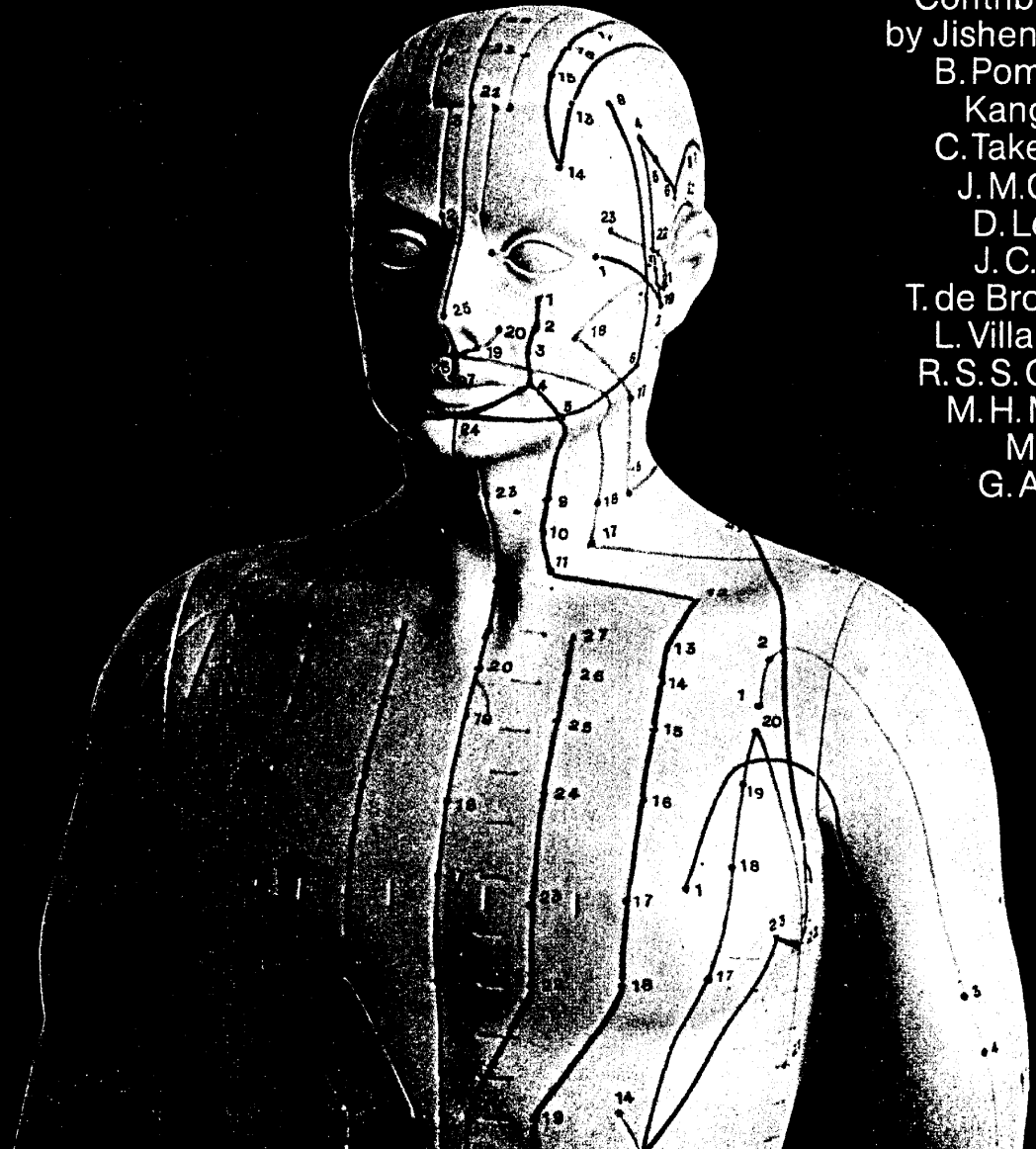


Bruce Pomeranz Gabriel Stux (Eds.)

