

Western Science, Pain, & Acupuncture

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□ INTRODUCTION

In 1971, the United States was still basking in its recent success of landing the first man on the moon—perhaps the greatest technological feat of human history. An electronic microprocessor—a computer “chip”—had just been introduced. Texas Instruments had begun marketing the first pocket calculator: it could add, subtract, multiply, and divide—and it sold for \$150! America was still experiencing “hippies” and their youthful counterculture of exploring psychedelic drugs and heroin. Much fanfare accompanied President Richard Nixon’s effort to reestablish U.S. ties with the People’s Republic of China. For several decades, relations with its communist regime had been severed. China was the most populous nation on the globe, with one-quarter of the earth’s people crowded within its borders. It had a rich tradition of culture and technological discovery dating back thousands of years, but was also largely a nation of peasants.

Imagine yourself as an American physician visiting a Chinese hospital in 1971. Some doctors there tell you that they can alleviate pain by inserting needles at specific points in your skin and then twirling them slowly. The points may be quite remote from the source of pain. Would you believe them?

Next, you witness a surgical operation where the main source of pain control is from a needle inserted in the patient’s forearm. The surgeon makes a 14-inch incision around the left side of the thorax, cuts two ribs, and removes a lobe of a tuberculosis-infected lung. Meanwhile, the patient—still conscious—chats with the surgeon (Figure 12.1). At the end of the two-hour procedure, the patient sits up and leaves the operating table under his own power.

Finally, the doctor, who knows some Western medicine, explains that it is all quite reasonable if you understand traditional Chinese medicine and its basis in the flow of the life force and the harmony of nature. How would you respond?

The use of needling as a form of medicine—a practice known as **acupuncture**—extends back more than 2,000 years in China (Figure 12.2). Acupuncture received widespread exposure in the United States, however, only in the wake of

Nixon's diplomacy. American physicians could not explain how acupuncture could suppress pain. It followed no known physiological mechanisms. Indeed, it seemed contrary to scientific and commonsense notions about pain. What would have been an appropriate response in 1971? Could acupuncture be interpreted or explained in terms of Western science? Was it even worthy of serious scientific attention?

A SKEPTICAL RESPONSE

The spectacle of surgery done under acupuncture startled many Western physicians. Chinese doctors also used acupuncture to alleviate other sorts of pain, such as headaches, toothaches, and chronic pain in joints and muscles. They inserted needles at different points specific for each treatment, as prescribed by the experience of many centuries. The Chinese even used needling to treat other ailments: hiccups, insomnia, asthma, blindness, ulcers, vitamin E deficiency, and (more recently) drug and smoking addictions. That was quite an extraordinary list for such a modest procedure.

It is not surprising, then, that some American doctors doubted the Chinese claims. For them, acupuncture was unscientific. They alleged fraud and warned of possible abuse by "quackupuncturists." In fact, many acupuncture clinics that opened in the United States—and some that had existed previously in various Chinatowns in major U.S. cities—were soon closed by government authorities. But as Western physician after Western physician offered eyewitness testimony and as doctors began to replicate acupuncture's control of pain in U.S. hospitals, the claims of fraud gradually became untenable. Public decisions based on early judgments about acupuncture's scientific validity, however, often remained unchanged.

Many people acknowledged that acupuncture helped patients, but they were nonetheless unimpressed. They gave two reasons. First, a patient sometimes recovers from his or her condition even without treatment. For these cases, it would be inappropriate to credit acupuncture. To assess the effect of the needling alone, they argued, you must conduct a controlled study in which you compare patients treated with acupuncture with those who receive no treatment.

From a traditional Chinese perspective, however, this idea posed an ethical problem: Why would you withhold a treatment you knew to be effective? Chinese medicine stresses the result for the patient. Research is secondary. Therefore, you do not refrain from treating someone just for the sake of a test. Basically, for the traditional Chinese, if you already knew *how* to help a patient recover, you did not also need to know *why* the procedure worked, especially if your research might be at the cost of a patient's well-being.

A second reason for disregarding acupuncture, according to some critics, was that pain might be suppressed merely through psychological suggestion, not by the needling itself. In other words, pain control might have resulted from some "unscientific" influence, such as hypnosis, that was not worthy of serious medical attention.

