

# Newsletter

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## How Red Light Heals the Body

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Lower Level Laser Therapy (LLLT) uses therapeutic lasers to deliver a wavelength of monochromatic light in the 600 to 950 nanometer (nm) range that penetrates up to 10 cm into the targeted tissue. These light particles known as photons stimulate the mitochondria in the target cells, causing an increased production rate of adenosine triphosphate (ATP), which provides cells energy in order to heal tissue at accelerated rates. The laser simply jumpstarts the healing process and since the laser used operates within a specific wavelength range that is non thermal (the "therapeutic window"), there is no risk of tissue damage or other complications.

### Cellular Pathway Activation

#### Adenosine Triphosphate (ATP) Pathway - Accelerates Healing, Activated By 630-670 nm, Visible Red Light

Cells that lack energy are unable to participate in the healing process. Light energy is delivered to injured cells which in turn absorbs the light and converts it into food energy and uses it to replenish themselves. Once cells are fully recharged they are able to replicate and divide, and build upon one another to heal the injured area. Lower Level Laser Therapy stimulates the mitochondria of the cell to produce more ATP (energy) thus repairing damaged tissue through the phosphorylation of glucose to ATP via the Krebs' Cycle and Electron Transport Chain. Photons with wavelengths between 630nm - 670nm increase the speed at which the mitochondria can absorb glucose and convert it into ATP. 660 nm visible red laser light, is at the peak excitation of cytochrome C oxidase (a critical cytochrome in the Electron Transport Chain used in the phosphorylation of glucose into ATP)

#### Nitric Oxide (NO) Pathway -Decreases Inflammation, Activated By 905 nm, Near Infrared Red Light

When tissue injury occurs, the inflammatory process is initiated to immobilize the area to prevent further damage, providing us with an indication that the body is hurt. This process is usually associated with pain caused by inflammation pressuring nerve endings. In order to reabsorb this interstitial fluid and decrease inflammation in the region, the body produces nitric oxide (NO), which has been proven to relax the lymphatic system causing it to become more porous allowing the reabsorption process to occur. This process not only reduces inflammation but causes temporary vasodilatation (increased diameter of capillaries) bringing much needed oxygen, fuel molecules and other metabolites to the injured tissue aiding in their natural healing.

#### Lipid Absorption Pathway - Removes Pain, Peak Activation by 905 nm, Near Infrared Red Light

Pain results when a stimulus causes action potentials to rapidly propagate along a nerve cell. These actions potentials are primarily due to an expulsion of positively charged sodium ions (Na+) and an influx of potassium (K+) ions into the nerve cell altering the electrical potential across the membrane. The peak absorption of lipids is in the 905 nm to 910 nm range. Laser light is thus directly absorbed by receptors within the bi-lipid cellular membrane of nerve cells. Once absorbed, the laser light will increase the porosity of the cellular membrane allowing for reabsorption of sodium ions and expulsion of potassium ions across the cellular membrane rebalancing the sodium-potassium pump and removing the pain signal at source.

Therapeutic laser systems are athermic (no heat) and therefore incapable of causing tissue damage. As well, cells have a natural ability to resist over-stimulation, meaning it is not possible to harm tissue by overdosing, as long as you use a therapeutic laser that is used in the therapeutic window and remains below the Maximum permissible Exposure (MPE) of tissue.

Lower Level Laser Therapy (LLLT) is:

- Non-toxic
- Decrease/eliminate pain
- Reduce inflammation
- Promote new blood vessels and tissue growth
- Promote nerve axon growth
- Faster wound healing and closure
- Virtually painless
- Non-invasive
- Highly effective for patient (>90% efficacy) No side effects
- Drug free
- Extremely safe
- Superior alternative to analgesics, NSAID's, other medications and other modalities
- Virtually no contraindications

Biological Effects of Lower Level Laser Therapy (LLLT):

- Rapid Cell Growth - Accelerates cellular reproduction and growth.
- Faster Wound Healing - Stimulates fibroblast development and accelerates collagen synthesis in damaged tissue.
- Increased Metabolic Activity - Higher outputs of specific enzymes, greater oxygen and nutrient loads for blood cells, greater production of adenosine triphosphate (ATP) and greater ability to remove waste products.
- Reduced Fibrous Tissue Formation - Reduces the formation of scar tissue following damage from cuts, scratches, burns or surgery and allows the reabsorption of fibrotic tissue already formed through biostimulation of collagen during the remodelling phase of healing.
- Anti-Inflammatory Action - Reduces swelling caused by bruising or inflammation of joints for enhanced joint mobility.
- Increased Vascular Activity - Induces temporary vasodilatation, increasing blood flow to damaged areas and removal of waste products
- Stimulated Nerve Function - Speeds the process of nerve cell reconnection to prevent or stimulate recovery from nerve damaged areas ("dead" limbs or numb areas).