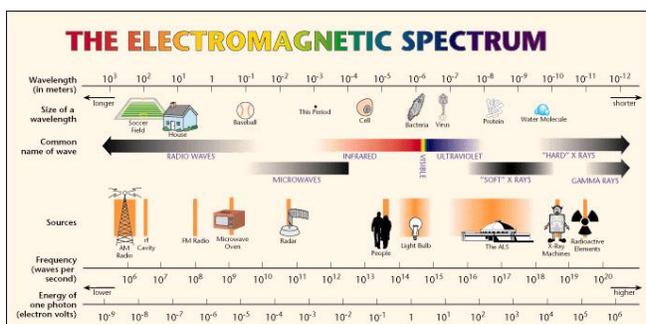


### Part 3 – Natural Low Level Laser Therapy (LLLT) (Laser Light Therapy)

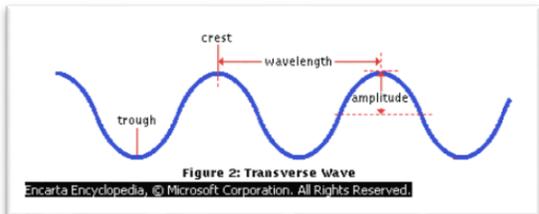
## The Foundation of Natural Energy Medicine

Below are definitions of common terms used in LLLT and pertaining to this article.

**Light:** Light is the visible spectrum of electromagnetic energy given off by the sun. This is from 760nm to 380nm wavelength energy.



**Wavelength:** Photons travel in waves of peaks and troughs. Wavelength is the distance between waves and the energy carried by each photon is proportional to its Wavelength.



**Nanometers (nm):** A nm is a unit of measurement used to measure the wavelengths of electromagnetic energy within the visible range defined as (Light).

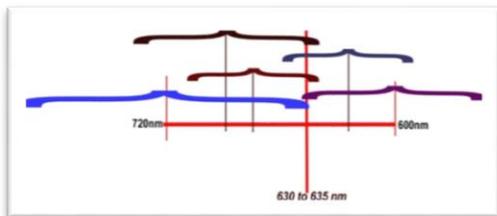
- One nanometer is one billionth of a meter.  $10^{-9}$  meters or .000000001 meter = 1nm.

**Chromophore:** Pigmented substances that accept photons in living tissue are called Chromophores, also referred to as “Light Receptors”. When a photon within a specific wavelength spectrum having the correct power density (mW) strikes a matching chromophore the energy of the photon is transferred to the chromophore and the photon ceases to exist. When the chromophore accepts a photon, it causes a biochemical change within the cell or tissue. This biochemical change will either activate or inhibit the cells function.

**Visual Chromophores:** Visual chromophores are the pigmented substances in the Rods and Cones of the eye. When these chromophores are struck with the correct wavelength (nm) and brightness (mW) of light they allow us to see.

**Biological Chromophores:** Biological chromophores are the chromophores that exist in living tissue that when struck with the correct wavelength and brightness of light produce a biochemical change in the tissue where they exist. Each biological chromophore of the

body has its own peak activation wavelength. These exist between 720nm through 600nm. However there is a spectrum of wavelengths that will activate any given chromophore. If you get shot with a poison dart, any where on the body will do. The same with activating a chromophore with a photon, any photon within the spectrum of wavelengths for that chromophore will activate that chromophore. There are many different chromophores with in the body that can be activated. However there is one wavelength within the spectrum of activation that all chromophores share. This is between 630nm to 635 nm of light. This means that we do not need multiple wavelengths or colors of lasers as one wavelength, 635nm, has the potential to activate all known biological chromophores in the human body. Any other wavelength of laser may activate a few chromophores but not all of them.



**LASER:** Laser is not a word but an Acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. Laser refers to the properties of the light not how the light was generated with the primary property being coherency. Original lasers were tube lasers filled with different gases to create different wavelengths or color of light. For example, Helium Neon gas tube lasers created a wavelength of 630nm, a pure ruby red color. This is the laser that most of the research papers over the past 60 years in Russia used. Most new electronic lasers are semiconductor lasers that generate laser light with a diode making them technically a laser LED or laser Light Emitting Diode. However, not all diodes are laser diodes. A laser diode produces coherent light where normal LEDs do not. I cannot tell you how many intelligent doctors become confused over this one simple issue.

Next, you can purchase a laser diode at a cost anywhere from 10 cents to hundreds of dollars. Since there is a significant difference in the therapeutic value and no way that an individual can tell the difference, you need to purchase your laser from a company that is trustworthy.

