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Accelerated healing of skin ulcers by electrical stimulation and the intracellular physiological mechanisms involved

[M C Biedebach¹](#)

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Abstract

Evidence is reviewed (8 studies involving 215 clinical patients with ischemic skin ulcers and 7 animal tissue or tissue culture studies) that electrical stimulation of fibroblast cells accelerates the intracellular biosynthesis necessary to form new granulation tissue in a healing wound, and that both a direct local tissue effect and a circulatory improvement occur. A model is presented in which transmembrane currents open voltage-controlled calcium channels in fibroblast cells, causing ATP resynthesis, activation of protein kinase mechanisms to synthesize new cellular protein, and the DNA replication necessary for mitotic cell division. Stimulation efficacy appears to be determined by a number of basic electrical parameters, and judicious waveform control is desirable.