A Pain Management
Treatment Perspective

Electroanalgesia
Historical and Contemporary Developments -

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Section 1.1 Early Developments in Electroanalgesia

1.1.1 In the beginning.

The beginning of electrical stimulation for pain is coincident with the beginning of electrotherapy itself (Stillings 1975a). Though the origins of magnetism and electricity are lost, animated minerals such as amber, magnetite or lodestone were all known to ancient man. Starting around 9000 BC, bracelets, necklaces, and other appurtenances were used to prevent or assuage headache, arthralgia, and numerous visceral upheavals (Schechter 1971). Paracelus was enchanted with the properties of the magnetic stone and prescribed the lodestone with great abandon. However, much as the 'animated minerals' impressed the ancients, certain fish (Schechter 1971) inspired a yet greater sense of awe. For it is one of the curious symbolic coincidences that medical electricity can trace its origin back to the dawn of the astrological age of Pisces, and moreover, to a fish (Stillings 1973a).

Undoubtedly the first bioelectric phenomenon of which man became aware was the electric discharge of certain types of fish. Throughout the ages, electric organs in several species of fresh and salt-water fish, notably the *Torpedo mamorata, Malopterurus electricus* and *Gymnotus electricus* have reached a high degree of development and are capable of delivering a very painful and paralysing shock. These three species happen to be found near the sites of ancient civilizations, and it is probable that their uncanny power has been a source of fear and superstitious conjecture from very primitive times. The earliest man-made records in which electric fish are represented are the fishing scenes depicted on the walls of certain Egyptian tombs, C. 2750 BC. the electric fish represented being the Nile catfish, *Malopterurus electricus*. However in spite of the fact that its unmistakable lines appear in many early fishing scenes nothing has been extracted from the ancient inscriptions which throws any light on what the Egyptians knew or thought of the electric catfish. There is no doubt, however, that the numbing force of the electric fish was known to the early writers and that the name was synonymous with the effect (Kellaway 1946).

The first known Egyptian work to mention the electric catfish is dated some time in the 4th Century AD, in "The Hieroglyphica of Horapollo". The first chronicler was not concerned with the wondrous powers of these creatures but rather with their nutritive value. That the Hippocratic writings discuss the torpedo and yet make no reference to its strange powers is not remarkable, for these works are characterised by a rational approach to disease and an almost complete disregard for the marvellous and the esoteric. The simple prescription of easily digested torpedo flesh for the undernourished patient is merely another example of the Hippocratic belief in 'natural' therapy, and it stands in sharp contrast to the heavy-handed polypharmacy of succeeding ages (Kellaway 1946).

The torpedo fish was also well known to the fishermen working off the shores of the Mediterranean, before the birth of Christ, and numbing shocks were ample evidence that a torpedo had been ensnared in their nets. The saving and healing powers of fish were acclaimed throughout the medical and non-medical literature of the early centuries of the Christian era. These beliefs doubtless derived from the ubiquitous fish symbolism of the new religion and its founder, the Fisher of Men (Stillings 1973a).

On the basis of what can be garnered from the subsequent writings of Celsius, Oribasius and other compilers, it is apparent that nothing new was added to the medical history of the torpedo after Hippocrates (420 BC) until about AD 46, at which time the Roman physician, Scribonus Largus, introduced the electrical powers of the fish into clinical medicine as a cure for headache and gout. Of all the amazing ichthyic nostrums by far the most remarkable, and perhaps the most rational was the employment of the torpedo's electric discharge for the relief of intractable headache and for gout. This remedy represents the first recorded use of electroanalgesia introduced into clinical practice. Historians characterize Scribonus as a man of sound judgement and high principles, his sole existing work being the '*Compositiones Medicae*'. He confesses that in his quest for remedies he gleaned from every likely person he encountered including slaves and wise women. Indeed he lists the electro-ichthyic remedy for gout on the basis of a report that Anteros, a freedman of Tiberius, had been successfully treated for the disease by this means (Kellaway 1946). After the initial excruciating cramp in his foot had abated, he found to his amazement that the pain he had long suffered, from gutta (gout), was completely banished. This event reached the ears of Scribonius Largus and his commentary appeared as follows.