Scientific Bases of

Acupuncture

With
Contributions
by Jisheng Han
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Scientific Bases of Acupuncture

The Scientific Bases of Acupuncture summarizes the major contributions made in the period from 1976 to 1988 on the mechanisms of acupuncture. Outstanding researchers from the West, Japan and from China report the findings of their basic research in the form of review articles.

The various chapters summarize the results of the author's own research and discuss them in the context of the overall literature in the field of acupuncture and transcutaneous electrical nerve stimulation. Contributors are Prof. Jisheng Han, Beijing Medical University; Prof. Bruce Pomeranz, Toronto; Prof. Kang Tsou, Shanghai Materia Medica; Prof. Chifuyu Takeshige, Showa University Tokyo; Prof. Jin Mo Chung, Galveston, Texas; Prof. Daniel Le Bars, Inserm, Prof. Jean-Claude Willer, Dr. T. de Broucker, Dr. L. Villanueva, Paris; Dr. Richard Cheng, Toronto; Prof. Mathew Lee, Dr. Monique Ernst, New York University; Prof. George Ulett, St. Louis School of Medicine.

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With 79 Figures

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Preface

Serious basic research on acupuncture began in 1976 when the acupuncture endorphin hypothesis was postulated. In the ensuing twelve years (1976-1988), a critical mass of rigorous research on acupuncture has accumulated, necessitating this book to bring it all together. Moreover, the growth of acupuncture world-wide, to the point where there are over one million practitioners doing acupuncture, makes it important to disseminate this important research data. Finally, a comprehensive book was needed for legislators, hospital administrators, insurance companies and government agencies, etc., to help them make decisions on a more rational basis; many regulations made in 1976 should be revised in 1988 based on 12 years of new data!

As a result of this need to prepare a book, the editors arranged a conference in Düsseldorf, Germany, to coincide with the 1987 IASP (International Association for the Study of Pain) Congress to which leading researchers from around the world were invited to present review papers on acupuncture and to discuss the state of the field. As an outgrowth of this successful conference, each of the participants was asked to write a review chapter for this anthology. In this chapter, they were asked to summarize the research from their laboratory and to correlate it with the broader literature on acupuncture.

As can be seen from this comprehensive, multi-authored book, there is an enormous amount of rigorous research into the mechanisms of acupuncture. Indeed, we know more about acupuncture analgesia mechanisms than many conventional medical procedures. Perhaps the time has come to stop calling acupuncture an "experimental procedure".

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Introduction

Gabriel Stux and Bruce Pomeranz

Acupuncture is experiencing a renaissance both in China and world wide with over 1 million practitioners using it. In the 19th century, acupuncture declined in China after 2500 years of widespread use. This is attributed to western influences and the degeneration of Chinese culture as a result of foreign Manchu rule. After 1949, when the People's republic was founded, Mao Zedong encouraged the practice of acupuncture which marks the beginning of the current renaissance. Academies of Chinese medicine were established in Beijing, Shanghai, Nanking and other major cities. Western style medical schools such as Beijing University and Shanghai First Medical School also began to research into the basic mechanisms of acupuncture. Unfortunately, their failure to publish in English, and the general distrust of Chinese science by western scientists and physicians, kept this new information from disseminating. However, one phenomenon caught the eye of westerners: the development of acupuncture anesthesia for surgical operations. Spectacular documentary films showing awake patients having surgery under the influence of acupuncture, awakened the interest of the western medical world. As a result acupuncture for the treatment of chronic pain was gradually introduced into many western pain clinics starting in 1972, after Nixon opened up ties with China. In the USSR acupuncture was introduced in the 1950's because of close political ties with China. Europe had several schools of acupuncture since the 1930's, but the major impetus for acupuncture's spread in the west came after Nixon's visit to China.

