

## Laser Therapy

# Low Level Laser Therapy (LLLT) - Part 2

A review of seminal works on the theory of non-mechanistic, quantum physics effects of low level energy on biological systems.



"This month Dr. Murphy discusses the theoretical concepts about how lasers work from the quantum physics perspective. This non-mechanistic view is very interesting. Dr. Mary Dyson, a laser researcher from the U.K. divides the effects of therapeutic laser on body tissues into three types: primary, secondary and tertiary. These tertiary or whole body effects appear to be both biochemical and quantum physical in nature. Quantum tertiary effects are some of the most interesting effects observed in clinical therapeutic laser application."

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By Daniel J. Murphy, DC, DABCO

In the last issue of this journal, I presented a theory concerning the mechanisms of low-level laser therapy, involving the production of ATP as a consequence of photonic alteration of the mitochondrial cytochrome c oxidase enzyme.<sup>1</sup>

In this article, I present an alternative theory regarding low-level laser therapy.

In 2000, James Oschman, PhD, published *Energy Medicine, The Scientific Basis of Bioenergy Therapies*.<sup>2</sup> In this text, Dr. Oschman explained that the cytoskeletons of all the cells in the body are linked to the connective tissue extracellular matrix. This physical mechanical link exists between the cellular cytoplasmic matrix, the nuclear envelope, the nuclear matrix, and the DNA of the genes/chromosomes. This entire interconnected system is called the "connective tissue-cytoskeleton" matrix.

According to Dr. Oschman's theory, the entire physical body is interconnected. Energy applied to one part of the system will spread to other parts of the system, including the genome and its genetic expression.

Dr. Oschman notes that communication in living systems involve two main systems:

- Chemical
- Energetic

There are two kinds of energetic interactions:

- Electrical, classic nerve and muscle function
- Electronic, classic alterations of the tensegrity matrix

### Crystalline Matrix Model of Physiology

Biological material is crystalline. This crystalline arrangement generates piezoelectricity and streaming potentials in both hard and soft tissues. Energy applied to the crystalline lattice of the connective tissues generate bioelectric signals that influence local and systemic physiological processes. Dr. Oschman notes, "The entire living matrix forms an electronic and photonic network."<sup>2</sup> In understanding low level laser therapy, Dr. Oschman's "photonic network" is important. Dr. Oschman further notes:

"Conductors are substances, such as metallic wires, that readi-

ly conduct electricity. Insulators are the opposite: they are barriers to the flow of electricity. Semiconductors are between conductors and insulators in terms of their ability to conduct electricity...The proteins of the body are semiconductors...Virtually all of the molecules forming the living matrix are semiconductors."<sup>2</sup>

Therefore, molecules do not have to touch to interact, as their energy can flow through electromagnetic fields. The living network is simultaneously a mechanical and electrical continuum. It is a whole-body communication system that is separate from the nervous system, yet it can—and does—influence the thresholds of the nervous system.

The crystalline nature of living tissues dictates that energy applied to one part of the body will affect the whole body. "Molecular electromagnetic communications can account for the rapid and subtle and integrated functioning of living systems."<sup>2</sup>

Millions of molecules can communicate with each other in this way, at the speed of light. Additionally, biological systems respond paradoxically to applied energy: in living systems, small amounts of energy can have potent effects, while higher amounts of energy may render little or no response. Oschman states:

"Organisms are poised to respond to minute 'whispers' in the electromagnetic environment...Living systems are exquisitely sensitive to low energy signals...Living systems completely defy the logic that larger stimuli should produce larger responses..."<sup>2</sup>

In other words, when it comes to affecting biological healing responses with electromagnetic fields, a subtle application of energy is far more effective.

