# Light promotes regeneration and functional recovery and alters the immune response after spinal cord injury

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## Abstract

Photobiomodulation (PBM) has been proposed as a potential therapy for spinal cord injury (SCI). We aimed to demonstrate that 810 nm light can penetrate deep into the body and promote neuronal regeneration and functional recovery. Adult rats underwent a T9 dorsal hemisection, followed by treatment with an 810 nm, 150 mW diode laser (dosage = 1,589 J/cm$^2$). Axonal regeneration and functional recovery were assessed using single and double label tract tracing and various locomotor tasks. The immune response within the spinal cord was also assessed. PBM, with 6% power penetration to the spinal cord depth, significantly increased axonal number and distance of regrowth ($P < 0.001$). PBM also returned aspects of function to baseline levels and significantly suppressed immune cell activation and cytokine/chemokine expression. Our results demonstrate that light, delivered transcutaneously, improves recovery after injury and suggests that light will be a useful treatment for human SCI.

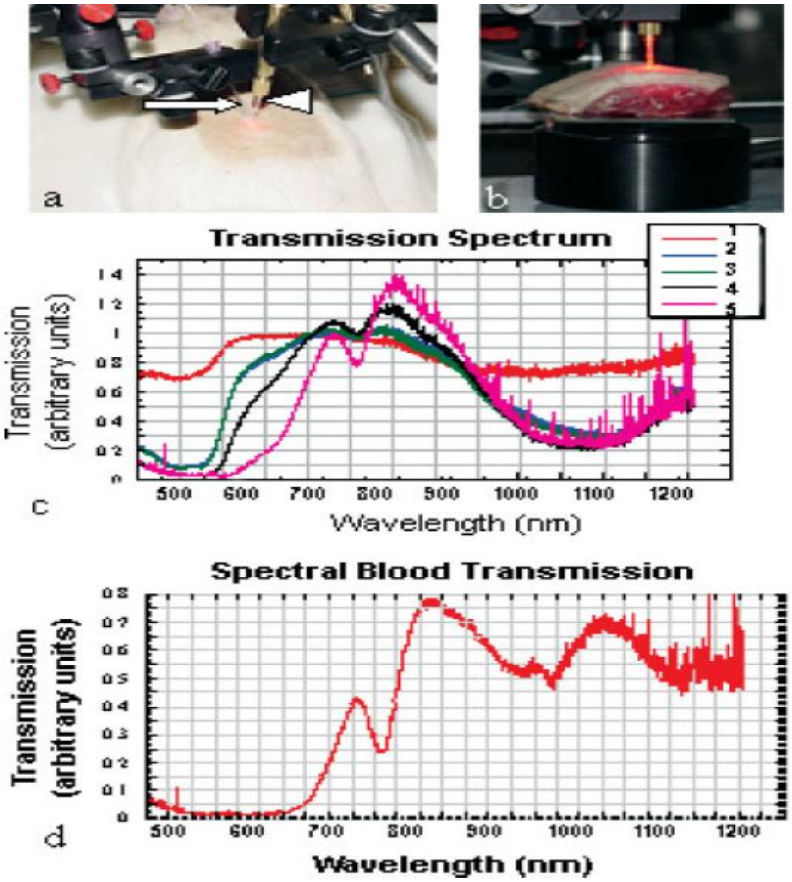


**Figure** Light penetration analysis. a: Photograph of spectrophotometric analysis experimental set-up. The smart fiber (arrow) is inserted below the skin of the rat, the light source (arrowhead) is positioned above the skin for transcutaneous application of light. b: Ex vivo power analysis, a cross section of the rat's dorsal thoracic region was placed between the light source and a power meter. Graphical representation of transmission (in arbitrary units) through each layer of tissue (c) or through blood (d), depending on wavelength (nm). Layer 1, skin; 2, loose connective tissue; 3, dense connective tissue; 4, muscle; 5, vertebral column and spinal cord.