However skepticism remained high. How could a needle in the hand possibly relieve a toothache? Because such phenomena did not fit into the existing knowledge of physiology, scientists and clinicians were skeptical. Many explained it by the well-known placebo effect [11]. In 1955 Beecher had shown that, while morphine relieved pain in majority of patients, sugar injections (placebo) reduced pain in 30% of patients who believed they were receiving morphine [2]. Thus many pain physiologists in the 1970's assumed that AA worked by the placebo (psychological) effect. However, there were several problems with this idea. How does one explain its widespread use in veterinary medicine and in pediatrics? Moreover studies in which patients were given psychological tests for suggestibility did not show a good correlation between acupuncture analgesia (AA) and suggestibility (see review of Ulett in this volume, and [5]). Hypnosis has also been ruled out as an explanation as studies show that hypnotic analgesia and AA respond differently to naloxone, AA being blocked and hypnosis being unaffected by this endorphin antagonist [1, 3].

In addition to the lack of a plausible mechanism to explain AA, skeptics were concerned about the anecdotal nature of acupuncture claims. Despite the huge size of the anecdotal database (one quarter of the world's population had been using acupuncture for 2500 years) skeptics were calling for controlled clinical studies to prove the efficacy of acupuncture.

A growing body of research published in the past 12 years shows that AA is very effective in treating chronic pain, helping from 55% to 85% of patients [4, 8, 10], which compares favourably with potent drugs. Moreover the evidence shows that in placebo control groups only 30% of cases were helped proving that AA is more effective than placebo and that AA is a real physical effect (see appendix for details). In addition to the clinical studies which prove efficacy, the only way to overcome the deep skepticism towards acupuncture was to establish credible physiological mechanisms of action.

The breakthrough came in 1976, soon after the discovery of endorphins. Two groups, one studying human volunteers [6], the other working on animals [7] showed that naloxone (an endorphin antagonist) blocked AA. The acupuncture-endorphin hypothesis which emerged proposed that AA is a result of peripheral nerve stimulation which sends impulses to the brain to release endorphins and causes analgesia [9]. This hypothesis, more than any other, has stimulated research in dozens of laboratories on 4 continents. A recent review summarizes over 200 papers in the western literature on this subject [9].

Because of the extensive literature which has now accumulated, it was decided to ask leading scientists to each write a chapter reviewing their own research and related papers.

Prof. Jisheng Han, Chairman of the Physiology Department, Beijing Medical University (China), considered to be one of China's leading neuroscientists, and is world renowned for his animal studies on acupuncture mechanisms. In his work he showed that electrical stimulation of needles released different endorphin compounds at different pulse frequencies. Thus with EA at 4 Hz enkephalins were activated while at 100 Hz dynorphins were released. Very elegant experiments were used to prove these facts. For examples antibodies to enkephalins injected intrathecally onto the spinal cord of rats blocked acupuncture analgesia produced by 4 Hz EA, while antibodies to dynorphins blocked 100 Hz EA.

Prof. Kang Tsou, Chairman Department of Pharmacology at Shanghai Institute of Materia Medica, Chinese Academy of Science, is China's most renowned endorphin researcher. Using advanced molecular biology techniques (eg DNA hybridization) he showed that the messenger RNA involved in making endorphins was elevated in the rat brain 1 hour after EA, an effect which lasted 48 hours. This suggests that long term analgesia from acupuncture could be caused by increased synthesis of endorphins.

