A scientific review of acupuncture

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Acupuncture, the ancient Chinese art of healing has become popular in many countries during the last few decades, not only as an anaesthetic agent for surgical procedures, but in many diseases which are resistant to conventional forms of therapy, acupuncture has proved remarkably effective.

Besides being free from the side-effects commonly encountered in drug therapy, it is simple, safe, effective and economical.

Therefore, slowly but surely, it is being absorbed into the mainstream of modern medicine, even though the philosophy that it is based on is rather bewildering to the modern doctor.

Whether acupuncture works or not, is no longer the question today. The only question is "How does it work?" This is not an easy question which can be fully answered in our present state of knowledge.

After several decades of dedicated research we know very little of how the normal nervous system functions in health, let alone in disease. Serious research on acupuncture commenced only a few years ago, and such a short period of time has been insufficient to unravel all the mechanisms of the complicated neurophysiological phenomenon which acupuncture evidently is.

Part of the difficulty lies in the fact that acupuncture works in a great variety of disorders and its wide spectrum of action must therefore be assumed to vary to a great extent with each type of pathology.

Nevertheless, many aspects of its action are now being understood in the light of recent research and are being pieced together in an attempt to solve this enigma.

Effects

The effects observed on needling are both subjective and objective. One of the subjective effects may be slight pain at the site of needling, but with the use of a proper technique by a trained acupuncturist this is usually negligible.

Another important subjective effect is the appearance of a peculiar sensation which is called "deqi" in Chinese. There is no exact equivalent for this term in English but it is usually translated as "take".

The deqi which the patient feels is a combination of numbness, heaviness, slight soreness and distention. For acupuncture anaesthesia to be successful it is essential that adequate "deqi" is elicited. In therapy of chronic disorders this is not mandatory.

Objective effects

As regards the objective effects produced by needling, six different effects may be recognised.

(1) Of these the best known is the analgesic (pain-relieving) effect which is achieved by the raising of the pain threshold. This is the physiological basis of acupuncture anaesthesia and also explains how acupuncture analgesia similarly produced during therapy is able to relieve the pain of arthritis, toothache, headache, low backache and other similar painful disorders. Some acupuncture points are more effective in this respect than others. This is an example of what is called "the specificity of acupuncture points."

(2) Secondly, the needling of certain specific acupuncture points results in sedation. Some people may even fall asleep during treatment but wake up refreshed. It has been shown that there is a decrease in delta and theta wave activity on the electroencephalogram during acupuncture treatment. These effects are utilised in the acupuncture treatment of insomnia, mental disorders, anxiety states, addictions, epilepsy and behavioural problems.

(3) The third effect is very important, it is called the homeostatic or regulatory effect which means adjustment of the internal environment of the body towards a state of proper balance. Normally, homeostasis is maintained by the balanced activity of the symphathetic and parasympathetic divisions of the autonomic nervous system and also by the endocrine system. In addition there are numerous homeostatic mechanisms in the body for regulating the respiration, heart rate, sweating, temperature, ionic balance of the blood and many other vital parameters. These mechanisms are seriously deranged in many diseases, and in such cases acupuncture is very helpful in restoring the original

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state of equilbrium. Very often the same set of points may be used for treating opposite disorders like high and low blood pressure, or diarrhoea and constipation. These are examples of the homeostatic or normalising action of acupuncture.

(4) Fourthly, there is the immune-enhancing action of acupuncture whereby body resistance to disease is strengthened. This has been shown to be due to an increase in the white corpuscles (leucocytosis), antibodies, gamma-globulins and other substances which increase the resistive powers of the body. In many cases a two- to four-fold increase in antibody titre has been observed, presumably brought about by activation of the reticulo-endothelial system. Acupuncture is therefore very useful in combating infections. Some workers believe that acupuncture increases the interferon levels in the body thus serving as a protective against infections and perhaps even against malignant disorders. Where antibiotics may have to be used, the need for prolonged antibiotic therapy can be considerably reduced by the concurrent use of acupuncture. It is also indicated in cases of resistance or hypersensitivity to antibiotics and in chronic infections where antibiotics have failed or given rise to serious side-effects. In the People's Republic of China it has been shown that acupuncture alone can be effective in infections like appendicitis and tonsilitis. Here again, certain specific points have to be used to enhance the immunological effects.

