pellet was gently re-suspended in 1 mL of plasma isolated previously. The cells were brought to a concentration of 200 cells/ μ L plasma.

Measurements. All Measurements were performed in a faradic cage to minimize 60 Hz coupling and external interference with our nanoelectronics sensors.