For any type of gout a live black torpedo should, when the pain begins, be placed under the feet. The patient must stand on a moist shore washed by the sea (note precautions to keep the torpedo alive) *and he should stay like this until his whole foot and leg up to the knee is numb. This takes away present pain and prevents pain from coming on if it has not already arisen. In this way Anteros, a freedman of Tiberius, was cured.* (Scribonius CLXII in Schechter 1971).

Scribonius gives no source, however, for the following description of his galvanic headache remedy and it is possible that he originated it himself (Kellaway 1946).

> *"Headache even if it is chronic and unbearable is taken away and remedied forever by a live torpedo placed on the spot which is in pain, until the pain ceases. As soon as the numbness has been felt the remedy should be removed lest the ability to feel be taken from the part. Moreover several torpedo's of the same kind should be prepared because the cure, that is, the torpor which is a sign of betterment, is sometimes effective only after two or three"* (Compositiones Medicae, XI. in Kellaway 1946).

The Herbal of Pedanius Discorides, '*De re medica',* written some thirty years after the 'Compositiones', not only adopts the use of torpedo viva for headaches, (although this has been disputed by some - see Stillings 1973a/1975a), but avers that the remedy may also be successfully employed in prolapsus ani. This clinical application of electric fish is however left to the imagination of the reader (McNeal 1977). Largely through the influence of Discorides these remedies enjoyed a great popularity for many centuries and in fact may be found in herbals and pharmacopoeias up to the end of the seventeenth century, (e.g. in Robert Lovell's (1661) '*Panzooryctologica, sive Panzoologic-omineralogica'* p.191). One wonders if the electrotherapeutic treatments for prolapsus ani represent the first intentional stimulation of muscles by artificial means. Nicholas Godinho in 1615 observed that a live torpedo thrown among dead fish seemed to cause them to revive (Stillings 1973a). So it appears that the shock of even a dying torpedo is of considerable intensity and certainly of sufficient magnitude to induce involuntary contractions of semi-striated muscles in dead fish and live animals (Kellaway 1946).

The history of electricity in general medicine often refers to Claudius Galen's (131-201 AD) early use of shocks from the electrical fish to aid gout and other diseases and is on record as follows:

> *"The whole torpedo, I mean the sea-torpedo, is said by some to cure headache and prolapsus ani when applied. I indeed tried both, and* the *torpedo should be applied alive to the person who has the headache, and that it could be that this remedy is anodyne and should free the patient from pain as do other remedies which numb the senses: this I found to be so, And I think that he who tried this did so for the above-mentioned reason."* (Galen quoted in Stillings 1975/a.

Indian physicians of general medicine, for example, also employed them in all diseases characterized by excessive heat, and Ibn-Sidah, a Muslim doctor of the eleventh century, believed a live electric catfish to have beneficial effects when placed on the brow of a person suffering an epileptic fit (Kellaway 1946). Many others, until the end of the renaissance continued to cite recipes for the torpedo and its ilk. Marcellus Empiricus, Aetius of Amida, Alexander of Tralles, and Paulus Aeginata listed it among the specifics for various cephalgias and arthralgias. Serapion called it *Pisces stupefaciens.* The Arabians emphasised the virtues of the sleep, which followed the jolting contact with fish. Haly Abbas referred to the latter as the *Pisces dormitans.* Avicenna and Averhoes thought it efficacious when placed on the brow of persons afflicted with migraine, melancholy, or epilepsy. Persistence of this belief to the sixteenth century is exemplified by Dawud al Antaki's statement that:-

> *"If the torpedo is brought near, while alive, to the head of an epileptic, the latter will be thoroughly cured... it removes chronic headache, unilateral headache, and vertigo even in desperate* cases*"* (Dawud al Antaki 16C in Schechter 1971/Stillings 1975/a).

