

This Week's Citation Classic®

Ling G N. *A physical theory of the living state: the association-induction hypothesis.*

New York: Blaisdell, 1962. 680 p.

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In the new theory of the living cell (the association-induction hypothesis), being alive at the cell level signifies that its three major components (proteins, ions, and water) exist in close association and that together they assume a high-(negative)-energy, low-entropy living state. Electrical polarization, or induction, plays a central role in the maintenance of the living state, in the functional activities of the cell, and in the pharmacological actions of drugs. [The SCI® indicates that this book has been cited in over 530 publications.]

What Makes Living Cells Living?

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A Physical Theory of the Living State was written in 1957-1961 at the Eastern Pennsylvania Psychiatric Institute, Philadelphia. Chapter 8 of the book describes research I conducted in the preceding five years; the results unequivocally disprove the traditional membrane-pump theory. Neither the experiments nor the conclusion have been disputed in print since their publication; the essence of the conclusion has been twice confirmed. Other chapters present the association-induction (AI) hypothesis, a first-of-its-kind, coherent, and comprehensive theory of the living cell. The disproof of the membrane-pump theory and the development of the AI hypothesis prompted me to write the volume.

In the 27 years following 1962, three types of advances have been made: (1) *further development of the theory* (for example, the subsidiary polarized multilayer theory of cell water was introduced in 1965); (2) *verification of the theory on inanimate models* that satisfy the criteria that, according to the theory, underlie the physiological manifestation of their living counterpart; (3) *worldwide testing of the predictions of the AI hypothesis* (and the membrane-pump theory). The results have been overwhelmingly in favor of the AI hypothesis.

In the last 10 years, I have written two more books: *In Search of the Physical Basis of Life* was published in 1984. *A Revolution in the Physiology of the Liv-*

ing Cell® will soon follow; though much shorter, it documents the completion of a scientific revolution.

These dramatic developments elicited enthusiastic endorsements as well as intense hostility, neither unexpected. However, the universal adoption of the peer review system has "thrown a monkey wrench" into the delicate balance between the old and the new in the renewal phase of biomedical science. Thus, my scientific opponents, unable to challenge the validity of my scientific positions by normal means, were nevertheless given the absolute power to decide whether or not my research (and others' like mine) should receive continued support from public funds administered by the National Institutes of Health (NIH). Based on their recommendations, NIH officials withdrew all my research support, forcing the closing of my laboratory on October 30, 1988.

However, a valid theory cannot be suppressed for long. For, among other reasons, such a theory generates useful products. Here the useful product is *magnetic resonance imaging, or MRI*. It was MRI that has provided one essential element that had made possible the preservation of my laboratory and what it stands for. Thus, my laboratory, forcibly closed in Philadelphia, has reopened in Melville, with the prospect that it will grow into a major Bell Laboratories-type of research institution. The second, more important element that has made all this possible is, of course, Dr. Raymond Damadian.

According to Damadian, the inventor and patent holder of MRI,³⁻⁵ his invention of MRI "originated in the modern concepts of salt-water biophysics [introduced by] the association-induction hypothesis."¹ (p. iv)

For his contributions, Damadian has received the nation's highest honor for scientists and technologists, the National Science and Technological Award, from President Ronald Reagan on July 15, 1988. He was also inducted into the National Inventors Hall of Fame on February 12, 1989, sharing the honor with such legendary inventors as Thomas Edison and Alexander Graham Bell. I must add in gratitude that my survival as a scientist is an expression of his high-mindedness.

MRI illustrates the creative development from the associative aspect of the AI hypothesis. The inductive aspect of the AI hypothesis may also benefit mankind, by opening the door to the creation of a rational drug therapy. Such a rational drug therapy will one day enable us to cure cancer and other "incurable" diseases, as easily as a skilled auto mechanic repairs a stalled automobile.

1. Ling G N. *In search of the physical basis of life*. New York: Plenum Press, 1984. 791 p. (Cited 70 times.)

2. ———. *A revolution in the physiology of the living cell*. Melbourne, FL: Krieger. (In press.)

3. Damadian R. Tumor detection by nuclear magnetic resonance. *Science* 171:1151-3, 1971. (Cited 575 times.)

4. Damadian R, Goldsmith M & Minkoff L. NMR in cancer: XVI. FONAR image of the live human body. *Physiol. Chem. Phys. Med. NMR* 9:97-100: 108, 1977. (Cited 110 times.)

5. Damadian R V. *Apparatus and method for detecting cancer in tissue*. US patent 3,789,832. 5 February 1974. (Cited 45 times.)