Such psychological effects were already well known from drug studies. Even biologically inactive substances—known as **placebos**—may sometimes have a positive effect. Physicians have accepted for several decades that as many as one-third of all patients respond favorably, even when treated with a placebo or "non"-treat-

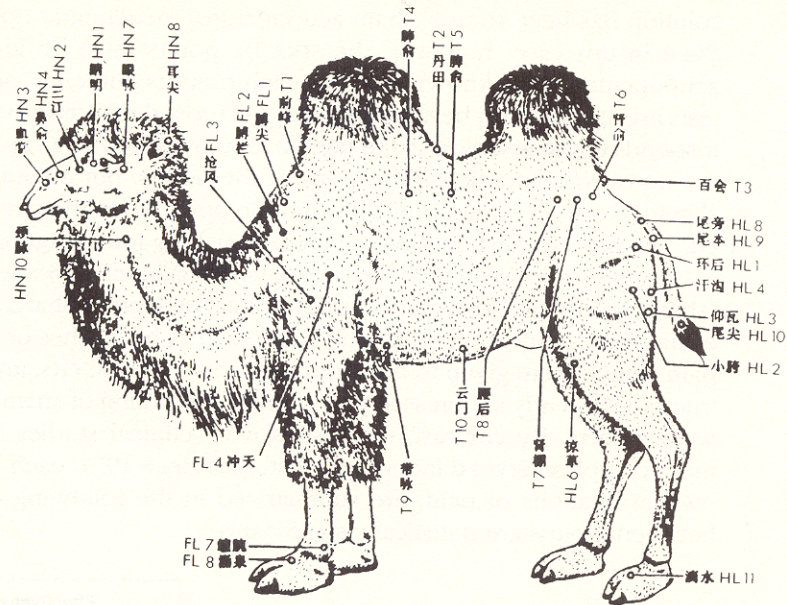


FIGURE 12.3 Acupuncture chart for a camel. Diagrams of needling points for animals first appeared in China centuries ago. *Source:* Camel diagram from *Veterinary Acupuncture* by Alan M. Klide and Shiu H. Kung. Copyright © 1977. Reprinted by permission of University of Pennsylvania Press.

ment, as long as they believe that they are receiving a real treatment. Many Westerners were especially suspicious when they discovered that the Chinese tended to screen patients: not all were deemed eligible for acupuncture. At the same time, Chinese doctors did not distinguish so sharply between psychological and physiological mechanisms. The treatment itself was effective. A Chinese doctor might have replied: “Is psychosomatic healing not healing?” Chinese and Western standards for “good” medicine and science emphasized different values in this instance.

Of course, you could test for the effect of suggestion. For example, you could check acupuncture on a person or organism who can feel pain but is not susceptible to suggestion. In fact, infants respond to acupuncture. So do animals. The Chinese have treated farm animals—horses, pigs, water buffaloes, etc.—with acupuncture since at least the Yuan period (1300s—before the European Renaissance). They have produced diagrams of the specific acupuncture points on animals—even camels! (Figure 12.3) Since the 1970s, numerous veterinarians in the United States have adopted acupuncture as part of their practice.

Another possible approach to testing suggestibility—similar to methods used in drug trials—is to prevent the patient from knowing whether he or she is receiving treatment. At the same time, you also need to guard against the possible suggestive influence (however subtle or indirect) of a doctor who knows which patients are receiving treatment and which are not. Such trials would be **double-blind**: both patient and doctor are “blind” to who is in the control or test group.

The nature of acupuncture poses special problems for double-blind tests. First, it is difficult for patients not to know whether they are receiving acupuncture. One

solution has been to use “sham acupuncture,” needling at nonacupuncture points. Even in this case, however, the specific points must be identified by a trained acupuncturist who knows whether each point is authentic or sham. Double-blind tests are also difficult because the acupuncturist depends in part on how the patient responds to the insertion of the needle to know whether it is placed precisely. There are no overt anatomical indications of the points, but a patient sometimes feels a slight distension or numbness around the point when the needle is properly inserted. The procedure should be interactive, making mutual ignorance difficult.