So it appears that the use of the torpedo fish continued within general medicine and by the sixteenth century its application had been broadened to include those suffering from migraine, melancholy and epilepsy (McNeal 1977). A 16th Century Jesuit missionary also described the use of electroichthic therapeutics as practised by the Abyssinians of that period in the treatment of arteries, joints and sinew pain. A seventeenth century traveller, Ludolf Hiob, also reported on the Abyssinians' treatment as follows:

> *"The Habessines cure Quartan and Tertian Agues with the torpedo, the patient is first to be bound hard to a table, after which the fish being applied to his joints, causeth a most cruel pain over all his members which being done the fit never returns again. A severe medicine which perhaps would not be unprofitable to those that are troubled with gout".* (Ludolf Hoib in Kellaway 1946).

Instances of Europeans using electric fish as medical shocking machines are to found in the literature up to about 1850 (Kellaway 1946). Girolamo Cardano in 1551, and Gilbert one-half century later, by clearly differentiating between magnetism and electricity, laid the groundwork for the production and leashing of man made electricity to replace the piscean variety. Gilbert's crude electrostatic induction machines were archetypal of apparatus of that kind in use for the next three hundred years (Schechter 1971). The early years of the seventeenth century also produced two of the most important scientific works ever written: the 'De magnete' of William Gilbert (1600), which first generalised and classified the then known phenomena of electricity; and William Harvey's 'De motu cordis' (1628), describing for the first time (in the West) scientifically, the circulation of the blood (Stillings 1975a). However, Dr William Gilbert (1544-1603), who was also a court physician to Queen Elizabeth and to James the First, apparently never made any significant use of magnetic electricity, but the publication in 1600 of his experiments with the 'loadstone' earned him the title of the 'First Electrician'. Belief in the medicinal properties of magnetism had been voiced by dozens of early writers including Albertus Magnus, Paracelsus, Discorides and Galen. While admitting the possible benefit of powdered loadstone and the possibility of using loadstone for removing arrowheads, Gilbert denied its value for curing headache and dropsy (Stillings 1974). Sixty years after the appearance of Gilbert's '*De Magnete',* Otto von Guericke in 1672, was the first to construct an early prototype of an electrostatic generator. He produced electricity by rotating sulfur against the friction of his hand (Stainbrook 1948). This effort being the first controlled artificial production of electricity.

Roughly coincident with the development of this electrotechnology, was the introduction of the practice of acupuncture, imported from Asia. In 1683, Ten Rhyne published his work '*Disser tatio dearthritide:mantissa schematica: de acupunctura...',* bringing the first details of oriental acupuncture pain relief to the West. Significant developments in electrical pain relief were found with the application of electricity to acupuncture needles in the early eighteenth century.

1.1.2 Electroanalgesia in the Eighteenth Century.

Hauksbee elaborated the crude implement of Otto Von Guerick further into an electrostatic generator, early in the eighteenth century (Stillings 1975a). Haukesbee's generator was a lathe and crank machine specifically designed for the efficient production of static electricity and he replaced von Guericke's sulfur globe with a glass one. His machine attracted the attention of Stephen Gray who has been credited with having laid the foundations for the study of electricity as a science (Stillings 1974). In 1742, Andreas Gordon, a Scotch Benedictine monk, replaced the glass globe with a cylinder and produced the most powerful electrical discharges up to that time (Stillings 1974).

