A call for standardization in electrical bio impedance spectroscopy (EBIS)

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As a physical phenomenon or property, EBIS is the frequency dependent difficulty for generating an alternating electrical current in any object of biological nature, i.e., where cells are present. As a technique or field of study, EBIS encompasses both the different approaches to measure that property and the use of the data acquired. Despite its increasing popularity among researchers of different fields, after almost half a century, EBIS still remains not universally accepted by everyone. This is due, in part, to the fact that there are many discrepancies between the different measurements and their final interpretation. On one side, not all the EBIS devices give exactly the same electrical impedance data when measuring the same objects, and the transformation of the raw data into final data of interest (i.e., body composition, metainflammation, etc.) is subject to many different processes of formula that will give very different results and, therefore, are regarded as no completely trustful. Finally, in the targeted possible final users, as they do not completely understand the basics of the technique, this gives them another reason to feel entrust. My call is, then, more a plea to standardize some aspects of the EBIS, so that some of the above mentioned difficulties can be overcome. Accordingly, I would advocate for, at least, the following agreements:

1. The misrepresentation of current flowing “through” de cells at high frequencies (i.e., crossing the cell membrane, as is universally represented in practically all books and articles) should be corrected and avoided.

2. Although the Cole model is well accepted and suitable for a mathematical explanation of the EBIS behavior, the adoption of the geometrical model should be adopted, as it more understandable for people on the biological side of the coin. This model allows the calculation of the Cole parameters, but only needs three pairs of data (R and Xc for three frequencies) to be calculated and, at the same time, also is expressed in terms of three parameters: localization of the center in the Cartesian plane (x and y), and the length of the radio.

3. Manufacturers should agree in three frequencies that all equipment should provide: namely 10, 50 and 100 kHz, at the same time that all them should provide the raw data to the users

4. Manufacturers should also guarantee that their devices give exactly the same raw data when taking measurements under the same circumstances (for instance, when measuring an electric dummy with predefined values, but also a physical dummy manufactured under the same conditions, as using physiological solution and microspheres with specific characteristics).

5. All values should be expressed in terms of calculates or apparent resistivity, instead of R, Xc, Z and φ.

6. The variables φ50kHz and IR (Impedance Ratio, as Z200kHz/Z5kHz) should be replace for φmax or φfc (equal to φ at the characteristic frequency) and Z∞/Z0, respectively.