

# Biological Responses of Stem Cells to Photobiomodulation Therapy

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## Abstract

**Background:** Stem cells have attracted the researchers interest, due to their applications in regenerative medicine. Their self-renewal capacity for multipotent differentiation, and immunomodulatory properties make them unique to significantly contribute to tissue repair and regeneration applications. Recently, stem cells have shown increased proliferation when irradiated with low-level laser therapy or Photobiomodulation Therapy (PBMT), which induces the activation of intracellular and extracellular chromophores and the initiation of cellular signaling. The purpose of this study was to evaluate this phenomenon in the literature.

**Methods:** The literature investigated the articles written in English in four electronic databases of PubMed, Scopus, Google Scholar and Cochrane up to April 2019. Stem cell was searched by combining the search keyword of "low-level laser therapy" OR "low power laser therapy" OR "low-intensity laser therapy" OR "photobiomodulation therapy" OR "photo biostimulation therapy" OR "LED". In total, 46 articles were eligible for evaluation.

**Results:** Studies demonstrated that red to near-infrared light is absorbed by the mitochondrial respiratory chain. Mitochondria are significant sources of reactive oxygen species (ROS). Mitochondria play an important role in metabolism, energy generation, and are also involved in mediating the effects induced by PBMT. PBMT may result in the increased production of (ROS), nitric oxide (NO), adenosine triphosphate (ATP), and cyclic adenosine monophosphate (cAMP). These changes, in turn, initiate cell proliferation and induce the signal cascade effect.

**Conclusion:** The findings of this review suggest that PBMT-based regenerative medicine could be a useful tool for future advances in tissue engineering and cell therapy.

**Keywords:** Stem cell; low-level laser therapy; mesenchymal stem cells; photobiomodulation; regenerative medicine.