So long before the first treatises on the subject of medical electricity appeared on the continent, Englishmen had been methodically applying electricity to the body and reasoning as to its function in the animal economy (Stillings 1974a). But interest in electroanalgesia shifted from England to France during the middle years of the eighteenth century (Stillings 1974). Artificially generated electricity had begun to find favour with European physicians by the middle of the eighteenth century. Johann Gottlob Krueger, for example, in 1743 as the new professor of philosophy and medicine, first gave his 'Thoughts About Electricity' as a series of lectures in that year. These were published in 1744 and reprinted and 'enlarged by notes' again the following year. In a way, this was the first book on medical electricity, although the book of his pupil, Kratzenstein (1745), was the first to use medical electricity in a title (Licht 1959). Since the publication of this very first book on electrotherapy, the average output has been about five books each year (Licht 1959).

In 1745, Ewald von Kleist constructed the first electrical condenser; an achievement independently duplicated the following year in Leyden by Pieter van Musschenbroek (Stainbrook 1948). They developed a device that would both generate and store large quantities of charge. This was accomplished by the addition of the capacitor to the electrostatic machine. Nolan called this the 'Leyden jar', and used it in his experiments with animals and plants (Kane and Taub 1975). Christian Kratzenstein was probably the first physician to use the electricity from the Leyden jar for therapeutic purposes in general medicine (Stainbrook 1948). The medical applications of electricity, and especially indications for pain now multiplied rapidly (Stillings 1975a). Armed with the electrostatic generator and the Leyden jar, the electrical practitioners really went to work. Paralysis, hemiplegias, epilepsy, kidney stones, sciatica, and angina pectoris were only a few of the conditions that were reported as successfully treated during the years that followed (McNeal 1977). For the invention of the Leyden jar permitted the use of far stronger shocks than the older static machines had been able to deliver, and called attention in a most dramatic manner to the effect of electricity on the human body. Between the years 1750 and 1780 no less than twenty-six papers dealing with medical electricity appeared in the Journal de Medicine alone. An electric shock machine, of the Ramsden type (glass plate style) was installed in the Middlesex hospital in 1767-8, and within the next decade many other hospitals followed suit. Almost immediately after the invention of the Leyden jar, however, the similarity between the shock it delivered and the discharge of the electric fish was pointed out, and physicians were quick to retest the remedial properties of the fish; apparently though, living shocking machines were seen as being more powerful than the man-made instrument (Kellaway 1946).

Storm van s'Gravesande, Governor of Surinam observed, in 1754, that various people who to some degree had gouty pains, and who touched the torpedo had been completely cured two or three minutes after contact. The experiment had been repeated at various times but always with the same result (Kellaway 1946). In1761, a Dutch surgeon, van der Lott related 'experiments', also performed in Surinam with the ferocious Conger eel. It was noted that several black slave boys had been thrown into a tub of water, containing a Conger eel of the black variety, with subsequent improvement in the boys' 'nerve' condition and their fever (Schechter 1971). These remedies were much favoured by Indians and Negroes and they continued to use them until comparative recent times. For example, for many years the colonists of Berbice and Demerara made it a practice to keep two or three living *gymnoti* in a tank for the use of their plantation workers, who had great faith in the power of the fish's shock to cure rheumatic and paralytic afflictions. The Negroes were not alone in their faith for there are instances on record of European doctors in Guiana using the shocks to treat rheumatism as late as 1850 (Kellaway 1946).

In Britain, Richard Lovett a lay clerk at Worcester Cathedral, claimed in 1755 to be successfully treating many conditions including mental disease by electric sparks and current (Stainbrook 1948). He published an account, the first English-language book on medical electricity, in 1756, of the many conditions for which electrotherapy was recommended, under the title '*The Subtil Medium Prov'd'.* John Wesley, the leader of the eighteenth century Methodist reformation, was so impressed by Lovett's electrical treatment that he enthusiastically observed in his own writings, in 1759, that:

"I doubt not but more nervous disorders would be cured in one year by this single remedy than the whole of the English Materia Medica will cure by the end of the century" (Wesley in Stainbrook 1948).