Studies proceeded with these qualifications in mind. Some examined acute pain (sharp, brief pain from such sources as intense heat or sharp objects), while others examined chronic, or long-lasting pain (such as backaches or arthritis). When acute pain stimuli were given to humans, mice, cats, horses, rats, and rabbits, needling of true points clearly suppressed pain, whereas needling of sham points produced very weak effects. By contrast, the results from clinical studies of chronic pain were more complex. Several independent studies since 1971, each based on the patients’ own evaluations of pain, are summarized in the following table (the differences between groups are statistically significant):

	Effectiveness (reported cases of pain relief)
Sham acupuncture	33%–50%
Placebos of needles taped to the skin	30%–35%
“True” acupuncture	55%–85%

By comparison, morphine, accepted in the West as the most widely effective painkiller, relieves pain about 70 percent of the time. Also, recall that approximately one-third of all patients respond positively to a placebo for almost any medical treatment.

PROBLEM

Based on these results, would you conclude that acupuncture works physiologically or psychologically? Explain. How do you interpret the difference in results for acute versus chronic pain?

CHALLENGE

Which treatment would you select as the experimental control in further studies: sham acupuncture or needles taped to the skin? Why?

AN EXPERIMENTALIST RESPONSE

While some medical researchers regarded acupuncture as so much hocus-pocus, others were curious to know how acupuncture might work. For answers, though, they had to commit themselves to investigating a phenomenon whose exact nature

in Western terms was still very much uncertain. Indeed, in the early 1970s, knowledge of how we perceive pain was itself quite incomplete.

Some researchers applied the biological principle that function relates to structure and supposed that acupuncture points might have some special anatomical or physiological properties. For example, might acupuncture needles stimulate some particular kind of nerve ending or bundle of nerves? Despite studies of cells and tissues in the skin, though, no structure was found that was unique to these points.

Other studies looked at the electrical properties of the skin. Initially, acupuncture points seemed to be areas of low skin resistance. Veterinary acupuncturists now frequently use electrical devices to help them locate points. At the same time, some experts now note how difficult it is to measure skin resistance and suggest that many studies are not reliable. There does seem to be lower skin resistance at acupuncture points, but this has not yet helped explain how acupuncture works.

By contrast, there was relatively quick confirmation that acupuncture for acute pain stimulates one particular kind of nerve. Most painful stimuli are carried along small fibers. Acupuncture, though, apparently stimulates larger fibers (type II and III muscle afferents). One recent theory suggested how the pain and acupuncture impulses might interact. The interaction was built on a mechanical analogy. According to the theory, there was a figurative "gate" in the spinal cord where the two types of fibers converged. Only one impulse could be conveyed to the brain. The large fiber would synapse with the small fibers, inhibit them, and prevent further impulses. This "gate-control" theory could thus explain how gentle needling might "switch" off perceptions of pain—at least where nerves entered the same segment of the spinal cord.

Other researchers noticed that the optimal effects of acupuncture often occur after several minutes—too slowly to be explained by nerve impulses. They wondered if the needling might release some factor in the blood. If so, they reasoned, the blood from one organism subjected to acupuncture, when transfused into a different organism, should have a measurable effect. One team set up a system of cross-circulation between pairs of rabbits by cross-linking the veins in their legs. Indeed, the acupuncture on one rabbit allowed the other to withstand stronger painful stimuli. Cross-injections of cerebral-spinal fluid also worked. Acupuncture seemed to trigger the release of an unknown hormone or similar "messenger" substance.

The puzzles of acupuncture in 1971 intersected with findings from other research on pain relief, already under way. Morphine, a derivative of the opium poppy, had been used medically for some time to relieve extreme pain. It was addictive, however, which limited its use. No one knew how it worked. In the 1960s, due to a widespread counterculture movement, the use of heroin and other morphine-related opiates to explore altered states of consciousness increased dramatically. So, too, did the number of cases of addiction. Due to the social consequences, funding became available for research—and some unexpected facts emerged.

In 1973, researchers discovered that opiate molecules fit into receptors on the surface of cells in the brain. They confronted a disturbing question: Why would substances that were not part of normal human physiology have such functional "slots" in human cells? Researchers inferred, somewhat reluctantly, that there must be some unknown natural "opiate" that controlled pain in the body. After a brief search, sev-

eral such substances were found. Among them was **endorphin**, released from the pituitary gland into the bloodstream. The curious effect of acupuncture through the blood now had a possible explanation that could be investigated further.