The helical molecules of DNA in living systems are piezoelectric semiconductors that respond to energy fields. Dr. Oschman notes that "Proteins carry out all of the vital tasks in living systems, and each protein must fold in a precise way to be most effective."<sup>2</sup> This folding is altered by energy fields and that to deny direct energetic interactions with living molecules "would be to deny the fundamental reaction upon which all life depends."<sup>2</sup>

Support for the crystalline matrix model of whole body physiology by Dr. Oschman is found in the writings of Helene Langevin, MD, from the University of Vermont College of Medicine where Dr. Langevin is a Research Associate Professor of

Neurology. Below, is a review of her 2006 article titled "Connective tissue: A body-wide signaling network?"<sup>3</sup> In her article, Dr. Langevin makes the following points:

1) Connective tissues form an anatomical network throughout the body.

2) Connective tissues function as a body-wide mechanosensitive signaling network that is separate from the nervous system, yet it also influences—and is influenced by—the nervous system. In other words, connective tissues function as a whole body communication system.

3) Since connective tissues are intimately associated with all other tissues, including the viscera, connective tissue signaling may influence the normal or pathological function of a wide variety of organ systems.

4) Dividing the human body into separate systems for research and medical specialization is a mistake because all of the systems are integrated through the nervous system and connective tissue. For example, the musculoskeletal system does not physiologically function in isolation from the rest of the body. Dr. Langevin notes: "Unspecialized connective tissue not only forms a continuous network surrounding and infiltrating all muscles, but also permeates all other tissues and organs...Since connective tissue plays an intimate role in the function of all other tissues, a complex connective tissue network system integrating whole body mechanical forces may coherently influence the function of all other physiological systems."<sup>3</sup>

5) The connective tissue matrix allows "cells to perceive and interpret mechanical forces."<sup>3</sup> Mechanical forces generate electrical signals that propagate through the connective tissue extracellular matrix because proteins, including collagen, have semiconductive, piezoelectric, and photoconductive properties.

6) Tissue electrical conductance is affected by various external influences, including mechanical stress and illumination. [The concept that "illumination" is an external influence that can effect tissue electrical conductance further explains—along with the photoconductive properties of the connective tissue matrix—a mechanism by which low level lasers could affect physiology].

7) A whole body web of connective tissue is involved in a dynamic, body-wide pattern of cellular activity reflecting all externally and internally generated mechanical forces acting upon the body.

8) Local connective tissue fibrosis following an injury may affect both electrical conductivity as well as fibroblast-to-fibroblast communication. Therefore, local pathology can affect whole-body connective tissue signaling.

9) There is direct communication between the connective tissues within the matrix, and also indirect communication via the nervous system because connective tissue is richly innervated with mechanoreceptors and nociceptors. Therefore, sensory information from connective tissue is integrated with the central nervous system.

10) "Connective tissue bioelectrical, cellular and tissue plasticity responses, as well as their interactions with other tissues, may be key to understanding how pathological changes in one part of the body may cause a cascade of 'remote' effects in seemingly unrelated areas and organ systems."<sup>3</sup>

11) "Connective tissue may be a key missing link needed to improve cross-system integration in both biomedical science and medicine."<sup>3</sup>

Additional support for the concept that there is a non-neurological communication of the cells throughout the body through

the systemic connective tissue crystalline lattice may be found in the writings of the following authors:

• Donald Ingber, MD, PhD from the Vascular Biology Program, Departments of Surgery and Pathology, Children's Hospital and Harvard Medical School. His article, titled "Mechanobiology and Diseases of Mechanotransduction," appeared in the *Annals of Medicine* in 2003.<sup>4</sup>

• Drs. Langevin, MD and Sherman, Ph.D, MPH published an article in the January 2007 issue of *Medical Hypothesis* titled "Pathophysiological Model for Chronic Low Back Pain; Integrating Connective Tissue and Nervous System Mechanisms."<sup>5</sup>

### Biological Basis for Low Level Laser Therapy

In 2006, Dr. James Oschman authored an article titled "The Biological Basis of Low Level Laser Light Therapy."<sup>6</sup> In this article, Dr. Oschman makes the following points<sup>6</sup>:

1) "All organisms, including humans, emit a glow that is too faint to be detected with the eye, but that can be measured precisely with photomultipliers that amplify weak signals millions of times."