John Wesley's book, '*The Desideratum'* 1759, extolled the virtues of electricity in many diseases and its popularity can in some way be measured by the fact that the book went into its fifth edition by 1781. He believed so strongly in the therapeutic properties of electricity that he brought four machines to treat the people of London (Licht 1959). Wesley saw the 'subtle fluid' as the soul of the universe. He advocated electrical therapy for the following conditions:- angina pectoris, bruising, cold feet, gout, gravel in the kidneys, headaches, hysterics and memory loss, pain in the toe, sciatica, pleuritic pain, stomach pain, palpitations and so on. He ends his Desideratum with the following plea:

> *Before I conclude, I would beg one Thing (If it be not too great a Favour) from the Gentlemen of the Faculty, and indeed from all who desire Health and Freedom from Pain, either for themselves or their Neighbours. It is, That none of them would condemn they not know what: That they would hear the Cause, before they pass Sentence: That they would not peremptorily pronounce against Electricity, while they know little or nothing about it. Rather let every candid Man take a little pains, to understand the Question before he determines it. Let him for two or three Weeks (at least) try it himself in the above-named Disorders. And then his own Senses will shew him, whether it is a mere Plaything, or the noblest Medicine yet known in the World* (Wesley 1759).

But compared with his position as the founder of Methodism, John Wesley's interest in electricity and his work as an electrotherapist are virtually unknown. Most of Wesley's applications would seem to many to be farfetched, but it is worth pointing out that Wesley's chief motivation for his promiscuous electrotherapeutics was his belief that this was an extremely effective cure that was, above all, cheap and therefore accessible to everyone (Stillings 1974a). The cataloguing of cases by Wesley in the above book, is evidence of the strictly empirical approach that dominated electroanalgesia in the eighteenth century. The wonder of sudden pain relief by discharging the marvellous electrical 'fire' through the afflicted body parts seemed to obviate any speculations regarding the physiology of the procedures (Stillings 1975a).

In the New World, theoretical electrical science was hardly a major concern of the early settlers in North America. Isolated from their families and traditions and faced with the day-to-day necessities of providing food and shelter, they could not ponder the niceties of natural philosophy. Even later, when the colonies began to enjoy a certain degree of prosperity, American science tended to produce practical inventions rather than theories. Franklin was the exception to this rule, developing the one-fluid theory of electricity that was to hold sway over all others for more than a century. Still, Franklin himself was apologetic about not finding use for his discoveries, and when later did find one, namely, the lightening rod, the Americans considered it his most important scientific achievement (Medronic 1977). Benjamin Franklin, was at times besieged by the lame and sick with requests for electrotherapy. He was master of the science of electricity to that time and also one of the most vocal sceptics of the exaggerated claims of electrotherapists (Stillings 1974). No doubt Franklin's most important contribution to medical electricity was indirect: with his experiments he proved that electricity is an ever-present natural force; he developed the theory and terminology of positive and negative charge as well as the idea that a balance of charge is conserved in nature. Before Franklin, the study of electricity had been primarily a matter of philosophical speculation; after him, it became a science. Franklin removed much of the fear and superstition that had become associated with electricity, and in so doing, he opened the way to serious scientific investigation of electricity in the treatment of disease (Medronic 1977)

Back in Europe, Paris in 1772 saw the Abbe Bertholon using electrical stimulation for foot drop - *'in all such cases the stiffness of the tarsus is inconceivable'.* After warming the affected foot, he then applied continuous electrification for three-quarters of an hour, after which the patient was allowed to rest for a few minutes before the procedure was repeated for another three quarters of an hour (Stillings 1975b). In Britain, John Birch, an English surgeon, also in 1772, described the methods by which he applied electrical currents and gave case reports including treatment for injuries, low back pain, gout, constipation and other afflictions (Hymes 1984). However, despite the stories of success, there were many sceptics including Morin in France; Marrigues a surgeon at Montfort in 1773; and Rabiqueau in 1782, an attorney, physics demonstrator, and optical engineer to the King of France; who failed to demonstrate the same degree of success (McNeal 1977). By 1777, more efficient machines were on offer, and as early as 1767/8 a machine had been installed at the Middlesex Hospital in London. St Thomas's, however, would not admit one until 1799, when John Birch finally prevailed:

> *"It was the usage at St Thomas's Hospital to admit nothing new into practice until seven years experience had given it validity. I have had three times seven years test of the pre-eminent power of electricity and am proud to own, that without this aid, I must have been obligated to perform many more operations"* (Birch quoted in Licht 1959).