(5) The fifth objective effect of acupuncture is the psychological effect which has a calming and tranquilising action apart from more sedation. This is believed to be due to an action on the mid-brain reticular formation and certain other parts of the brain. Measurable effects have also been reported on the metabolic chemistry of brain tissue. For instance, there is an increase in the dopamine content of the brain after acupuncture. This may account for its effectiveness in certain mental disorders and in Parkinsonism where there is a depletion of the dopamine content of the brain.

The psychological effect mentioned above should not be confused with hypnosis or autosuggestion. These effects follow (they do not precede) the use of acupuncture, and are therefore not a precondition for its success as erroneously supposed by some critics. Hypnosis and suggestion are very different from acupuncture in many important respects. Hypnotism has been found to work only in 10 to 14% of a population, whereas some degree of acupuncture analgesia can be induced in any person or animal. Patients with low hypnotisability scores respond equally well to acupuncture as those with high scores showing that suggestibility is by no means a requisite factor for success in acupuncture treatment. Also, prolonged training periods are required for hypnotic analgesia whereas emergency surgery can also be performed under acupuncture analgesia. Spontaneity of movement, gestures and facial expression are found in acupunctured patients unlike in hypnotised patients who move around like robots. Further injection of local anaesthetic (procaine block) at acupuncture points has been found to nullify the analgesic effect of acupuncture thus pointing to a neural and not an hypnotic explanation.

(6) The sixth important effect of acupuncture is that it hastens motor recovery in patients who have become paralysed from some cause or another. Even late cases of motor paralysis respond well to acupuncture therapy, despite previous failure with other forms of therapy. The explanation, which is complex, apparently involves antidromic stimulation of the anterior horn cells and their re-activation through a biofeedback mechanism operating through the Renshaw and Cajal cells of the spinal cord or their cranial equivalents.

(Motor Gate Theory — Jayasooriya and Fernando, paper presented at the Fifth World Congress on Acupuncture. Tokyo, 1977).

What has been discussed above are the physiological effects of needling. As regards the scientific explanation of these effects, numerous theories of simple reflex action are insufficient as the neurological pathways are complex.

The situation has become further complicated by the demonstration that humoral (chemical) factors are also involved in acupuncture. As far as pain relief is concerned, the most popular neurological explanation is based on the "Gate control theory of pain" proposed by R Melzack and PD Wall in 1965.

According to this theory our perception of pain is modulated by a functional gate (or gates) within the

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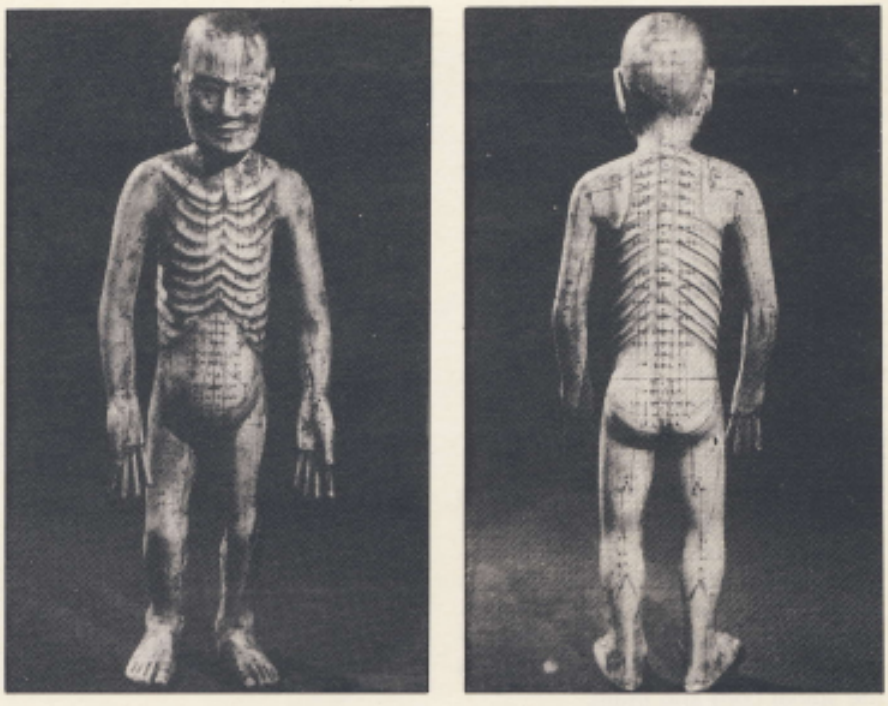