The study of endorphin's effects was facilitated by a chemical, *naloxone*. Researchers determined independently that naloxone inhibited or interfered with the effect of both natural and artificial opiates by blocking their receptors. In 1976, one study addressed the effects of naloxone injected just prior to acupuncture in rabbits:

Treatment	Pain Relief?
Acupuncture	Yes
Acupuncture + naloxone	No
Acupuncture + saline*	Yes
naloxone (no acupuncture)	No
saline* (no acupuncture)	No
Acupuncture at nonpoints (sham acupuncture)	No
Handling, restraint, and pain-testing (no acupuncture)	No

*"Saline" represents an injection of a physiologically inert solution of salts.

PROBLEM

Do these data effectively support the notion that acupuncture works by stimulating the release of endorphins? What is the role of each treatment in reaching a conclusion in this study? (For example, identify pairs of treatments that you compare with each other.)

CHALLENGE

Describe how you might further apply this procedure to test for suggestibility in humans.

POINTS EAST AND WEST

The notion that an apparently painful stimulus might reduce pain was paradoxical enough. But even more puzzling for Westerners were the patterns of needling. As noted earlier, Chinese doctors do not insert acupuncture needles haphazardly. There are specific points. Sometimes, the points are quite remote from the site of their intended effect. Thus, you would insert a needle between the thumb and forefinger (a well-known point called *ho-ku*) to treat either a headache or abdominal cramps! For coughing or a fever, you would use a point above the third toe. For Westerners, at least, the correlations made no anatomical sense.

The Chinese explanation for acupuncture, however, accounted for why the points and their effects could sometimes be so distant from each other. The Chinese conceived the body in a wholly different way. According to their traditional theories, the body is fundamentally maintained by a life force, *qi* (pronounced as a short, breathy "chee"). *Qi* flows through the body along several intersecting meridians, or channels (Figure 12.4). There are 12 primary meridians, each corresponding to a

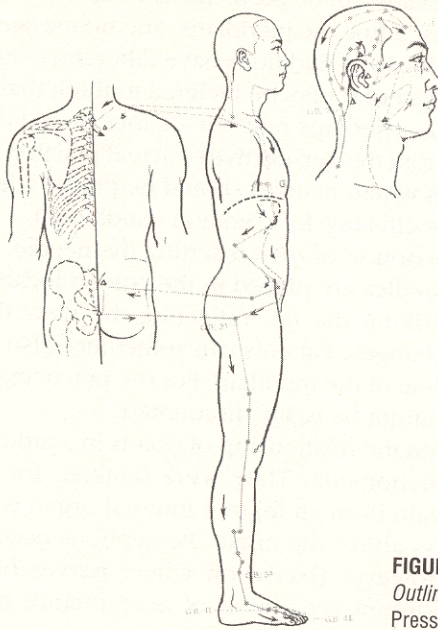


FIGURE 12.4 The gall bladder meridian. Source: *An Outline of Chinese Acupuncture*, Foreign Language Press (Peking, 1975).

major organ (liver, stomach, spleen, gall bladder, etc.). They also correspond to the 12 yearly cycles of the moon. The flow of *qi* along the meridians maintains a balance between *yin* and *yang*, the two complementary forces of the universe, according to Chinese philosophy. Thus, some meridians or channels are yin, others yang.

The flow of *qi* along the meridians is part of the traditional Chinese explanations for health and illness. When the flow is impeded or imbalanced, disease, malfunction, or pain results. To restore the balance, needles are inserted at points along the appropriate meridian. The needles either promote or impede the flow of *qi*, reestablishing the balance of yin and yang. Because the *qi* flows along the meridians, a needle inserted at one point may affect a distant organ along the same meridian. Thus a needle at *bo-ku* can affect a headache or abdominal cramps because all lie on the large intestine meridian. In the Chinese view, part of the acupuncturist's skill is diagnosing which meridians are affected and where along those meridians needles should be placed.