2) "Studies have shown photonic interactions between cell populations that are optically coupled (e.g. via quartz windows or an air gap) but chemically separated so that communications via chemical mediators such as hormones, growth factors, and neurotransmitters cannot take place."

3) "The cells in the human body, and the body as a whole, both emit and absorb coherent biophotons; these photonic emissions and absorptions play key roles in the regulation of cellular and physiological processes, including the healing of injuries and diseases."

4) "Optimal results with light therapy take place when the light is of low intensity (does not heat tissues), short duration, and pulsed on and off."

5) "Biophotons have a role in energizing and coordinating physiological processes."

6) "The cells in the human body, and the body as a whole, both emit and absorb coherent biophotons; these photonic emissions and absorptions play key roles in the regulation of cellular and physiological processes, including the healing of injuries and diseases."

7) Photonic biocommunications take place at the speed of light, as contrasted to chemical communications which are relatively slow.

8) Certain kinds of light can stimulate mitosis, which is very important in injury and disease because damaged cells must be replaced by cell division. This is one of the most significant processes involved in injury repair.

9) Cells are responsive to very low levels of light, particularly if the light is pulsed on and off.

10) A single photon can trigger a reaction in one cell that causes the emission of several photons. These photons then trigger photon emissions in other cells, and the effect spreads from one cell to many cells, like a chain reaction. "These are called high-speed branched-chain processes or avalanche effects. They account for the fact that a tiny signal can be multiplied to cause a rapid and regenerative flow of energy throughout a biological system."

11) Biological coherence also explains the extreme sensitivity of living systems to tiny signals in the environment.

12) Photonic communication can take place through the connective tissue reticular web, so that "projecting laser light on one part of the skin would affect the entire skin."

### Applicability of Quantum Theory

Dr. Oschman's article discusses the applicability of quantum

physics and quantum biology in biological processes. He notes:

"Quantum physics is regarded as 'the most precisely tested and most successful theory in the history of science.' Quantum mechanics is distinctly different from the older and more familiar Newtonian mechanics, and gives a more precise picture of the structure and behavior of matter, including living matter."<sup>6</sup>

Dr. Oschman is critical of Newtonian mechanistic thinking when applied to therapeutic laser therapy. He explains that Newtonian mechanistic thinking has now been supplanted by non-linear dynamics and quantum physics, noting:

"There is an important distinction between linear and non-linear systems. Linear systems are Newtonian...When Newtonian linear thinking is "applied to living systems and to medicine, we tend to think that the absence of a clinical effect may mean that we have not applied enough force or our dosage is too low. Linear systems tend to respond slowly to large stimuli, and larger stimuli are expected to produce larger responses...There is a subtle non-linear aspect of living systems. Non-linear systems actually respond rapidly to tiny stimuli. This is, of course, counter intuitive...Much of the confusion around low level light therapy stems from a lack of appreciation of the well established non-linear aspects of living systems.

"The established physiological principle known as the Arndt-Schultz Law states:

Small doses or forces of energies stimulate functions in the living organism with little or no inhibition. Larger doses or forces of energies initially stimulate and then equally inhibit function. Very large doses of energy dramatically stimulate function for a very short time only and then dramatically, and for long periods of time, inhibit [function], even to the point of death.

"Living systems are profoundly non-linear, as was documented by the research of Ilya Prigogine (Nobel Prize 1977). These conclusions are significant because some have suggested that a low level laser can have no biological effect because the energy levels are too low to heat the tissues. The work of modern non-linear dynamics and quantum coherence show that the opposite is true: very low levels of light or other forms of energy can produce significant biological effects, and these responses can avalanche through the organism from atom to atom, molecule to molecule, and cell to cell, creating a chain reaction of effects."<sup>6</sup>

This effect is a consequence of the crystalline lattice of the connective tissue matrix. These sensitivities are the basis for the evolutionary and survival pressure for sophisticated biosensors to enable organisms to find prey, avoid predators, navigate, sense approaching weather patterns, adjust their activities and metabolism to harmonize with the large rhythms of nature, including seasons, tides, and other diurnal influences including sensing imminent earthquakes.

