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Correcting an Inaccurate Paradigm on Cellular Functions -- Lay Version

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A Revolution in the Physiology of the Living Cell

by Gilbert N. Ling, Ph.D.
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Effects of Faulty Medical Paradigms

All physiological systems considered by the health professional, in small or large, must begin at the cellular level. It's a basic truism that the manner in which each cell functions and behaves under differing environments, including cooperative relationships between adjoining and remotely located cells, determines the functioning of each organ and each system.

A model that describes cellular functions and their relationships in error will cascade inoperative medical techniques throughout medical literature. Such accumulated paradigm errors often reach patients producing ill health and death. There are countless examples throughout medical history where faulty premises or theories have brought about drastic negative consequences.

In describing potential causes for rheumatoid disease and cancer, Roger Wyburn-Mason, M.D., Ph.D. listed two widespread, faulty medical paradigms.

Tuberculosis was once defined in terms of 100 different diseases, depending upon which part of the body symptoms appeared. Of course, treatments usually took on weird and obscure rationale when attempting to solve each of these differently appearing symptoms. Then the tubercule bacillus was discovered, and all of those 100 names collapsed, now being named TB of the lung, TB of the spine, TB of the skin, and so on. Rational treatments took hold, and, for many years, reduced the tuberculosis problem.

As is now true for rheumatoid diseases, syphilis was once described as a classical auto-immune disease -- until discovery of the spirochete.

Let's consider our grand fight against cancer, whose 26th birthday was celebrated December 23, 1997. Legislation on that date 26 years ago created the unprecedented multi-billion dollar government-private sector alliance known as the "War on Cancer." It was signed by President Nixon in 1971, six months before the Watergate break-in.

I hate "everyone knows," but this is one time the generality is fully justified, for everyone knows that billions have been spent on faulty treatments based on faulty paradigms, and there seems no way to halt this powerful, destructive engine.

Professor Alfred Burger, University of Virginia, wrote in his monumental treatise, *Medicinal Chemistry*, (pg 19, 2nd ed.), "Almost all the problems of medicinal chemistry would become more amenable if we had even an inkling of the reaction of any drug with body chemicals. . . . "

Could this be so because the theory of the living cell -- seat of body chemicals -- taught in all medical schools to this day -- is wrong?

Dr. Gilbert Ling is a world-class scientist, who has spent a lifetime researching cellular functions, also collaborating with top-ranking scientists, and producing peer-reviewed literature that ranks among the highest. He's published more than 200 peer-reviewed scientific papers.

His book, *A Revolution in the Physiology of the Living Cell*, summarzies not his philosophy, but the results of definitively brilliant laboratory work on and about the living cell.

The book is exceptionally well-written and foot-noted, and is easily read by one versed in a course or two of chemistry and physics, although here and there it helps to have a broader range of knowledge of physiological mechanisms. Ling's notes at the end of each chapter are both entertaining and highly educational.

Autocratic medical paradigms have held back progress in medical science since the death of Hippocrates -- and probably earlier. Few of these faulty concepts can be more basic than the defective Membrane-Pump model which attempts to describe the workings of cellular mechanisms.

The Membrane-Pump Theory

For many years the Membrane-Pump mechanism has been used to explain how Na^+ can reach a lower concentration level inside a cell when it is surrounded by a sea of higher Na^+ concentration. This Membrane-Pump model, although never adequately tested scientifically, ruled medical text-books -- as well as *Scientific American* -- for more than a generation. There were micro-molecular pumps, it was theorized, that functioned by permitting K^+ to enter the cell, but which kept out excess Na^+. This, it was said, kept the concentration of Na^+ within the cell lower than the concentration in the surrounding fluids.

During a life-time of astute laboratory observations, Ling not only totally demolishes this faulty paradigm, but seems to rely on electromagnetic mechanisms which cause cells to cooperate and communicate together, much as -- by metaphor -- the wheeling and darting of a flock of birds appears as though the flock moves together as a single organism without an easily observed signal to one another.

Postulating a "sodium-potassium pump" was necessary to uphold a law of entropy.

Disorder in a system, such as the universe or a container of hot chocolate, always increases, even as the available energy for useful work decreases. This is known as the law of entropy.