Prof. Bruce Pomeranz, Professor of Physiology and Zoology at University of Toronto (Canada) has published 42 papers on neural effects of acupuncture in animals and humans; his laboratory was one of the first to show that acupuncture analgesia was mediated by endorphins. He began his work with spinal cord experiments in anesthetized animals. Recording from single cells involved in nociceptive transmission from spinal cord to brain he showed that EA blocked the message and that this effect was prevented by naloxone, the endorphin antagonist. In

another series of experiments he showed that intrathecal naltrexone only blocked when injected before acupuncture treatment began, but could not block analgesia if given after completion of the acupuncture treatment. He has recent publications suggesting that acupuncture is not merely useful for analgesia and reported that EA speeds up nerve regeneration in the leg of adult rats after nerve injury. Acupuncture is in widespread use in China for treatment of neurological diseases which have no pain components. Finally in his review he described a transcutaneous electrical nerve stimulation (TENS) device which he developed to give patients "De Qi" sensations from deep muscle nerves. This device produces much more effective analgesia in chronic pain patients than either conventional TENS or standard EA, which he showed by controlled studies.

Dr. Richard Cheng, Director of the Pain Clinic at St. Josephs Hospital in Toronto (Canada) showed the importance of frequency of stimulation (compare Prof. Han above). His results indicate that in mice, 4 Hz pulses work through endorphin mechanisms, while 200 Hz stimulation is mediated by monoamines (serotonin and norepinephrine).

Prof. Jin Mo Chung, Professor of Physiology at University of Texas in Galveston (USA) and a senior scientist in the renowned pain laboratory of Prof. W.D. Willis at the Marine Biomedical Institute, performed a series of elegant experiments on decerebrate spinalized animals, showing that small diameter myelinated peripheral nerves (A delta and type III) produced analgesia against heat pain, while causing no effect on pinch pain or "touch". Presumably this suggests that pain from unmyelinated "C" fibres is more easily suppressed than pain from "A delta" fibres by acupuncture-like stimulation.

Prof. Chifuyu Takeshige, Dean of Medicine at Showa University in Tokyo (Japan), described an "Analgesia Inhibitory System" influenced by specific acupuncture points. In a series of 10 elegant papers (published in Japanese) Prof. Takeshige's group reported on an "Analgesia Inhibitory System" which is activated by giving acupuncture to points in the ventral abdominal region of the rat. Lesions placed anywhere along the brain circuitry of this inhibitory system unmasked the ventral abdominal points, enabling these sites to produce acupuncture analgesia which they cannot do in intact rats. All together Prof. Takeshige's group has published over 50 papers on acupuncture mechanisms (in Japanese). He also reviewed some recent experiments showing that acupuncture can overcome muscle fatigue in rats undergoing repetitive muscle activation. This is an additional example of non-analgesic properties of acupuncture.

Another review was written by Prof. D. Le Bars, Prof. J.C. Willer, Dr. T. de Broucker and L. Villanueva of University of Paris (France) (from the renowned pain group of J.M. Besson at INSERM). It was titled "Neurophysiological Mechanisms Involved in Pain Relieving Effect of Counterirritation and Related Techniques Including Acupuncture". This review was in two parts. The first summarized the results from Prof. Le Bars' group in rats, showing that pain in one part of the body inhibits pain responses in another part; when observed on spinal cord dorsal horn wide dynamic range neurons this effect has been called DNIC (diffuse non specific inhibitory control); when observed in behaving rats, or with flexor withdrawal reflexes in humans it is called "counterirritation". Whether or not DNIC is a model for acupuncture is unclear, as unmyelinated "C" fibres are

activated for the conditioning stimulus, whereas acupuncture generally activates small myelinated "A delta" and type III muscle afferents. The famous "De Qi" sensation produced by acupuncture is a mild ache and not frank pain. Also the time course of DNIC is a matter of controversy; it shows a rapid onset and short after-effect, starting immediately and lasting only several minutes after conditioning stimulus ends. Acupuncture has a much longer induction time and after-effect, taking 5 to 30 minutes to get going, and outlasting the treatment by 20 min to several hours.

In the second part of the review the counterirritation experiments conducted in humans had a much more appropriate time course for a model of acupuncture than the DNIC experiments in rats. Moreover, the human experiments were very convincing because of the beautiful correlation of flexor reflex suppression (measured by sural evoked reflex EMGs from biceps femoris) and psychophysical measures of sensory analgesia produced by counterirritation. The subjects dipped their arm into hot water (above 45°C) several minutes to produce counterirritation. This produced analgesia which had after-effects lasting 10-15 minutes. The effect was blocked by naloxone (pretreatment), and was absent in paraplegic patients.