Dr. Oschman's concluding hypothesis is:

"Injury brings about damage and destruction of cells; damaged cells produce more light than normal cells, and this light travels throughout the organism, signaling other cells and attracting them to the site of injury. Some of these cells clean up damaged cells and destroy bacteria. Others, such as fibroblasts, divide to provide replacements for cells that have been lost. One of the therapeutic effects of laser light is to artificially simulate the cell-cell communications and trigger cell migration and cell division. Laser light can have a protective function by simulating the photonic aspects of an injury without actually damaging tissues. The flow of energy through a system organizes the sys-

tem, so laser light may open up and facilitate the operation of biophotonic communication pathways."<sup>6</sup>

### Success of LLLT In Sports Applications

Perhaps the best known sports physician today is Dr. Jeff Spencer (DC). An interview with Dr. Spencer on October 8, 2007 noted that he is "The man who treated Lance Armstrong before, during, and after all seven of his Tour de France victories and helped Lance's former team to its eighth Tour victory in 2007."<sup>7</sup> Television viewing of this year's Tour de France would often spot Dr. Spencer in the background of activity. In response to an interview question "What types of equipment do you take with you out on tour?" Dr. Spencer responded, in part, "My toolkit consists of three 5mw dual-head, extremely low-power cold lasers."<sup>7</sup>

My careful observation of Dr. Spencer's low level laser therapy protocols for treating his Tour de France athletes (and his other patients as well) indicates that his approach is not Newtonian, but rather non-linear quantum biology. His laser (Erchonia Medical) is extremely low powered (5 mW), and he uses it to manage a large array of injuries and stresses, as well as using it to enhance peak performance and fatigue recovery. His protocols are consistent with the conclusions of Oschman, Langevin, Ingber, and Sherman, as noted above. Dr. Spencer examines the athlete's entire physiological function in terms of strength and range of motion, and applies the light therapy to neurological reflex points. The typical length of time for light exposure is 5 to 15 seconds. Post-treatment re-evaluation of strength and range of motion typically shows immediate improvement. Such improvements—utilizing such low power and short duration of exposure—would be impossible if the concepts outlined above were not accurate. Dr. Spencer's track record speaks for itself: Eight out of eight Tour de France victories.■

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*He is a contributing author to the books Motor Vehicle Collision Injuries, Editions 1 and 2, and Pediatric Chiropractic, and writes a quarterly column in the American Journal of Clinical Chiropractic. He has received numerous awards recognizing his contributions as educator and clinician. Dr. Murphy's reviews of articles regarding alternative health issues can be accessed at [www.danmurphydc.com](http://www.danmurphydc.com).*

### References

1. Murphy D. Low Level Laser Therapy. *Pract Pain Manag.* Oct 2007. 7(8): 51-55.
2. Oschman JL. *Energy Medicine: The Scientific Basis of Bioenergy Therapies.* Churchill Livingstone, Philadelphia, PA. 2000.
3. Langevin HM. Connective tissue: A body-wide signaling network? *Medical Hypotheses.* Volume 66, June 2006. 66(6): 1074-1077.
4. Ingber DE. Mechanobiology and Diseases of Mechanotransduction. *Annals of Medicine.* 2003. 35(8): 564-577.
5. Langevin HM and Sherman KJ. Pathophysiological Model for Chronic Low Back Pain Integrating Connective Tissue and Nervous System Mechanisms. *Medical Hypotheses.* Jan 2007. 68(1): 74-80.
6. Oschman JL. *The Biological Basis of Low Level Laser Light Therapy.* Nature's Own Research Association. Dover, NH. 2006.
7. *Dynamic Chiropractic.* DC Interviews Dr. Jeff Spencer. October 8, 2007. 25(21).