An early nineteenth-century papier mâché figure used for teaching acupuncture points. (By courtesy "The Medicine Men", John Lloyd Fraser.)

central nervous system. Under normal circumstances this gate is wide open and pain impulses get through quite easily, but when acupuncture needling is carried out, a second stream of non-painful impulses is set up from the site of needling.

The result is over crowding or jamming at the gate causing it to close. In other words, there is competitive inhibition of the pain impulses and no pain or less pain is felt, even during a surgical operation. The gate control mechanism works by a process of pre-synaptic inhibition at the substantia gelatinosa.

The autonomic nervous system is also believed to play an important role in acupuncture. There is experimental evidence to show that it is along the sympathetic plexuses surrounding blood vessels that some of the acupuncture impulses travel to the spinal cord and brain.

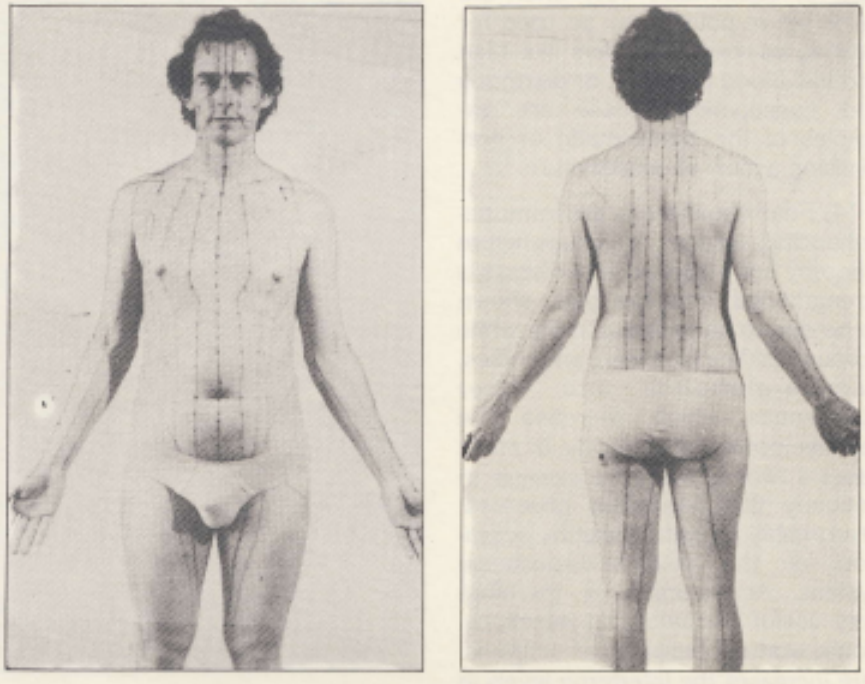
Chemical or humoral mechanisms are also involved in acupuncture. For instance, if a rabbit is acupunctured its pain threshold is found to rise. If the blood from this animal is then circulated into a non-acupunctured rabbit, the pain threshold of the second animal also rises. Likewise, perfusion of spinal fluid from an acupunctured to a non-acupunctured animal results in a similar effect showing that chemical transmitters are definitely involved in the mechanism of acupuncture.

