The crowning achievement of the Biophysical Society is the establishment of the *Biophysical Journal.* In this venture, the Society gratefully acknowledges its indebtedness to Detlev W. Bronk, a pioneer in our discipline, for contributing substantially through the resources of The Rockefeller Institute Press which publishes the *Journal* for the Society. It acknowledges further the contribution made by Walter Rosenblith, chairman of its Publications Committee, who spearheaded the effort to found the *Journal.*

The editorial policy of the *Biophysical Journal* is controlled by the Biophysical Society through its Editorial Board and its Editor, Frank Brink, Jr., both elected by the Council of the Society. It is the aim of the Society to provide a journal with the most discriminating standards of excellence but with widely representative subject matter. Review of the titles published in the first volume shows that the coverage is not narrow; nevertheless, there are important fields of biophysics not represented. The Editor and the Editorial Board are of necessity limited in their choice to manuscripts actually submitted. It is hoped and believed that high quality contributions in aspects of biophysics not thus far covered will be received in the future. All responsible for its development desire that the *Biophysical Journal* become the standard medium of communication for biophysicists of both biological and physical orientation with broad diversity of interests.

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MAX A. LAUFFER, *President*
ERNEST C. POLLARD, *Immediate Past President*
ROBLEY C. WILLIAMS, *Past President*

Dear Sir:

Mauro (1) has discussed the property of anomalous impedance displayed by time-variant resistances. When the impedance locus plot falls partially in the second or third quadrants, negative values of A. C. resistance are displayed.

Mauro developed the analysis of current-voltage relationships of the thermistor as an example of a time-variant resistance showing a slow negative resistance in its current-voltage plot (Fig. 1*a*). Further, it was shown that when the system is operated at a I_0, V_0 in the negative slope region of the I, V characteristic, it may also be described by the impedance diagram shown in Fig. 1*b*.

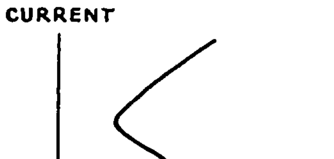

FIGURE 1 *a*

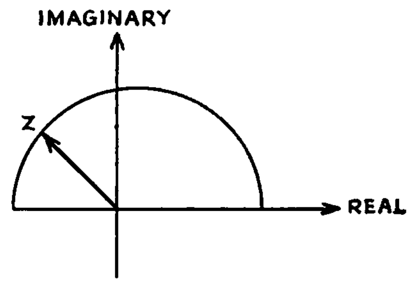

FIGURE 1 *b*

However, one additional point deserves special emphasis: all biological membrane systems thus far investigated which display a slow negative resistance (*e.g.*, references 2–4) belong to that class of devices having characteristic current-voltage curves which bend in the opposite direction from the above example: *i.e.*, are N-shaped and not S-shaped (Fig. 2*a*) (5). The corresponding impedance locus is shown in Fig. 2*b*. It should

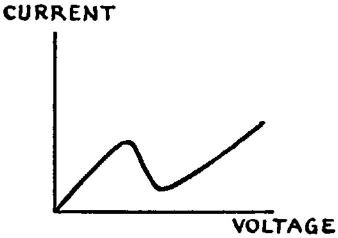

FIGURE 2 *a*

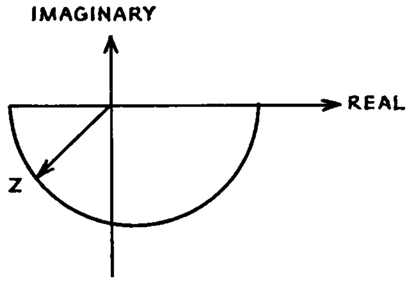

FIGURE 2 *b*

be noted that this agrees well with the curve measured by Cole (6) for the squid axon (if the inductive portion of the curve is neglected).

An N-shaped curve implies a system which is voltage-controlled (as excitable membranes are known to be). It also helps to specify that class of elements which are appropriate electrical analogs for the "all-or-none" response. Mackay (7) has listed the following elements that show N-shaped characteristics: tetrode (dynatron), split-anode magnetron, multivibrators, dynode-grid coupled systems, "passive" metal electrodes in electrolyte, certain electrostatic machines, and parallel resonant circuits containing nonlinear reactance (for alternating current). To this list might be added the tunnel diode. Tungsten filaments display current-voltage curves which bend in the proper direction to give an N-shaped curve, but their resistance usually does not become negative. Hence, they are not useful as analogs for the all-or-none biological response since bistability is only found in electrical systems displaying negative resistance.

A monostable multivibrator circuit has proved to be a useful analog, although the development of the negative resistance is far faster than that found in biological systems. It can be shown that reswitching from the excited state is due to progressive changes in the negative resistance characteristic that inevitably lead to that state being forbidden (5). It is possible to correlate the behavior of this analog with such biological properties as anode-break excitation and accommodation.

In summary:

1. Anomalous impedance is a property displayed by time-variant resistances.
2. When the impedance locus falls partially in quadrants II or III, negative values of resistance are displayed.
3. All-or-none switching behavior is possible only in the presence of negative resistance.
4. Negative resistance and hence all-or-none behavior may be displayed both by inherently fast (time-invariant resistances) and by time-variant elements. Thus anomalous impedance need not necessarily accompany switching behavior.
5. Biological negative resistances display N-shaped current-voltage characteristic curves rather than S-shaped curves. This fact dictates the class of elements which are the most appropriate analogs.

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