Sodium

Serum sodium.

Transient and frequency-dependent conductivity measurements on excised brain tissue lesions from epilepsy patients indicate that sodium cations are the predominant charge carriers. The transient conductivity ultimately vanishes as ions encounter blockages. The initial and final values of the transient conductivity correspond to the high-frequency and low-frequency limits of the frequency-dependent conductivity, respectively. Carrier dynamics determine the conductivity between these limits. Typically, the conductivity rises monotonically with increasing frequency. By contrast, when pathology examinations found exceptionally disorganized excised tissue, the conductivity falls with increasing frequency as it approaches its high-frequency limit. To analyze these measurements, excised tissues are modeled as mixtures of “normal” tissue within which sodium cations can diffuse and “abnormal” tissue within which sodium cations are trapped. The decrease in the conductivity with increasing frequency indicates the predominance of trapping. The high-frequency conductivity decreases as the rate at which carriers are liberated from traps decreases. A relatively low conductivity results when most sodium cations remain trapped in “abnormal” brain tissue, while few move within “normal” brain tissue. Thus, the high densities of sodium nuclei observed by 23Na-MRI in epilepsy patients' lesions are consistent with the low densities of diffusing sodium cations inferred from conductivity measurements of excised lesions [1].

1)
Emin D, Fallah A, Salamon N, Yong W, Frew A, Mathern G, Akhtari M. Understanding the sodium cation conductivity of human epileptic brain tissue. AIP Adv. 2021 Apr 16;11(4):045118. doi: 10.1063/5.0041906. PMID: 33907630; PMCID: PMC8053039.