Meanwhile, towards the end of the 18th and during the first part of the 19th century, many specimens of '*Gymnotus electricus'* were exhibited in Europe. Due to the current popularity of electro-therapeutics, or Franklinism as it was then called, many people suffering from gout, rheumatism, and similar diseases flocked to try the curative power of the "natural" electricity discharged by the fish, and an advertisement published in London in 1777 invited one and all to come and be shocked by a "torporific eel" at two shillings and sixpence a time (Kellaway 1946). Learned and large volumes were also written on electricity in the second half of the eighteenth century by Cavallo and Priestley. In each, many pages were devoted to medical uses, for that remained its chief application before 1800. However, even before the nineteenth century began, interest in the application of static electricity in medicine had markedly diminished in Europe. Several magazines that had mentioned progress in electrotherapy each year made no mention of it following 1790. Communication of ideas was relatively slow, and the application persisted a little longer in America, where Gale up to 1805 was permitted to use electricity on several convalescent yellow fever patients in Bellevue hospital (Licht 1959).

1.1.3 "Electro-quackery" in the 18th Century.

One might suppose that 'quack' medicine would have tried to carve out a distinctive identity for itself through championing novelty, and, in an age of science and technology, patenting a wave of gadgets to bamboozle the public (Porter 1989). The late eighteenth century indeed, saw the invasion of the field by two notorious charlatans. In the UK, James Graham after meeting Benjamin Franklin in America became an enthusiast for medical electricity and gave lectures, demonstrations and expensive treatments with his 'Celestial Bed' and electrical instruments to ensure fertility (Licht 1959). Case histories from Bath and Bristol in the late 1770's show Graham offering electrical treatments for a spectrum of conditions, from the modish 'nervous diseases' to fevers, rheumatism, gout, deafness and noises in the head. In 1780 at the fashionable Adelphi in London, just off the Strand, he combined lectures and multi-media spectacle with a practice privileging electrical therapy. In this Valhalla of health and fertility, he first unveiled his celestial bed, hired out at £50 a night as a specific against impotence and sterility (Porter 1989).

"Electroquackery" in America had a history all of its own that was as long and colourful as that of legitimate electromedicine. The first great American fraud occurred shortly after the mesmerist cult took Europe by storm in the 1780's. The two bear a certain resemblance to each other in that they both were initiated by well-trained physicians of great personal appeal, both promised quick and painless cures for disease, and both were mysteriously associated with that strange and marvellous new force, electricity (Medronic 1977). Elisha Perkins, with a medical degree from Yale, in 1796 secured a patent for 'electric' metallic tractors with which he claimed to cure many diseases by sweeping the skin with them. Glowing reports were published in the United States, England and Denmark, and it was not until 1800, when John Haygarth and Falconer of Bath, did a parallel control test with painted wooded tractors that the fraud was exposed. Even so, as has often happened before and since, Perkin's metallic tractors enjoyed considerable popularity for several years more (Licht 1959). For many years after the tractors fell from popular favour, America remained relatively free of 'electroquacks'. But the ideas were not dead, nor had electricity lost its appeal as a curative agent (Medronic 1977). However the grotesque proliferation of junk electrical technology - ozone boxes, masturbation-suppressors, electrical belts, thermal socks, hydraulic pimple squeezers, and the like - was a product of later Victorian 'quackery', (a reflex response, one suspects, to the introduction of laws regulating 'quack' pharmacy). So it would appear that Georgian 'quacks' probably drew upon the medical