Renown scientist Clerk Maxwell designed a thought experiment that would contradict the law of entropy. As I remember the story, a small demon was housed in a tube through which air of normal room temperature passed. The small demon would capture each molecule, and separate them into two directions, one for hot air and one for cold air, thus defying the universal law of entropy.

The original Boyle-Conway model of the membrane theory was derived from a single postulate known as "atomic sieve." The atomic sieve theory was introduced by Moritz Traube in the middle of the last century to explain semi-permeable behaviors of copper-ferrocyanide membranes. It was disproved in the early part of the century, reintroduced and disproved again in the thirties in connec-

tion with the downfall of the Boyle-Conway special version of the atomic-sieve theory, and then introduced again as a key concept in the construction of Na^+ -channel, K^+ -channel models now popular.

Since the disproof of this postulate, a patch-work of inconsistent explanations have held it together. Addition of the Membrane-Pump theory, as one of those ad hoc patchworks, has not been verified in inanimate model systems.

According to the Membrane-Pump theory the cell owes its continued existence and unique composition to a microscopically thin covering: the *plasma membrane*. Contained within this membrane are small structures which act as specific pumps, operating at the expense of energy stored in high-energy-phosphate bonds of ATP and other organic phosphates. This theory requires continual energy expenditure to maintain an uneven balance between K^+ inside the cell membrane, and Na^+ outside the cell membrane.

The celullar Membrane-Pump theory developed to explain the low level of Na+ in cells such as muscle cells, nerve cells, and erythocytes was a general theory attempting to deal with all solutes in living cells. According to Ling, "The Na pump theory has never attempted to offer more than an *ad hoc*, patchwork theory dealing with *one* solute, Na^+."

No one, says Ling, has yet given even a rough estimate of just how many pumps are required to keep afloat the cellular membrane-pump theory of "unifacial" cellular functions. There simply is no Maxwellian demon that can keep it afloat. (On the other hand, "bifacial" cells such as epithelial, frog skin, intestinal mucosa, kidney tubules, etc. have two different types of membranes. Active transport of Na^+ and other solutes across bifacial cells is not disputed.)

Ling's Association-Induction Hypothesis

All aspects of the association-induction hypothesis derive from a single set of deduced postulates which include the manifestation of closely associated, cooperatively linked protein-ion-water systems maintained at a high (negative) energy, low entropy living state.

In their order of abundance a cell interior consists of water, protein and K^+. Again in order of abundance, a cell exterior consists of water and Na^+. "Thus," Ling writes, "in the broadest sense, cell physiology is a story of assemblies of water-protein-K^+ in an environment of water and Na^+."

So, then, what keeps the cell from dispersing?

According to Ling, "The intuitively attractive idea that the preservation of cell contents is due to an enclosing membrane (with or without the help of membrane pumps) has not stood the test of time. . . . The major forces holding most of the atoms and molecules together are more like those holding together a school of fish swimming in the ocean. The cohesive forces are primarily interactions among individuals of the school. Not only do these interactions keep the school together, they also enable the entire school to alter the direction of motion swiftly and coherently."

Cells exist largely as a result of the cohesive interaction among three major components: protein, ions, and water. Proteins provide the "scaffold" on which other proteins, ions, and water are anchored. While the plasma membrane is important to the cell's existence, as would be the skin to a cucumber or tomato, it is not at all of the same nature as the membrane is to a balloon.

Simply having the correct proportions of water, protein and ions is a necessary, but not a sufficient condition to produce a living cell. The relationship of each component to all the other components satisfies the necessary condition, and, even when placed in the correct positions, each must also exist in a discrete *state*, called the **living state**, with a high (negative) energy and low entropy.

Ling asks us to consider a collection of soft-iron nails tied end to end with bits of string, and scattered among them are iron filings. When a magnet is placed on the terminal end of a nail, the nail is magnetized, which then magnetizes successive nails all along the chain. Not only will the nails be locked together closer, but also the surrounding iron filings become organized into a definite pattern. Depending upon the strength of the magnet, the magnet causes the whole assembly to rise to a specific, discrete higher-(negative)-energy and less random, or lower entropy state.

Describing his Association-Induction (AI) hypothesis, Ling writes, "In living cells, according to the AI hypothesis, electrical polarization, or induction . . . takes the place of magnetic polarization in the model discussed."

