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by Donald Kendall

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Mechanisms of Acupuncture

by Donald Kendall, O.M.D., Ph.D., L.Ac.

Much work has been accomplished in understanding many of the processes of acupuncture induced analgesia. However, not many studies have focused on the mechanism of action of acupuncture as a whole. More understanding needs to be achieved, including the study of channel phenomena, somatovisceral relationships, and other mechanisms that help bring about the beneficial effects that have long been noted for acupuncture.

In TCM theory, disease, pain, or dysfunction was considered to be the result of energy being out of balance by being blocked, stagnated, deficient, or excessive. If the body's energy was harmonious and uninterrupted, then the person should be in a fine state of health. It was observed that energy distributions could be manipulated by needling or heating (moxibustion) specific points along the channels that were particularly sensitive to stimulation, and that energy could also be strengthened through nutrition or the use of herbal remedies.

It can be shown that acupuncture works primarily because of its interaction with the afferent nociceptive (pain) and proprioceptive (muscle length and position) sensory and other nerves that in turn provoke local, spinal, and centrally mediated control.

Points and channels have unique tissue and anatomical properties and functional responses that can be shown to be related to defensive mechanisms. Activation of the spinal afferent processing system by stimulation of the superficial nociceptive and peripheral proprioceptive fibers appears to be most important in bringing about spinal and central control in the mediation of acupuncture.

No matter how minor the assault, the skin and subcutaneous tissue will provide efficient defense in the form of immune and repair processes. Stimulating the skin with an acupuncture needle is no exception, especially when inserted at acupoints, which, due to their unique histological features, will stimulate the body to react strongly. Overall, the body's defense system will seek to expel, destroy, or neutralize the foreign object by mounting an immune reaction, initially increasing the blood flow and reducing residual muscular or tissue tension to aid in working the object out of the body. This process brings about a complex integrated immune, visceral, and somatic response that causes activation the spinal afferent processing system, which in turn initiates descending control. Analgesia is also produced by spinal segmental processes and central mediated inhibition of the nociceptive fibers, probably to allow an animal to still respond to a life threatening stress episode without being hampered by the presence of a painful thorn or sticker.

It has been found through both human and animal research studies that acupoints contain a significantly higher concentration of mast cells, fine lymphatics, blood capillaries, venules, and converging arterioles, along with sympathetic nerves supplying the vessels, nerve bundles, nerve plexuses, and free nerve endings. This makes acupoints extremely reactive to the micro-damage of needle insertion.

When the endothelium of small blood vessels and capillaries, and the surrounding connective tissue of points are injured (such as by needle insertion), numerous damaging products, including fragments of collagen, microfibrils, and basement membrane, are generated. Mast cells concentrated at the acupuncture points help to increase the initial vasodilation phase by releasing histamine, heparin, and kinin protease. This delays the blood clotting aspects of the repair phase and has a positive anticoagulation effect.

The reaction to needle insertion is controlled by an energy and calcium dependent cascading process which is modulated by the cAMP-cGMP balance in the cytoplasm of the primary target cells (mast cells and basophils). The initial effect causes arterioles to vasodilate and increase the permeability of the capillaries. Venules and veins are induced to constrict and lymphatic vessels dilate. This enhances the flow of blood borne immune cells and damage and repair substances into the surrounding tissue area where the needle has been inserted. The reaction has several time dependent features that include (1) vasodilation, (2) nociceptive excitation, (3) chemotaxis, (4) solubilization, (5) tissue repair, and (6) inactivation of the reaction. Many of these substances have very short lifetimes and only act in localized areas, while others can continue to be active after the acupuncture needles have been removed.

When a needle is inserted into an acupuncture point and manipulated, usually by rotating the needle back and forth while at the same time lifting and thrusting up and down slightly, a reaction occurs that is called *deqi*. It refers to the arrival of response. The sensation to the reaction has been described as a feeling of distention, heaviness, cramping, numbness and soreness, and sometimes pain. A local redness, wheal formation (local edema), and spreading of the redness to form a flare response are typically observed surrounding the needle sometime after insertion. It is thought that histamine, substance P, leukotrienes (LT) and platelet activating factor (PAF) participate in this reaction. If nerve function to the area of needle insertion is interrupted, or if substance P is depleted in the nociceptive fiber by application of capsaicin, the flare response is absent.

Histamine, prostaglandins, serotonin (5HT) and leukotrienes are also important initial mediators of the acupuncture effect. Plasma levels of prostaglandin E have been observed to increase when excellent acupuncture analgesia is achieved for surgery with histamine, 5HT, dopamine beta hydroxylase (DBH), and cAMP levels showing a corresponding decrease. In cases of poor effect for acupuncture analgesia, plasma levels of histamine, 5HT, DBH, and cAMP show an increase. The effect of acupuncture on plasma 5HT seems to be related to increasing its re-uptake in platelets, thereby causing a decrease in levels.

The channels were mapped out in ancient times by carefully recording the superficial pathways of subjective reports of peripheral nerve reaction in response to stimulating points on the skin, and the resulting traditional acupuncture charts were diagrammatic representations of the propagation of sensation (PS) lines. PS can be stimulated either by needle insertion, moxibustion, pressure manipulation, vibration, acoustic stimulation, massage, chemical application, or electro-stimulation. Vital to the propagation of PS along the channels are nociceptive (A-delta, group III, C and group IV fibers) and proprioceptive (group II) fibers, sending branches that synapse on neurons several segmental levels above and below their point of entry in the dorsal horn, these inter-connections can give rise to the propagation of signals up and down the cord from the point that needling sensation is stimulated.

Propagated sensation has a latent characteristic as well as a prompt or conspicuous nature. In the case of latent PS needling sensation may be experienced without any propagation of a sensation along the channel. It can be induced after needle insertion by percussing the channel with a small hammer, demonstrating the involvement of intrafusal fibers.

The unique physiological features at acupuncture points, channels, and spinal axial pathways account for the higher probability that signals will propagate along these pathways as opposed to non-points or non-channel areas. Propagated sensation is not subjectively experienced unless a sufficient number of proprioceptive and nociceptive (FRA) fibers participate in the reaction.

This article was taken from Kendall, D.E. (1989). A Scientific Model for Acupuncture. *American Journal of Acupuncture*, 17(3), 251-268.

About the Author

Dr. Donald Kendall, author of *Dao of Chinese Medicine*, first became involved with Chinese medicine after graduating from the University of Illinois with a degree in engineering, when he adopted the use of Chinese herbs as his primary health care strategy. This led to the study of physiology and Chinese medicine, culminating in a degree from the California Acupuncture College as Doctor of Oriental Medicine. Dr. Kendall has more than twenty years of private clinical experience, including acupuncture research at the UCLA dental school and as a staff member at UCLA's Center for East-West Medicine. Dr. Kendall has also served on the boards of several state and national professional organizations for acupuncture and Oriental medicine. He has developed and taught acupuncture orthopedics and dental acupuncture certification courses, and has participated in veterinary medical acupuncture training programs. He lectures extensively around the United States, as well as internationally, and has published a number of articles on various aspects of Chinese medicine, with an emphasis on how acupuncture works.

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PO Box 92493

City of Industry, CA 91715

www.eLotus.org info@elotus.org