potential of electricity no more than their regular colleagues (Porter 1989) did. But did the 'quacks' colonise domains of disease relatively neglected by the regulars, such as intractable pain relief? Porter suggests not, for regular medicine did not trouble itself unduly about pain-control, and 'quack' medicine he suggests played not a pioneering role but rather followed in the footsteps of orthodoxy (Porter 1989). Graham's electrical therapy, for example, was integral to his overall medical doctrines and practice, and was, in any case, widely promoted by orthodox as well as 'quackish' practitioners in the last quarter of the eighteenth century (Porter 1989)

1.1.4 Electroanalgesia in the Nineteenth Century.

The nineteenth century was the era of rational positivism - of faith in the individual, in the supreme power of human reason, in science as the key to understanding nature. Better educated and considerably more affluent, the public was no longer so easily taken in by the wiles of 'quackery'. The nineteenth-century charlatan had to sound like a scientist to gain a following. Medicine was changing from a mysterious, widely mistrusted profession into a science that relied on advance in physics and chemistry for its subsequent developments (Medronic 1977).

At the beginning of the 19th Century, however, the therapeutic use of electricity was contaminated by the prevailing ideas about animal magnetism, and the legitimate medicine of the UK and USA made little use of electrotherapy until after the beginning of the last half of the 19th Century (Stainbrook 1948). Also a clutter of synonyms marred the literature on electrotherapeutics for a couple of centuries. Their equivalents are herewith indicated; franklinization, the application of electricity generated by friction; galvanisation, the application of electricity generated by chemical reaction, the current so produced being designated as galvanic, voltaic, dynamic, continuous, constant, direct, primary, uninterrupted, battery, or pile (actually the galvanic current may be interrupted as well as the continuous) and faradization, the application of electricity generated in a coil of wires adjoining another conductor through which the current traverses. The faradic current, which is necessarily interrupted by the apparatus that produces it, is also referred to as induced induction, inductive, electromagnetic, magnetoelectric, to-and-fro, indirect, or interrupted (Schechter 1971). Allessandro Volta had produced the first battery (Voltaic pile) about 1799 and in 1801 Bischoff claimed to have cured hysterical paralysis and stupor by the application of the direct continuous current (Stainbrook 1948). The Voltaic pile was the first source of electricity which could be produced without effort or regard to the weather, a current with characteristics so different from frictional electricity that for more than a half-century it was called galvanism in distinction from electricity, a name reserved for the static form (Licht 1959).

1.1.5 Electroanalgesia in 19th Century Britain.

By 1804, the galvanic current was being widely used for medical purposes in England for paralysis, tic douloureux etc (Stillings 1974). The London Electrical Dispensary at 16 Bunhill Street, founded in 1793, was able to report in 1820 that more than 8,000 patients had been treated there since its founding. Of these, 4,000 were listed as cured and another 3,000 as relieved. M. La Beaume was virtually the only physician interested in therapeutic electricity in England, but he was better appreciated in France than in his own country (Licht 1959:16). In 1836, Guy's Hospital set aside rooms for an electrical department and put Golding Bird, the instructor in physics, in charge. Because of his scientific standing, he soon had the co-operation of some of the leading clinicians of his time, especially Bright and Addison. However in some hospitals where electrotherapy was used the treatments were still entrusted to the house porter (Licht 1959). Bird gave lectures on medical electricity in 1847, which were published in 1849. These lectures had considerable influence (in the wrong direction!) which probably resulted in the Pulvermacher and Harness electric belts being foisted on a credulous public. These were the days of creativity in electrotherapy and many exorbitant claims often centring on improving the genital organs were proposed (Licht 1959).