Prof. Mathew Lee, Professor of Rehabilitation Medicine at New York University (USA), wrote a review on "Clinical and Research Observations on Acupuncture Analgesia and Thermography". In the first part of the review it was shown that strong (above pain threshold) EA of LI.4 (1st dorsal interosseus muscle of the hand) produced a 30% increase in the discomfort threshold for tooth electrical stimulation in normal volunteers, an effect which took 40 min to reach its peak. Naloxone was able to partially block this effect when given 10 min after onset of the EA treatment.

Perhaps, it was the second half of his review which was most novel as it dealt with a non-analgesic property of acupuncture: the effect of acupuncture on the autonomic control of skin circulation. The elegant design involved measurement of skin temperature of hands, feet and face using infrared colour thermography. Acupuncture treatments were given to normal volunteers in either LI.4 (1st dorsal interosseus muscle) or St.36 (tibialis anterior muscle) by one of two methods: either manual twirling of the needles manual acupuncture MA to produce mild painful sensations, or EA at 1 Hz at below pain threshold. Whereas MA caused marked vasodilatation in all regions from either acupuncture site, the results from EA were less consistent. Could this difference be attributed to intensity of stimulation? It seems that consistent results were only obtained when "De Qi" was obtained (compare Prof. Pomeranz's TENS study on humans). Prof. Lee thus showed convincing evidence that acupuncture is not just useful for analgesia, but should be studied further for its effects on autonomic function.

Prof. George Ulett, Professor of Psychiatry at St. Louis University School of Medicine and Director of Psychiatry Deaconess Hospital (USA), wrote a review entitled "Studies Supporting the Concept of Physiological Acupuncture". His work covered a broad range of topics. He showed that EA raised white blood cell counts in normal human subjects by 40%; however there was no significant difference between needling acupuncture points and non-acupuncture sites. The stimulus intensity was kept below pain threshold, and hence it would be interesting to

repeat the experiments while producing "De Qi". Clearly more research on non-analgesic effects of acupuncture is needed. In another important study Prof. Ulett showed that acupuncture is as effective as morphine or hypnosis in suppressing experimental pain in human volunteers. Since hypnotic susceptibility did not correlate with acupuncture success rate, the two are not the same phenomenon (a result confirmed by others using naloxone antagonists which block acupuncture but not hypnotic analgesia).

Unfortunately several additional researchers who were invited to attend the Düsseldorf Acupuncture Symposium (1987) could not come because of conflicts in their schedule. Professors David Mayer, Lars Terenius, Sven Andersson, Bengt Sjölund, Peter Hand, and Manfred Zimmermann were thus unable to contribute to this volume. We hope to include their contributions in later anthologies.

References

1. Barber J, Mayer DJ (1977) Evaluation of the efficacy and neural mechanism of a hypnotic analgesia procedure in experimental and clinical dental pain. *Pain* 4: 41-48
2. Beecher HK (1955) Placebo analgesia in human volunteers. *J Am Med Assoc* 159: 1602-1606
3. Goldstein A, Hilgard EF (1975) Failure of the opiate antagonist naloxone to modify hypnotic analgesia. *Proc Natl Acad Sci USA* 72: 2041-2043
4. Lewith GT, Field J, Machin D (1983) Acupuncture compared with placebo in post-herpetic pain. *Pain* 17: 361-368
5. Liao SJ (1978) Recent advances in the understanding of acupuncture. *Yale J Biol Med* 51: 55-65
6. Mayer DJ, Price DD, Raffi A (1977) Antagonism of acupuncture analgesia in man by the narcotic antagonist naloxone. *Brain Res* 121: 368-372
7. Pomeranz B, Chiu D (1976) Naloxone blocks acupuncture analgesia and causes hyperalgesia: endorphin is implicated. *Life Sci* 19: 1757-1762
8. Richardson PH, Vincent CA (1986) Acupuncture for the treatment of pain: a review of evaluative research. *Pain* 24: 15-40
9. Stux G, Pomeranz B (1987) *Acupuncture - textbook and atlas*. Springer Verlag, Heidelberg
10. Vincent CA, Richardson PH (1986) The evaluation of therapeutic acupuncture: concepts and methods. *Pain* 24: 1-13
11. Wall PD (1972) An eye on the needle. *New Sci* July 20, pp 129-131