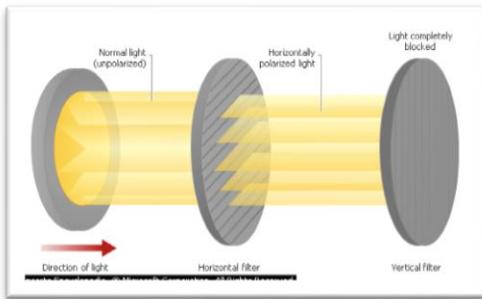
As stated above the Helium Neon gas tube lasers utilized for most of the original laser research had a wavelength of 630nm. However, the new semiconductor lasers utilize a wavelength of 635nm. Since a wavelength of 632.5nm is the ideal target for therapy lasers, both 630nm tube and 635nm semiconductor lasers are within the ideal target wavelength for therapy. The benefit for the 635nm semiconductor laser is several fold including size, weight, and power consumption. However, the primary benefit is the fact that you can pulse, turn off and on, a semiconductor laser hundreds of millions of times a second and therefore utilize very precise frequency biomodulation therapy where the tube lasers can only be pulsed a few hundred times a second making frequency therapy extremely limited.

**Coherent Light:** Coherent means that the peaks and troughs of the light wave are in phase with each other. The illustration below shows an example of coherent, monochromatic and collimated light. Monochromatic means that all the light waves are of one wavelength or color. Coherent light can only be produced by man with a laser. LED and other forms of light are not coherent. Coherent light is extremely important in light therapy as only coherent light will properly travel through the optical windows of each cell and stimulate the chromophores in all of the living tissues of the body. Forty years before science understood LASER, Einstein theorized that the body produced Coherent, (LASER) light as a method of internal cell to cell communication.



## Polarized Light:

Light travels in a two dimensional field, Length and Width. Polarized light is light where all of the photons are traveling in the same plane. This can be accomplished with polarizing filters but laser light is automatically polarized. Polarization is a vital property for therapeutic application of light.



**Power Density or Milliwatts mW:** One mW is 1/1000 Watt. This determines the brightness of the light. The brightness of light is extremely important in LLLT. The power or brightness of light needed for light therapy is dependent on the type of light therapy you are performing. When activating a chromophore with a photon, more is not better. To explain this we will compare the visual chromophores to the biological chromophores. The correct brightness of light is vital for you to see. Not enough light and the visual chromophores in the eyes will not be activated. However, too much light, looking at snow on a bright day, will over power the chromophore and you still cannot see. It requires the correct range of light for our visual chromophores to function and transmit visual information properly. The same holds true with biological chromophores. They function within a spectrum of brightness, too little and they are not activated, too much and they are also not activated. When utilizing fully collimated lasers a power density from less than 1 mW to no greater than 5 mW is usually the optimal range for activating all mammalian chromophores.

**Therapy:** Therapy is defined as having or exhibiting healing powers, healing power or quality, and as related to the Medical treatment of disease; the art or science of healing. So a word like radiation therapy is a true oxymoron.

**Neuroplasticity:** Neuroplasticity represents the brain's ability to reorganize itself by forming new neural connections throughout life. Neuroplasticity provides a way for nerve cells (neurons) in the brain to respond and compensate for injury and disease and adjust neuronal activity in response to a new situation or to changes in the environment.

Reorganizing the brain occurs by the mechanism of "axonal sprouting" where damaged axons grow new nerve endings to reconnect neurons whose links were injured or severed. Undamaged axons can also contribute new nerve endings and connect with other undamaged nerve cells, forming new neural pathways to accomplish a needed function. In order for neurons to reconnect or form new connections, the neurons need active stimulation.

Neuroplasticity describes an internal neurological environment that the brain can be in. To place the nervous system into this environment requires specific stimulation. 635nm fully collimated laser light at low levels, <5mW is the greatest active stimulant to produce a neuroplastic environment for the nervous system.

Most other known stimulants include trauma, which is why neurological trauma is so difficult to correct.

Introducing neuroplasticity in an organized controlled manor represents a new rapidly evolving approach to healing. *Given any trauma, realizing all traumas involve the central nervous system*

*recognizing the trauma (consciously or subconsciously), quick response with activity neuronal stimulation, could theoretically maintain, repair, retain most CNS functions (learning, memory, speech, emotional distress, movement, balance etc.)*

## **Photobiomodulation of Chromophores:**

Pigmented substances that accept **photons** in living tissue are called **Chromophores**. When a **photon** within a **specific wavelength spectrum** having the correct **power density (mW)** strikes a matching chromophore the energy of the photon is **transferred** to the chromophore and the photon ceases to exist.

When the chromophore **accepts** a photon, it causes a **biochemical** change within the cell or tissue. This biochemical change will either **activate** or **inhibit** the cells function. If this change **activates** or improves cellular function it is called **photobioactivation**. This is usually just referred to as **Photobiomodulation** and is the **first goal** of light therapy.

If this change sedates or **inhibits** cellular function it is said to have de-activated the tissue and **photobioinhibition** has occurred.

## **Biological Amplification:**

The Ultimate Goal of LLLT would be Biological Amplification. When photobiomodulation occurs, the photon activates a chromophore and that single enzyme molecule rapidly catalyses thousands of other chemicals.

This is similar to the well-known, calcium regulated, 2nd messenger cAMP cascade.

This **biological amplification** process explains how Photobiomodulation can produce such profound systemic, cellular, and clinical effects. Biological Amplification is the alternative response to Penetration in infrared laser therapy.