Polypeptide chains of proteins are the equivalent of chains of nails. Water molecules and K^+ are the equivalent of the iron filings. The equivalent of magnets are "biologically potent substances of prime importance" called *cardinal adsorbents*, which include drugs, hormones, transmitters, and Ca^{++}, and other substances. The most unique and important cardinal adsorbent in maintaining the living cell in the specific and discrete high-(negative)-energy, low-entropy *living state* is the final product of cell metabolism -- adenosine triphosphate, or ATP.

Being alive doesn't mean that a cell must continue with functional activity of one sort or another, but rather means that a cell exists in the specific, discrete high-(negative)-energy, low-entropy state called the *living state*.

"A functionally *active* (living) state and death represent two other discrete metastable equilibrium states of increasingly higher entropy and lower (negative) energy in the direction toward the ultimate random state."

The characteristic asymmetric distribution of K^+ and Na^+ is both a weathervane and the substance of the living state. No Na-K pump is involved, but rather a natural consequence of the relative attraction and repulsion of ions in an organic matrix.

"The inability of Na^+ to compete successfully for K^+ -preferring β- and γ-carboxyl groups and the low solubility of Na^+ in the cell water (virtually all existing in the state of polarized multilayers) explain the low concentration of Na^+ found in most resting living cells." [Underlining added.][2]

According to Ling, only the outside surface of cell membranes faces a dilute aqueous solution, and the inside surface of the membrane is continuous with the cytoplasm in the sense that both represent fixed-charge systems consisting of associated, cooperatively linked proteins, ions, and water.[2]

Completed Revolution

Point by point, and in great scientific detail, Dr. Ling has performed and reported on experimental studies that have satisfied all criteria for bringing about a revolution in thought in the way that cellular mechanisms are viewed.

Ling's Association-Induction Hypothesis Predicts

Einstein's theories would have been long forgotten had they not predicted, and also led to new phenomena.

The Na-K pump hypothesis has predicted nothing, without a patchwork of additional, supporting postulates, and has led to no new phenomena.

Ling's Association-Induction hypothesis has already led to the development of the MRI, a new and detailed viewing of soft-tissue inside the body with considerably less danger than use of X-rays,

and which has already revolutionized some medical practices.

Sky David, Santa Fe, NM, has developed an adenosine-triphosphate (ATP) inductor based in part on Gilbert Ling's hypothesis. When special light frequencies (between 400 and 900 nanometers) produced by Sky encounter the body, mitochondria began manufacturing ATP as proven both by blood tests as well as computerized dermatron measurements. Increase in ATP, of course, increases available cellular energy which, in turn, may better fight disease conditions such as cancer. Limited anecdotal experiences report that some cancers have regressed using this device. There's also some reports from Dr. John Myers, Tulsa, Oklahoma, that after 3-weeks of usage, the thymus begins producing T-cells.

What other discoveries lie in wait for those who try out Ling's new hypothesis?

Will understanding of apparently complex subtle energy effects -- homeopathy, prayer, various devices such as the ATP inductor -- began to unravel, and come under clear control at last?

One can only guess with the full knowledge that imagination always seems to turn out to be less than reality.

Conclusion

Dr. Ling, a creditable biological research scientist, has presented well-written documentation of a life-time accumulation of his scientific experimental evidence which clearly substantiates his Association-Induction hypothesis, and virtually demolishes the Membrane-Pump theory, showing it to be, at best, an inaccurate metaphor without good scientific underpinnings.

May I take this opportunity to most highly recommend reading Dr. Gilbert N. Ling's book.

Gilbert Ling's Background

Gilbert N. Ling, Ph.D.

It's clear that Ling is a learned and objective scientist with a long history of important research grants and peer reviewed literature to his credit. His past publications include *A Physical Theory of the Living State* (1962) and *In Search of the Physical Basis of Life* (1984).

Dr. Ling graduated from National Central University in Chungking, China, also winning the biology slot of what is known as the Boxer scholarship, an important gift by America to China in the wake of the Boxer rebellion. Enrolling in National Tsing Hua University in Kunming, he roomed with C.N. Yang who, with T.D. Lee, was awarded the Nobel prize for physics in 1957.