Appendix

Bruce Pomeranz

Acupuncture Analgesia for Chronic Pain: Brief Survey of Clinical Trials

The papers reviewed below indicate that AA is very effective in treating chronic pain, helping 55%–85% of patients (compared to morphine which helps 70%). Secondly, these papers show that AA is better than placebo which helps only 30% of patients. These statements are based on evidence collected in four classes of studies (see recent reviews [15, 22, 25]).

Class A: studies in which there was no control group for comparison with the acupuncture group or in which there was a control group where the subjects received no treatment.

Class B: studies in which the control group received percutaneous acupuncture but at the wrong location (called sham acupuncture).

Class C: studies using a placebo control group (usually a disconnected TENS device or acupuncture needle taped to the skin). It is important to note that needles were not inserted percutaneously in the control group for class C studies and hence this is not considered to be sham acupuncture.

Class D: studies in which the control group received conventional therapy (e.g. drugs or physiotherapy).

In classes B and C, the experiments were single blind (the patients did not know about the sham or placebo, but the therapists knew). The quality of studies in descending order is class C, class D, class B and class A. Initially, it was thought that class B studies were similar in quality to those of class C. It was hoped that sham acupuncture (insertion of needles at wrong locations) was a good control for placebo effects and, hence, many studies were based on this approach. Unfortunately, experience has since shown that sham acupuncture helps 33%–50% of patients while placebo in class C helps only 30% of patients (note that true acupuncture helps 55%–85% of patients) [22, 25].

In the review by Lewith and Machin [15], it was convincingly argued that the statistical problems inherent in class B experiments, in which one group shows a 40% success rate (sham) and another group shows a 70% success rate (true acu-

puncture), make the burden of proof unrealistic, requiring at least 122 patients in the study to find a difference between the two groups. In contrast, placebos in class C only benefit 30% of patients, making the burden of proof easier. To compare 30% success in placebo controls with 70% success from true acupuncture requires only 70 patients. Hence, it is not surprising that two out of two studies [18, 20] in class C showed significant differences between treated and controls, whereas four out of six class B experiments failed to show differences [6, 7, 8, 26 no differences shown, 10, 19 differences shown]. Class B experiments should be repeated with larger sample size, above 122, to settle this problem.

Normally, we should completely ignore class A experiments as they are poorly controlled. This is too severe as most of these studies showed the 55%-85% success rate that we now know from class C experiments to be far above the placebo level of 30% [2, 3, 4, 5, 11, 12, 13, 14, 21, 23, 27].

Class D studies suffered from the same problems as class B, placing too big a burden of proof on the small sample size. Nevertheless, four of these studies did show AA to outperform the conventional medical treatment [9, 16, 17, 24] while one showed no difference [1] (perhaps due to a type II error).

However, even if the analgesic effects of acupuncture and of a chemical analgesic are equivalent, this is also a victory for AA, given the many side effects of analgesic drugs and the relatively few side effects of acupuncture.

Hence, from the above considerations, it is clear that AA helps from 55%-85% of patients which compares favorably with morphine (but with fewer side effects). It works better than placebo; but more research is needed to see if it works better than sham acupuncture.

