

## Top Ten Biological Effects of Laser Therapy (Photobiomodulation; Phototherapy)

*NOTE<sup>1</sup>: Many thousands of bona fide clinical research studies are available on these subjects through simple subject research online on PubMed (<https://pubmed.ncbi.nlm.nih.gov/>).*

*NOTE<sup>2</sup>: The terms “Low Level Laser Therapy” (LLLT), “High Intensity Laser Therapy” (HILT), and other similar terms were developed mainly to differentiate between high and low output devices and are unreasonably confusing. For the sake of simplification these superfluous terms will be removed from this document. Laser energy at any output is no different between therapeutic laser devices (all other factors such as wavelength(s) being equal). The mitigating primary factor between one therapy laser device and another is the maximum available volume of energy that can be generated and transferred. As energy volume is the primary factor in photobiomodulation (all other factors being equal), the device most able to generate and transfer requisite volumes of energy is the most useful for healing. Since most so-called “cold laser” devices are only able to generate tiny amounts of energy, they are almost useless for tissue stimulation in laser therapy treatments.*

### 1. Anti-Inflammatory Effect

Laser Therapy reduces inflammation with vasodilation, activation of the lymphatic drainage system, and reduction of pro-inflammatory mediators. As a result, inflammation, erythema, bruising, and edema are reduced.

- Source: Effect of Laser Therapy on the Expression of Inflammatory Mediators... (<https://arthritis-research.biomedcentral.com/articles/10.1186/ar4296>)
- Source: Review on the Cellular Mechanisms of Laser Therapy in Oncology (<https://www.frontiersin.org/articles/10.3389/fonc.2020.01255/full>)
- Source: Mechanisms and Applications of the Anti-inflammatory Effects of Photobiomodulation (Laser Therapy) (<https://www.aimspress.com/article/id/1434>)

### 2. Analgesic Effect

Reduction of pain through the suppression of nerve signal transmission over unmyelinated c-fibers; production of high levels of peptides such as endorphins and enkephalins from the brain and adrenal glands, offering successful treatment of many conditions; a suppression of nociceptors, an increase of simulated threshold, an increased release of tissue endorphins.

- Source: Analgesic Effect of Laser Therapy... ([https://scholar.google.com/scholar\\_url?url=https://hrcak.srce.hr/file/107552&hl=en&sa=X&ei=xH9oYaL-LILQyQTYmojQCA&scisig=AAGBfm1xUZcyPr4ZB-Up42-8CZA-Q5cPjw&oi=scholar](https://scholar.google.com/scholar_url?url=https://hrcak.srce.hr/file/107552&hl=en&sa=X&ei=xH9oYaL-LILQyQTYmojQCA&scisig=AAGBfm1xUZcyPr4ZB-Up42-8CZA-Q5cPjw&oi=scholar))
- Source: Anti-inflammatory and Analgesic Effects of Laser Therapy... (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4499952/>)
- Source: Laser Therapy and Analgesic Action (<https://www.spiedigitallibrary.org/conference-proceedings-of-spie/4166/0000/Low-level-laser-therapy-and-analgesic-action/10.1117/12.389463.short?SSO=1>)

### 3. Accelerated Tissue Repair and Cell Growth

Photons of light from lasers penetrate deeply into tissue and accelerate cellular reproduction

and growth. Laser light increases the energy available to the cells so that they can take on nutrients and get rid of waste products more quickly.

- Source: Effect of Laser Therapy on Proliferation and Differentiation of Cells...  
(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4281990/>)
- Source: A Meta-analysis of the Efficacy of Phototherapy (Laser Therapy) in Tissue Repair  
<http://www.ncbi.nlm.nih.gov/pubmed/19698019>
- Source: *Biological Effects of Laser Therapy*  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4291815/>

#### **4. Improved Vascular Activity**

Laser light significantly increases the formation of new capillaries in damaged tissue. This speeds the healing process, resulting in more rapid wound closure.

- Source: Limb Blood Flow After Laser Therapy  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3418129/>
- Source: Laser Irradiation Promotes Cellular Redox Activity  
<https://www.liebertpub.com/doi/abs/10.1089/pho.2005.23.3>
- Source: The use of Laser Blood Irradiation to prevent vascular diseases and to increase life expectancy...  
[https://www.jstage.jst.go.jp/article/islsm/24/1/24\\_15-OR-02/article/-char/ja/](https://www.jstage.jst.go.jp/article/islsm/24/1/24_15-OR-02/article/-char/ja/)

#### **5. Increased Metabolic Activity**

Laser therapy creates higher outputs of specific enzymes, greater oxygen and food particle loads for blood cells.