# **Natural Low Level Laser Therapy (LLLT)**

## **The Foundation of Natural Energy Medicine**

Each different form of light used in therapy has different effects and is accomplished by different methods. The object or goal of most light therapy is based on a mechanical, chemical or thermal stimulus. These types of stimulus have local effects only and do not play a role in a larger therapy system and especially not in Natural Energy Medicine.

The object of Natural LLLT is only about delivering and managing information. This light must have the following properties:

1. **Coherent, Polarized Light:** It must be from a laser light source.
2. **635nm:** It must be a monochromatic light source of a ruby red color of precisely 635 nanometers in wavelength.
3. **<5mW of Power:** The light must be from <1mW to no greater than 5mW of power.

This form of light will have very specific effects on the body.

This starts by placing the body and nervous system into a neuroplastic environment making it receptive to change and correction.

Next is the ability to activate all the light receptors called physiological chromophores in mammalian tissue which includes all humans. Physiological Chromophores are utilized in the body as part of the internal communication system. By tapping into this communication system we can deliver and manage information that no other light source has the capacity to perform.

With the ability to directly communicate with the body's own communication system it could be considered the language the body speaks. And with this language you can deliver multiple forms

of other information such as frequency therapy and homeopathy etc. making it the foundation component of natural energy medicine.

Because of the ability of this form of light to activate the physiological chromophores it has the ability to biomodulate tissue with photons (light). This process is called photobiomodulation. Photobiomodulation occurs in three forms:

1. **The transferred photon changes the energy state of an electron** (mitochondrial electron transport chain),
2. **The transferred photon donates an electron** to a re-dox molecule (Cytochrome oxidase, hemoglobin, melanin, serotonin, porphyrin ring, amino acid, nucleic acid etc.),
3. **The transferred photon ionizes a chemical bond** (ion or protein channel on the cell, mitochondrial or nuclear membrane) thereby producing a cellular response which changes the cell's homeostatic set point .

**There are four distinct biological effects of photobiomodulation:**

1. **Growth factor production** occurs within cells and tissue in response to increased ATP and protein synthesis. This initiates mitosis, cell proliferation by changing the cell, mitochondrial, or nuclear membranes permeability to monovalent (Na<sup>+</sup>, K<sup>+</sup>) and divalent (Ca<sup>++</sup>, Mg<sup>++</sup>) ions (Karu 1987, 1998, 2002).
2. **Pain relief** results from suppression of the nociceptor response mediated by increased serotonin and endorphin release (Sumano et al., 1987a, 1987b).
3. **Immune-modulation and mitigation of the inflammatory response** occur because the mononuclear phagocytic cells, mast cells, and leukocytes are stabilized preventing the release of harmful inflammatory mediators (Amano 1994). In addition, vasodilatation and increased microcirculation allows a rapid return to homeostasis and **promotes first intention healing** (Sumano 1987a, 1987b; Fiszerman and Rozenbom 1995).
4. **Direct trigger point stimulation** allows direct release of endorphins and other endogenous pain mediators such as serotonin, VIP, substance P, prostaglandins, etc. (Kaada, B and Eielson O, 1983, Kaada, Olsen and Eielson,1985).

There are two totally different methods of delivering therapeutic energy to the target tissue. The first method is publicized a great deal in most ads and brochures that are utilized in infrared and most other laser therapies called PENETRATION. This method relies on the ability to penetrate tissue to reach the targeted tissue. This requires high power and wavelengths that penetrate tissue easily. The second method is infinitely more sophisticated and defined as Biological Amplification. This is the method photobiomodulation utilizes to deliver the energy to the targeted tissue. Biological Amplification is the process of transferring light and information from one cell to the next via the optical windows on every living cell. This means as soon as this energy reaches the first living cell in the body this light, energy and information is delivered to every cell in the body at the speed of light systemically. So when you treat one wound on the body, every wound receives the same treatment regardless of the depth or location in the body. This explains the amazing systemic therapeutic responses when utilizing true LLLT. There is one thing that you must understand, the energy that is utilized to produce biological amplification cannot produce penetration and likewise the energy that produces penetration cannot produce biological amplification. In the realm of infrared lasers there is a lot of bragging about the depth of penetration over the LLLT systems. However, if they understood biological amplification this would be one subject that they would be ashamed to talk about.

As you can see, Low Level Laser at 635nm below 5mW is a very powerful form of informational medicine all by itself. This is why this form of light is very therapeutic and patients receive significant results from just this therapy alone. And even though this form of therapy is ideal for trauma this therapy is still quite general in its application and is therefore difficult to develop specific applications of therapy. However, when you add other informational types of therapy such as frequency therapy, homeopathy, reflexology, etc. we can then target specific organs, systems

and functions of the body with precise therapeutic protocols. We will talk about each of these additional forms of therapy in future articles.

The most important thing that we can emphasize here is this. If you are using true LLLT it must have the 3 properties as outlined above. Any light source different than these 3 properties above may certainly have the ability to change symptoms, but will not have the properties described as true LLLT and will not meet the criteria to be part of Natural Energy Medicine.

**Dr. R Gerry Graham III**  
President: LazrPulsr System