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Electrostatically localized protons bioenergetics over Mitchell's classic chemiosmotic theory

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According to the proton-electrostatics localization hypothesis presented in this work, protons injected into a thylakoid may be electrostatically localized at the water-membrane interface along the lumenal surface. This hypothesis provides a natural framework to explain a wide range of experimental observations in the bioenergetics of chloroplast and other biological systems conducted since the 1960s, including the longstanding well-characterized energetic problems of alkalophilic bacteria such as *Bacillus firmus*. It can also help reconcile the elegant scientific observations of both the Dilley experiment and the Junge neutral-red thylakoid proton detection. Our analysis indicates that the Mitchellian view of delocalized proton coupling to ATP synthase could only be true under special circumstances; namely, when the membrane electrical potential difference is near zero and the bulk phase-to-bulk phase pH difference becomes the dominant factor. The proton coupling under most physiological conditions of photosynthesis is likely to occur in a mixed state of proton electrostatic localization of excess charge at the membrane surface and delocalization in the bulk media. The proton-electrostatics localization hypothesis leads to a new bioenergetics equation for the proton motive force which may provide a unified framework for understanding the energetics of many biological systems.

Biography

James W. Lee completed his Ph.D. at Cornell University in 1993 and then worked as a Scientist at the U.S. Department of Energy's Oak Ridge National Laboratory for over 15 years. Currently, he severs as an Adjunct Professor at Johns Hopkins University and as a Faculty Member at Old Dominion University. He is the Assistant Director of the Virginia Costal Energy Research Consortium. He has published more than 40 papers in reputed journals and book series, held 9 U.S. patents, and produced 2 Springer books: (1) Micro and Nano Technologies in Bioanalysis, and (2) Advanced Biofuels and Bioproducts.

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