- Source: Biological Effects of Laser Therapy  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4291815/>
- Biostimulatory effect of laser therapy...  
<https://link.springer.com/article/10.1007/s10103-012-1057-8>
- Brain Photobiomodulation Therapy: a Narrative Review  
<https://pubmed.ncbi.nlm.nih.gov/29327206/>

#### **6. Trigger Points and Acupuncture Points**

Laser therapy stimulates muscle trigger points and acupuncture points on a non-invasive basis, providing musculoskeletal pain relief.

- Source: Laser Acupuncture: A Concise Review  
<https://pubmed.ncbi.nlm.nih.gov/31297170/>
- Source: Laser Acupuncture: 35 Years of Successful Application...  
<https://pubmed.ncbi.nlm.nih.gov/33425287/>
- Source: Efficacy of Laser Therapy Applied at Acupuncture Points  
<https://pubmed.ncbi.nlm.nih.gov/24418801/>

## 7. Reduced Fibrous Tissue Formation

Laser Therapy reduces the formation of scar tissue.

- Source: Control of connective tissue metabolism by laser therapy: Recent developments and future prospects  
<https://www.sciencedirect.com/science/article/abs/pii/S0190962284801942>
- Laser therapy contributes to muscle regeneration and prevents fibrosis...  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3521873/>
- Low-level laser (light) therapy (LLLT) in skin: stimulating, healing, restoring  
<https://pubmed.ncbi.nlm.nih.gov/24049929/>

## 8. Improved Nerve Function

Slow recovery of nerve functions in damaged tissue results in numbness and impaired limbs. Laser therapy accelerated nerve cell regeneration.

- Source: Transcranial Laser Photobiomodulation Improves Intracellular Signaling Linked to Cell Survival, Memory and Glucose Metabolism in the Aged Brain...  
<https://www.frontiersin.org/articles/10.3389/fncel.2021.683127/full>
- Source: Comparison of Laser Therapy, Ultrasound, and Transcutaneous Nerve Stimulation in Patients with Cervical Spondylosis...  
<https://pubmed.ncbi.nlm.nih.gov/30443883/>
- Source: Efficacy of Laser Therapy in Nerve Injury Repair - a New Era in Therapeutic Agents and Regenerative Treatments  
<https://pubmed.ncbi.nlm.nih.gov/34292450/>

## 9. Immunoregulation

Laser therapy benefits the immune system by stimulating immunoglobulins and lymphocytes; energy is absorbed by targeted chromophores (molecular enzymes) that react to laser light. The production of adenosine triphosphate (ATP) accelerates in targeted tissues, stimulating increased energy for all chemical reactions in targeted cells.

- Source: Modulation of Immune Response to Induced-Arthritis by Laser Therapy  
<https://pubmed.ncbi.nlm.nih.gov/30203577/>
- Source: Photobiomodulation (Laser) Therapy as a High Potential Treatment Modality for COVID-19  
<https://pubmed.ncbi.nlm.nih.gov/33241526/>
- Source: The Potential Role of (Laser Therapy) in Long COVID-19 Patient Rehabilitation  
<https://pubmed.ncbi.nlm.nih.gov/33497594/>
- Source: Exposure of Skin to Near-Infrared Laser Modulates Mast Cell Function and Augments the Immune Response  
<https://pubmed.ncbi.nlm.nih.gov/30420435/>

## 10. Faster Wound Healing

Laser therapy accelerates the body's natural healing processes by using stimulated light energy to increase blood flow, reduce pain, accelerate tissue repair, heal wounds, and improve nerve function and vascular activity.

- Source: Laser Therapy Facilitates Superficial Wound Healing in Humans...  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC522143/>
- Source: Therapeutic Strategies for Enhancing Angiogenesis in Wound Healing  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6435442/>
- Source: Photobiomodulation with Pulsed and Continuous Wave Laser Therapy Augments Dermal Wound Healing in Immunosuppressed...  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5115773/>