Research done at the Shanghai Institute of Physiology by Professor Chang Hsiang-Tung and his coworkers indicate that 5-hydroxy tryptamine (serotonin) and noradrenaline are also actively involved in the mechanism of acupuncture analgesia.

Endorphin theory

The endorphin release theory (Pomeranz, 1976) is the most popular chemical theory which explains acupuncture today. It may be regarded as a natural successor to the older Humoral theory (Shanghai, 1972) which left open, owing to insufficient data at the time, the identity of the humoral agent involved in the animal cross-circulation experiments.

The endorphin theory is based largely on the work of Bruce Pomeranz, Professor of Neurobiology at Toronto University, Ontario, Canada. Pomeranz has put forward the view that acupuncture analgesia may be explained by the release during acupuncture of a group of substances called endorphins which are a naturally-occuring opiate-like substances discovered recently.



There are about 1,000 acupuncture points, of which about one-third are commonly used. Chi, the life force, is said to flow along the fourteen major meridians. (By courtesy "The Medicine Men", John Lloyd Fraser.)

According to Pomeranz, endorphins could also explain how acupuncture gives relief in painful conditions and help to combat the withdrawal symptoms in drug addicts.

Endorphin belongs to a group of substances called neurotransmitters whose function is to convey impulses from one nerve cell to the next across the intervening gaps, the synapses. It is well known that conduction of nerve impulses, is an electrical event involving alternate polarisation and depolarisation along the course of the nerve fibers. However, these electrical impulses cannot "jump" across the synapses.

They come to a complete halt at the end of each nerve fibre.

Transmission at the synapses takes place by means of chemical messengers or neurotransmitters which are stored at the nerve-endings in very small sacs or vesicles and released from them, then these sacs are excited by the electrical impulses travelling along the nerve fibre. On being released from the containing sac, the transmitter moves across the synaptic gap at high speed (fractions of a second) and stimulates the adjacent nerve cell by interacting with specific receptors which are located on the postsynaptic membranes of the latter cell, thereby producing a local depolarisation which is subsequently propagated as a nerve impulse.

After completing this action, the major part of the transmitter travels back to the sacs which released them and wait once more for the next impulse to release them. By this method of re-cycling there is minimal wastage of the transmitter substance. In brief this is how endorphin and other transmitters act at the synapses under normal circumstances. Interference of these chemical transmitter mechanisms is possible by means of competitive substrate block and other mechanisms resulting from disordered metabolism or from the use of drugs.

Many different neurotransmitters have been identified since research on this commenced at the turn of the century. The best known of these are acetyl-choline and nor-adrenaline, which act as transmitters for the cholinergic and adrenergic nerves respectively. Acetyl-choline is also

well known as the active agent in neuromuscular transmission due to its liberation at the motor endplates. Others are dopamine and serotonin, and now endorphins and enkephalins have also been identified.

Neurotransmitters are regarded as being very important in modern medicine because they are crucial for our understanding of the central as well as the peripheral nervous system functioning. They have in fact become important research tools for mapping the nerve pathways in the brain. Also they seem to be involved in a great many derangements of bodily function ranging from heart disease and strokes to Parkinsonism and psychiatric disorders.

It was for this work on neurotransmitters that Julius Axelred was awarded a Nobel prize some years ago.

An important characteristic of a neurotransmitter is that only nerve cells having specific receptors are responsive to their action, each transmitter having its own specific receptor. These receptors are three dimensional structures having configurations which enable the transmitters concerned to fit into them much in the same way that a key fits into a lock. For example, in the brain there are receptors which have the propensity by virtue of their chemical structure of binding with morphine as well as certain other morphine-like substances.

