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LETTERS

Electrical Measurements on Endomembranes

In recent years, patch-electrode and lipid bilayer techniques have fostered rapidly expanding electrophysiological research on endomembranes (membranes from intracellular organelles), particularly those of the sarcoplasmic reticulum (SR) and the plant vacuole. However, the use of different sign conventions for designating transmembrane voltages, currents, and transporter functions has made the resulting literature unnecessarily difficult to read. We therefore wish to propose adoption of the following uniform convention of signs.

Specifically, let the potential difference ($\Delta\Psi$), or voltage (V), across the endomembrane (m) be calculated as

$$\Delta\Psi = V_m = V_{cytosol} - V_{noncytosol}$$

which, in the case of plant vacuoles, would give the vacuolar membrane (tonoplast) voltage as

$$\Delta\Psi = V_m = V_{cytosol} - V_{vacuole}$$

and in the case of the SR

$$\Delta\Psi = V_m = V_{cytosol} - V_{lumen}$$

This convention treats the tonoplast and the SR membrane as electrically equivalent to cell plasma membranes, for which membrane voltage has generally been written

$$V_m = V_{cytosol} - V_{out}$$

There are three principal reasons for applying this convention to endomembranes. (i) In the topology of development, the side of the membranes that contacts cytosol is homologous for plasmalemma, vacuoles, SR, endoplasmic reticulum, Golgi, endocytotic and exocytotic vesicles, and other simple endo-organelles. (ii) In many cases, the organellar lumen is functionally equivalent to extracellular space. (iii) Most of the terminology needed to describe transport processes in endomembranes already exists for the cell plasma membrane and can be transferred directly for use with endomembranes, provided V_m is taken as $V_{cytosol} - V_{lumen}$.

Some useful additional definitions that arise naturally from the above, and from corresponding usages at plasma membranes, are as follows. *Positive* or *outward* currents across the endomembrane would represent cation flow *out of the cytosol* (to the organellar lumen), and *outward* rectifiers (channels or "carriers") would permit current preferentially *out of the cytosol*, that is, would open as V_m moves in the *positive* direction. Conversely, *negative* or *inward* currents across the endomembrane would represent cation flow *into the cytosol* (from the organellar lumen), and *inward* rectifiers would admit current preferentially *into the cytosol*, that is, would open with *negative-going* V_m. (In plots and drawings, positive quantities should be depicted upward or to the right, and negative quantities downward or to the left.)

The proposed convention specifically rejects use of the electrical ground or amplifier input as points of reference, because most recording techniques permit different physical orientations of membranes relative to the amplifier terminals. The use of such nonanatomic references has resulted in descriptions that are inconsistent even within single research reports.

In circumstances where the sum of plasma-membrane and endomembrane voltages is measured, voltage should be reported as

$$V_{total} = V_{lumen} - V_{out}$$

That is, extracellular space is treated as the ultimate reference point. (This situation often arises, for example, in experiments made on whole plant cells with conventional penetrating electrodes where, de facto, $V_{vacuole}$ has come to mean $V_{cellsap} - V_{out}$.) Individual transport systems reside in single membranes, however, so measurements across the pair of membranes (plasma membrane plus endomembrane) do not allow a simple and consistent terminology for currents and conductances.

This general recommendation is being made after informal discussions among many concerned laboratories. For practical reasons, these discussions have not settled on a satisfactory sign convention to use with the more complicated organelles, such as mitochrondria and chloroplasts, where the intermembrane spaces (and the thylakoidal interior) are anatomically equivalent to the cell exterior.

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Bioremediation Review

Richard Stone's article about the use of bioremediation for destroying oil on the beach in Alaska after the 1989 Exxon Valdez oil spill in Prince William Sound (News & Comment, 17 July, p. 320) is somewhat misleading with regard to the technical review of the project by the Environmental Protection Agency's (EPA's) Science Advisory Board (SAB). The headline and the text at the beginning of the article imply that the SAB draft report concluded that bioremediation was generally ineffective. In fact, the draft SAB report and EPA's own study clearly state that bioremediation *was* effective, but not at all sites. Given that this is the first detailed, full-scale assessment in the field of bioremediation of an oil spill of great magnitude, the finding that bioremediation worked at two of the sites is considered to be a positive and significant accomplishment. Field research in heterogeneous environments exposed to highly variable conditions frequently does not give identical results at different sites or at different times.

Admittedly, the studies and evaluations conducted by EPA have several limitations. Many of these limitations were known to the researchers involved in the field and laboratory assessments. Many are pointed out in the SAB report. In contrast to the text of the article, the SAB did not conclude "that the treatment's efficacy wasn't all it was cracked up to be." We did, however, seek to further define the limitations of the program, as establishing those deficiencies and shortcomings is a necessary step in increasing the frequency of success of bioremediation.

The SAB considers this EPA project to be a significant accomplishment that should lay the foundation for improved research and planning for emergency responses in the future. Implementation of the SAB recommendations by EPA should contribute to that understanding. In addition, the SAB urges EPA to join with other informed parties in sharing data and developing guidance and principles to respond to future oil spills.

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Biomimesis: An Apology

National science policy has been a primary focus of mine for many years. It is a subject to which I have dedicated considerable time and energy. The issue of overselling science is an issue in national science policy that deserves not only mine but others' time and energy. Over the past year, I have conducted a public debate with editors from *Nature*, *The Scientist*, and *Research/Penn State* about overselling science regarding biomimesis and bio-derived materials (Research News, 30 Aug. 1991, p. 968).

However, as a part of that debate, I am afraid that a colleague of mine, Patricia Bianconi, may have been unfairly caught in the middle, and to the extent that she feels her research has been a victim in this debate, I extend to her this apology, as I never intended for her research itself to be the focus of the debate.

In the policy memo I privately circulated to various agencies and persons, I used the world "duplicating." The statement was, "this result—duplicating work precipitating very small crystals of any one of a dozen phases including CdS in an inorganic gel. . . ." While I believe the work derives from the general experiments done by many on crystallization in gels, Bianconi's work had the special feature that she obtained an organized array of crystals of cadmium sulfide in an organic host. In this respect her work did not duplicate earlier research and contains novel and unreported findings. The significance of this work will, as in all science, be determined over the course of time. I recognize that some well-respected scientists find her results to be quite significant.

It was also imprecise for me to state that Bianconi had not "read or cited" the literature. I had no first-hand knowledge of whether she had or had not read the literature. It was not cited. In large part, the literature to