A Neural Mechanism for Acupuncture

Acupuncture may work by activating a natural pain-suppression mechanism in the brain. Such an explanation would rule out earlier suggestions that acupuncture is merely a psychological distraction, says Bruce Pomeranz of the University of Toronto.

Research reported by Pomeranz at the annual meeting of the Society for Neuroscience last week in Toronto suggests that the acupuncture needles stimulate nerves deep in muscles, causing the pituitary and other brain structures to release endorphin. That chemical then inhibits the cells in the brain that fire in response to pain. Endorphin, a recently discovered natural pain suppressant, is 200 times more potent than morphine (SN: 9/25/76, p. 206).

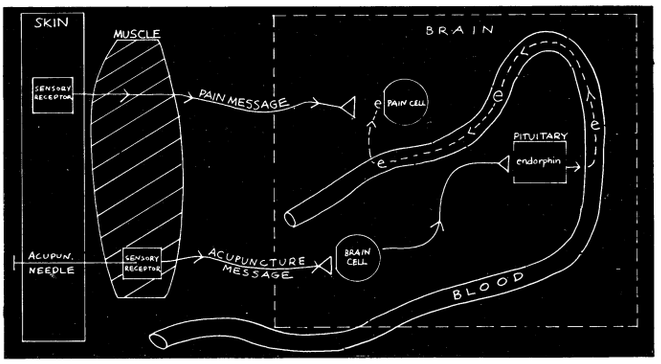
Pomeranz has recorded the electrical activity of single cells in the brains of anesthetized animals. He located cells that fire rapidly when the animal's toe was pricked with a pin. Acupuncture slowed down those cells' firing, and within about 90 minutes after acupuncture they recovered their normal response to pain.

When Pomeranz removed the pituitary of an animal, acupuncture no longer had any effect. This result led him to suspect that endorphin produced by the pituitary normally could block transmission of a nerve signal to the brain cells that respond to pain.

Further evidence that acupuncture initiates internal pain suppression comes from experiments with the drug naloxone, an analog of morphine. Naloxone binds to the morphine receptors, so opiate drugs can no longer be effective. But naloxone does not itself change perception of pain. This drug has been shown to block the effect of endorphin experimentally applied to brain cells. Now Pomeranz reports that naloxone blocked acupuncture's effect on cells responding to pain. In contrast, a control injection of saline did not alter the effect of acupuncture.

Pomeranz is currently working on what he considers to be definitive proof of acupuncture's mechanism. He hopes to show increased levels of endorphin in blood in the brain during acupuncture's effect.

Research on humans also supports the hypothesis that the pain-killing effect of acupuncture involves the same receptors as the action of opiate drugs and internal pain suppressants. David J. Mayer at the Medical College of Virginia measured people's pain threshold to stimulation of tooth pulp, a "pure" pain. Acupuncture raised that threshold by 28 percent. Mayer then injected the drug naloxone, and acupuncture no longer affected pain perception. Pain reduction by hypnosis, on the other hand, was not affected by naloxone. So hypnosis and acupuncture somehow work by different mechanisms.



From the needle to the brain: A pathway by which acupuncture may suppress perception of pain.

Because naloxone has some side effects, Mayer considers his results a necessary, but not sufficient, indication that acupuncture in humans works via the internal pain suppressors.

These findings may initiate more scientific study of acupuncture methods to improve their effectiveness as a painkiller. According to Pomeranz, the release of a brain chemical by acupuncture is preferable to injecting endorphin for treatment of pain because injections are addictive while acupuncture is not. □

Getting kepone out of the body

In July 1975 a worker in a pesticide manufacturing plant sought medical attention for tremor, irritability and memory loss. He told the doctor that other workers in his plant were suffering from similar symptoms. Blood analyses detected large amounts of kepone, the pesticide that the plant manufactured.

Since then, epidemiologists have found evidence of kepone exposure in more than 100 workers and residents of the Hopewell, Va., area. And although the plant has been shut down and the chemical company heavily fined, the toxic chemical is still circulating in the victims.

Clinical studies have begun on a new approach to removing kepone from these persons, Philip Guzelian of Virginia Medical College reported to the annual meeting of the Society for Neuroscience in Toronto. The technique involves swallowing a resin that binds to the pesticide and hastens its excretion. That approach may also be applicable to people poisoned with other environmental toxins.

Guzelian estimates that in untreated victims only a tiny fraction of the kepone in the body, 0.1 percent, is excreted each day. Much of the pesticide binds to bile in the liver and, with the bile, is repeatedly circulated into the intestine and back to the liver.

The researchers examined a series of compounds, such as those used in purification of chemicals, to attempt to separate kepone from bile in the laboratory. They discovered that a resin called cholestyramine binds kepone. Cholestyramine is an anion exchange resin made of ammonium ions attached to a polystyrene backbone. Initially the resin is bonded to chloride ions, but those ions can exchange for other negatively charged chemicals the resin contacts.

When cholestyramine is taken orally, it moves through the digestive tract but never gets into the blood. While in the intestine it can interact with bile circulating from the liver.

Cholestyramine already has one clinical use. It is prescribed to reduce blood cholesterol levels of patients with certain disorders. The resin binds bile acids, which are synthesized from cholesterol, forcing the body to convert cholesterol into more bile acids. A national study is currently examining whether such drug-induced lowering of cholesterol could lower risk of atherosclerosis and coronary heart disease.

In preliminary work on seven patients Guzelian found that ingestion of cholestyramine increased about sixfold the elimination of kepone in the feces. He is now in the second month of a larger study examining whether the resin will have the same effect on a long-term basis, and whether decreased levels of kepone will initiate improvement of the symptoms.

In the persons exposed to kepone, researchers have observed changes in the Schwann cells, which wrap around nerve cell axons, and degeneration of axons. However the relationship between these changes and the neurological symptoms is not established.

"At this time it's still up in the air as to whether the effects of kepone are reversible," Guzelian says. "We guess that some will be." □