Such receptors are called opiate receptors. It is the methyl group of the morphine molecule which locks into these receptors.

Another curious property of receptors is their stereo-specificity. This means that a particular receptor can accommodate only one of the mirror image (dextro or laevo) forms of the substance. For example, laeverphanel which is a laevo (left handed) derivative of morphine can fit the opiate receptors whereas the dextro isomer (right handed form) is unable to do so.

Laeverphanel can therefore stimulate the action of morphine and is called a morphine agonist whereas the dextro isomer is totally inactive in this respect. Other examples of morphine agonists are codeine, heroin, methadone and hydro-morphone. Endorphins and enkephalins also have similar binding properties and are called endogenous morphine-like substances or endogenous opiates, because unlike the others these two chemicals occur naturally in the body.

The concept of an agonist is necessarily a biological one. Opiate agonists may be defined as producing a change in physiological activity by directly combining with a membrane-bound receptor site, which then initiates a series of biochemical events related to the final physiological response that are not well understood. A substance may be accepted as an opiate agonist (i) if it produces a dose-related inhibition of nerve-mediated contractions of the mouse vas deferens, cat nictitating membrance and guinea-pig ileum, (ii) if the effects are reversed by narcotic antagonists such as naloxone or naltroxone, (iii) if both the narcotic agonist and antagonist effects are stereospecific, and finally (iv) if it can be shown that low concentrations (10^{-6}) of the substance compete with radioactive opiate ligands in the opiate receptor binding assay. Conditions (i) and (ii) are prerequisites for agonist action whilst (iv) is the final confirmation for a direct action at the receptor site.

The ancient Chinese believed that disease ("dis-ease") was caused by the imbalance in the body of two principles which they called Yin and Yang: By Yin they meant the negative or female principle, while Yang was the positive or male principle, both of which are universally present in all nature. In the healthy state, there was believed to be a harmonious balance between these opposite but mutually interacting principles — a state of affairs which today we would call "homeostasis."

When disease supervenes, it was believed that one or other principle becomes dominant at the expense of the other. Correction of this imbalance was achieved by needling of selected acupuncture points. While these ideas may look esotoric and irrational from today's stand-point, we must remember that they were man's first steps in logical thinking. To have formulated these ideas at a time when the rest of the world was living in caves and on tops of trees was itself a remarkable intellectual achievement.

What we know today of homeostatic mechanisms has an unmistakable Yin-Yang flavour. If a modern physician accepts this position, there is no contradiction in practising acupuncture as no one who is familiar with this discipline has any doubts that it works, and not infrequently when all other modalities have failed.

Thus we see that there is no dearth of theories to account for the many aspects of acupuncture.

What is presently really lacking is an integrated theory which covers all the known facts. The very fact there is a multiplicity of theories is an admission that each theory, by itself, is unable to explain all the innumerable aspects of the acupuncture phenomenon. This is no reason however for the modern physician to be unduly disturbed.

The lack of a complete scientific explanation regarding some phenomenon does not make it any less likely that the phenomenon exists, still less does it eliminate the possibility of putting it to practical use.

If we look dispassionately at so-called "modern scientific medicine" we find only an empirical basis or none at all, for many procedures that are carried out daily.

For example, many high-powered procedures in physical medicine such as short wave, micro-wave and iontophoresis do not have much scientific basis for their medical applications. In fact the little research that has been done on these methods has shown their value to be nil or at the most equal to a hot water bottle.

Similarly, it has not yet been shown in the long term therapy of rheumatic disorders that the administration of large doses of analgesics and steroids changes the natural history. Many respectable ancillary methods such as psychoanalysis have not been proven by any scientific methods.

It is against the backdrop of such practices and the spiralling incidence of iatroganic (drug-induced or doctor-induced) diseases that the safety and efficacy of acupuncture should be judged. Theories, hypotheses, conjectures and speculations are interesting, and

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