In many ways, the Chinese concepts resonate strongly with W. B. Cannon's notion of homeostasis (Chapter 9). The concepts of yin and yang, especially, seem to parallel the sympathetic and parasympathetic nervous systems in their balanced interaction. In both cases, an imbalance is associated with illness, and restoring the balance is associated with health and well-being.

Historically, acupuncturists also had to determine exactly where the points were and how they were connected along meridians. No one could predict, apparently, the sometimes zig-zagging pathways of the meridians—and there is no reason in the Chinese view why they follow the paths as now described. Instead, the meridian maps represent the collected experience of generations of acupuncturists.

The concepts of *qi* and meridians can be problematic from a Western perspective because no anatomical structures define the meridians, and no measurable force can be identified as *qi*. Chinese and Western traditions have different, even incompatible “geographies” of the body. A Westerner may be inclined to think that the notions of meridians and *qi* are superfluous—perhaps relics of an ancient and discredited cosmology—but they are essential from the perspective of actual practice. Acupuncturists use the meridian maps to assess where needles should be placed (though they also learn specific points traditionally effective for common conditions).

Acupuncturists also use the notion of *qi* in inserting the needle. As noted earlier, the patient can feel when needles are placed in the correct location. The sensation is known as *de qi*, or “striking the *qi*,” reflecting the view that the patient perceives how the flow of *qi* changes. Patients can sometimes also feel the numbness of *de qi* spread along the line of the meridian. For the practicing acupuncturist, at least, the traditional theory cannot be easily discounted.

Westerners could not explain the relationship of points in acupuncture. Not that they hadn’t noticed similar phenomena. They were familiar, for example, with *referred pain*. In these cases, pain from an injured internal organ is felt on the surface of the body, but not always above the organ. Perceptions occurred within the same segment of the body, however (based on where nerves branch from the spinal cord). The sometimes distant separation of acupuncture points and their effects was still puzzling in terms of referred pain.

Westerners were also familiar with another set of points, discovered at the end of the last century, now known as *trigger points*. They evoke pain when pressure is applied. According to one physician, additional pressure on these points can also alleviate pain. Researchers found in 1971 that there is a strong correlation between the location of the trigger points of the West and the acupuncture points of traditional Chinese medicine. But again, no one knows why trigger points produce pain, sometimes at specific locations remote from the point. In neither case—for trigger points or referred pain—is there an explanation in Western terms why these points might be related to pain relief.

PROBLEM

In recent years, many acupuncture points have been found that do not lie on traditional meridians. How would you expect a Western skeptic to interpret this fact? How might a Chinese doctor interpret the same fact? Explain how each interpretation might reflect existing theoretical perspectives.

The contrast between the apparent effectiveness of acupuncture and explanations that did not fit Western conceptions posed several dilemmas for U.S. doctors and medical researchers. Should they reject the Chinese claims as unscientific because they found the explanations unacceptable? Could they reject the explanations while offering no viable alternative? Could Americans split the demonstrated effectiveness and the explanations and accept one but not the other, while the Chinese saw them as inseparable in practice? Even if Westerners developed their own interpretation of acupuncture, could they disregard the Chinese explanations? It was difficult to dismiss the Chinese explanations out of hand, despite their apparent

implausibility in terms of Western physiology, because the Chinese had discovered and developed acupuncture over several centuries, whereas Westerners had not.

□ EPILOGUE

The introduction of acupuncture to the United States in the 1970s illustrates how different cultural traditions in science sometimes converge. Both scientific knowledge and attitudes about experimentation and methods of investigation differed. The different cultural contexts also guided subsequent approaches to acupuncture and to medicine more generally.

The Chinese have largely accepted Western medicine, though not exclusively. Western and traditional Chinese systems exist side by side. One American acupuncturist trained in China noted, "In China, the idea is: they do not only give you Chinese traditional medicine, because if you only learn Chinese traditional medicine, your mind will get stuck." Acupuncture is valued in China, particularly in an economic context. It is a relatively "low-tech" form of medicine. It requires little equipment, though it does require expertise and substantial training for the acupuncturist. It is a labor-intensive rather than capital-intensive form of medicine.