Admiring the "holistic" approach taken by Ralph W. Gerard (*The Unresting Cell*, Harper, 1940), Ling approached Dr. Gerard at the famous University of Chicago Department of Physiology to be accepted as a graduate student.

Later Ling received his first laboratory position at the Wilmer Institute of Ophthalmolgy, John Hopkins Medical School in Baltimore, where Ling was permitted to pursue his own direction of research.

When Gerard moved to the Neuropsychiatric Institute at the University of Illinois, Ling followed, now having available a well-designed research laboratory, also designed by Ling.

In 1957 Ling accepted a position at the newly inaugurated Department of Basic Research at the Eastern Pennsylvania Psychiatric Institute in Philadelphia. Here Ling continued his work on his growing Association-Induction hypothesis.

Through the efforts of Pennsylvania Hospital's neurologist, Frank Elliott, M.D., the John A. Hartford Foundation (founded by the A and P estate) provided funds for constructing on the ground of the Pennsylvania Hospital a new laboratory. During the next 27 years Ling's Association-Induction hypothesis of cellular function was put to extensive worldwide tests.

Termination of Ling's research grant resulted in another move, including Ling's entire laboratory, to Melville, New York, Damadian Foundation for Basic and Cancer Research, (% Fonar Corporation) a rescue performed by MRI's, Raymond Damadian.

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1. Alfred Burger, *Medicinal Chemistry*, 2nd Ed., Intersience Publishers, Inc., 250 Fifth Ave., New York, NY 1960, (LOCC 59-12441), p. 19.

2. Proteins in the cell don't exist in their conformation (steric and electronic) known to exist after isolation and purification, as special forms are, as a rule, required for cell proteins to serve their roles in the asymmetrical distribution of K^+ and Na^+ ions.

Ling reports that, polypeptide chains (of the same proteins or a variety of proteins), which are found pervasively throughout the entire cell, exist in a **fully-extended** conformation. By a fully-extended conformation, he does not mean that the proteins necessarily exist as perfectly straight chains, but rather that their backbone NHCO groups are not locked in long linear polymer molecules wound in a spiral so that each constituent monomer is linked to another monomer farther down the same polymer chain in a regular manner (α-helical). Nor are they folded in another zigzag manner, where each segment of the monomers are linked to another monomer in a parallel neighboring zigzag chain belonging to another region of the same polymer or a neighboring one, often forming a flat sheet (β-pleated sheets). Nor are they in other intra- or intermacromolecular H bonds, and are therefore free to react with the main body of water (bulk-phase water, as opposed to water at the surface or adsorbed onto a solid body)."

In Ling's Association-Induction hypothesis, β- and γ-carboxyl groups are the seats of adsorption of potassium and to a lesser extent sodium ions. It is necessary, therefore, to explain β- and γ-carboxyl groups in some further detail.

Each amino acid, the building block of proteins, has both a carboxyl group and an amino group (hence the name amino acid) which is attached to the same carbon atom called alpha carbon atom, and are called alpha-carboxyl and alpha-amino group, respectively. Two amino acids (aspartic acid and glutamic acid) carry an additional carboxyl group farther down the carbon chain on either the second (or beta-) carbon or third (or gamma-) carbon and are called, respectively, beta- or gamma-carboxyl groups.

When amino acids are joined into a poly-peptide chain or protein, the alpha-amino group of one amino acid is joined to the chain or protein, the alpha-amino group of one amino acid is joined to the

alpha-carboxyl group of a neighboring amino acid (now called amino acid residue) and the electric charges are lost in the process. However, the beta- and gamma-carboxyl groups are not affected so that the presence of these two (dicarboxylic) amino acids endows the polypeptide or proteins with its net negative electric charged group. It is these beta- and gamma-carboxyl groups that are the seats of adsorption of potassium and to a lesser extent sodium ions.

Thus, no Na-K pump is involved, but rather a natural consequence of the relative attraction and repulsion of ions in an organic matrix.

About half of the cell Na^+ is adsorbed on β- and γ-carboxyl groups in resting frog muscle cells. The other half exists as free Na^+ in cell water. "The inability of Na^+ to compete successfully for K^+ -preferring β- and γ-carboxyl groups and the low solubility of Na^+ in the cell water (virtually all existing in the state of polarized multilayers) explain the low concentration of Na^+ found in most resting living cells." [Underlining added.]