References

1. Ahonen E, Hakumaki M et al (1983) Acupuncture and physiotherapy in the treatment of myogenic headache patients: Pain relief and EMG activity. In: Bonica JJ (ed) *Advances in pain research and therapy*, vol 5. Raven Press, New York, pp 571-576
2. Chen GS (1977) Therapeutic effect of acupuncture for chronic pain. *Am J Chin Med* 5: 45-61
3. Cheng ACK (1975) The treatment of headaches employing acupuncture. *Am J Chin Med* 3: 181-185
4. Coan RM, Wong G et al (1980) The acupuncture treatment of low back pain: a randomized controlled study. *Am J Chin Med* 8: 181-189
5. Coan RM, Wong G, Coan PL (1982) The acupuncture treatment of neck pain: a randomized controlled study. *Am J Chin Med* 9: 326-332
6. Edelist G, Gross AE, Langer F (1976) Treatment of low back pain with acupuncture. *Can Anaesth Soc J* 23: 303-306
7. Gaw AC, Chang LW, Shaw LC (1975) Efficacy of acupuncture on osteoarthritis pain. *N Engl J Med* 21: 375-378
8. Ghia J, Mao W, Toomey T, Gregg J (1976) Acupuncture and chronic pain mechanisms. *Pain* 2: 285-299
9. Gunn CC, Milbrandt WE et al (1980) Dry needling to muscle motor points for chronic low back pain. *Spine* 5: 279-291
10. Hansen PE, Hansen JH (1983) Acupuncture treatment of chronic facial pain: a controlled cross-over trial. *Headache* 23: 66-69
11. Kim KC, Yount RA (1974) The effect of acupuncture on migraine headache. *Am J Chin Med* 2: 407-411

12. Laitinen J (1975) Acupuncture for migraine prophylaxis: a prospective clinical study with six months follow-up. *Am J Chin Med* 3: 271-274
13. Lee PK, Andersen TW et al (1975) Treatment of chronic pain with acupuncture. *J Am Med Assoc* 232: 1133-1135
14. Leung PC (1979) Treatment of low back pain with acupuncture. *Am J Chin Med* 7: 372-378
15. Lewith GT, Machin D (1983) On the evaluation of the clinical effects of acupuncture. *Pain* 16: 111-127
16. Loh L, Nathan PW et al (1984) Acupuncture versus medical treatment for migraine and muscle tension headaches. *J Neurol Neurosurg Psychiatry* 47: 333-337
17. Loy TT (1983) Treatment of cervical spondylosis. *Med J Aust* 2: 32-34
18. MacDonald AJR, Macrae KD et al (1983) Superficial acupuncture in the relief of chronic low back pain. *Ann R Coll Surg Engl* 65: 44-46
19. Matsumoto T, Levy B, Ambruso V (1974) Clinical evaluation of acupuncture. *Am Surg* 40: 400-405
20. Petrie JP, Langley GB (1983) Acupuncture in the treatment of chronic cervical pain. A pilot study. *Clin Exp Rheumatol* 1: 33-35
21. Pontinen PJ (1979) Acupuncture in the treatment of low back pain and sciatica. *Acupunct Electrother Res Int J* 4: 53-57
22. Richardson PH, Vincent CA (1986) Acupuncture for the treatment of pain: a review of evaluative research. *Pain* 24: 15-40
23. Spoerel W (1976) Acupuncture in chronic pain. *Am J Chin Med* 4: 267-279
24. Sung YF, Kutner MH et al (1977) Comparison of the effects of acupuncture and codeine on postoperative dental pain. *Anesth Analg* 56: 473-478
25. Vincent CA, Richardson PH (1986) The evaluation of therapeutic acupuncture: concepts and methods. *Pain* 24: 1-13
26. Yue SJ (1978) Acupuncture for chronic back and neck pain. *Acupunct Electrother Res Int J* 3: 323-324
27. Yuen RWM, Vaughan RJ et al (1976) The response to acupuncture therapy in patients with chronic disabling pain. *Med J Aust* 1: 862-865