By contrast, acupuncture is still widely viewed in the United States as an alternative or "folk" medicine. It has peripheral status. Many insurance companies or health plans do not pay for acupuncture treatments. Even Western doctors sympathetic to acupuncture often recommend it only when Western medicine fails or is *first* shown to be ineffective. Many practitioners and health administrators say that scientific assessments leave the effectiveness and explanations of acupuncture still uncertain. They also cite the potential for fraud.

What we know about acupuncture has been and will be shaped by the research that is done. Because acupuncture involves no product to sell, drug companies and other investors have had little incentive to fund acupuncture research. There is no opportunity for profit. Research on endorphinlike molecules that may relieve pain, on the other hand, has been well funded. The prospect for knowing more about acupuncture thus depends on certain sources of funding to support research.

Research on pain and acupuncture is far from complete, but the picture is becoming clearer. The system of interactions appears to be quite complex. The "gate-control" theory, for example, now seems far too simple. There are numerous nerves that originate in the brain and end at more peripheral points. There, they inhibit the transmission of impulses towards the brain. Acupuncture activates many of these inhibitory systems at several levels. In quite different studies, acupuncture has also been linked to increased levels of cortisol, a steroid hormone released from the adrenal cortex (see Chapter 10). This suggests a link to immune responses. If confirmed, these might help explain acupuncture's other reported health effects in Western terms.

Cross-cultural perspectives in medical science have become increasingly important recently. Many researchers are interested in medical treatments among cultures in nonindustrialized nations. Native practitioners often use plants that are not familiar to Westerners. Many drug companies are investing heavily to research whether indigenous herbal treatments can cure various diseases. Where effective, they want

to look for their “active” chemical ingredients. By contrast, they are usually not interested in the context of indigenous medicine, the explanations for various cures, or how they were discovered. In what ways do you think we might learn from the “science” in these other cultures?

QUESTIONS AND ACTIVITIES

1. What does this case show about the following aspects of doing biology?
 - controlled experiments
 - double-blind studies
 - theoretical perspectives in interpreting experimental results
 - the cultural context of the norms of scientific practice
 - the burden of proof and the role of skepticism
 - acceptance versus pursuit (research) of explanations
2. What level of skepticism or acceptance do you think was initially warranted in this case? Given both the long history of acupuncture in China *and* the lack of controlled studies, where did the burden of proof lie in 1971? How would these judgments affect research funding as well as public policy?
3. What do you think may have motivated such strong criticism and concerns about fraud in this case? Were such initial criticisms valuable to developing scientific knowledge or not? Socially or institutionally, how might you either encourage or suppress such motivations or otherwise regulate their effect?
4. The effectiveness of acupuncture on drug addiction, asthma, hypertension, and other conditions is still being investigated. Do you think these claims need to be scrutinized with the same vigor as acupuncture’s control of pain before these treatments are adopted in the United States? Why or why not?
5. Suggest ways you might design a double-blind test for assessing the effectiveness of acupuncture. Suggest other possible ways to investigate whether the effects of acupuncture are produced by psychological suggestion.
6. In this case, Western scientists generally trusted claims by U.S. doctors more than those by Chinese physicians. Suggest several reasons, both justified and unjustified, why this might have been so. Especially given the apparent implausibility of the Chinese claims in the United States, suggest how a Chinese physician—credible among Chinese peers—might have established credibility in a community of Western scientists. Who qualifies as an expert for evaluating the claims of acupuncture?
7. Some specific studies reported pain relief from acupuncture, while others found no significant relief. How do you reconcile different studies that give both positive and negative results? For example, does one unsuccessful study undermine a string of apparently successful reports? By contrast, how might one criticize a study that fails to produce an effect? More generally, what makes an experiment decisive? How do you assess where the burden of proof lies?

8. The “discovery” of acupuncture by the West is not unlike other discoveries in science that can introduce new technologies or medical practices into society. Describe a system to address such new practices whose effectiveness is deemed uncertain. In particular, on whom would you rely to distinguish between authentic and fraudulent claims? How will the burden of proof affect such decisions?
9. What scientific assumptions are reflected in Western efforts to retest Chinese acupuncture and other native therapies? Discuss the justification for these assumptions.

SUGGESTED READING AND VIEWING

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