Julius Althaus was the first in England to introduce the work of Duchenne, described later, and all other forms of electrotherapy. A graduate of Berlin, he settled in London in 1855 where he soon began to administer electrical treatments at King's College Hospital (Licht 1959). In 1858 he applied 'interrupted' current transcutaneously to peripheral nerves. Althaus claimed like Garrett, that he had experimented with electrical anaesthesia long before Francis in America had popularised it. Whether this claim was true or not, Althaus was the major proponent of electrical anaesthesia in Britain and contributed a great deal to its dissemination (Kane and Taub 1975). He produced the first edition of his '*Treatise on Medical Electricity'* in 1859, and it reached its third, very much enlarged and revised edition in 1873. It is with this work that the era of purely empiricistic approaches to electrotherapy comes to an end (Stillings 1974). In subsequent years, the less careful, the less experienced, and the more cautious abandoned the technique of producing analgesia by electricity because of variable and irreproducible results. With its loss of popularity, obscurity followed, and it was necessary for 'local analgesia' to be 'discovered' (or rediscovered) many times after 1858, for example, Guyot in 1878, Araya in 1870-88, and others working in Chile at that time.

1.1.6 Electroanalgesia in 19th Century Europe

The nineteenth century witnessed a widespread irrational use of galvanism and of static electricity in Europe, which continued until the middle of the century when Duchenne and Remak, following Faraday's description in 1831 of electromagnetism, (and his first electric generator), and the subsequent introduction of the induced current, re-established the medical use of electricity on a more rational basis (Stainbrook 1948).

At about this time, something new was added to electrotherapy, which resulted twenty-five years later in the work of Duchenne. In 1821, James Morss Churchill's tract on acupuncture caused considerable renewal of interest (Stillings 1975a). Acupuncture, or the treatment of disease by piercing the skin with needles, is an ancient practice of the Far East. Missionaries brought it back to France with them and Dujardin introduced it into the practice of that country in 1774. Berlioz revived it in 1811, and in 1816 suggested that the medical effects of acupuncture would be enhanced by electricity. Churchill's tract of 1821, also attracted the attention of Sarlandière, who in 1823 decided that all lesions of motion should be treated by (static) electricity and all those of sensation by galvanism. For him, the best way to introduce these currents was through needles. At first he practised electropuncture with both currents, but eventually he used only galvanism. Sarlandière claimed in 1825 that his method "introduces the shock into the very place I wish and this is able to modify the pain, motion or capillary circulation". He was convinced that he helped those with gout and arthritis (Licht 1959). Subsequently, Sarlandière published an extensive work on 'electroacupuncture' which chiefly discussed the great benefits for pain relief resulting from the combination of electricity and oriental needling (Stillings 1975a). He claimed at that time that electrical stimulation "confused" the perception of pain signals (McNeal 1977).

In 1820, Magendie in France, and Purkinje, also employed galvanic current to treat neuralgia, cardalgia and epilepsy (Stainbrook 1948). Later, in 1826, Magendie proved even bolder than Sarlandière and plunged platinum or steel needles into muscles and nerves. He then went on to introduce needles through the eyeball right into the optic nerve and then connected the needles to the poles of a battery. Magendie mentions his remarkable cures but not his failures or accidents (Licht 1959).

The man who probably did most to place electroanalgesia on a sound footing was Guillaume Benjamin Amand Duchenne of Boulogne, who started with the acupuncture of Sarlandière and Magendie in 1833, but who later found that he could admit the electric current less painfully into the body with moistened surface electrodes (Licht 1959), this is also a popular 20th century method of electrotherapy application to be considered in detail later in this thesis. By 1849, Guillaume Duchenne was probably the first to use faradic current in medical research and treatment. Nonetheless the first results of his work was to stimulate in French medicine renewed interest in the galvanic current. Referring to Duchenne's experiments, Recamier in 1851, reported successful improvement in cases of obstinate constipation, abdominal pain and neuralgia's (Stainbrook 1948).

The attention to electrically produced muscular contractions led Duchenne in the 1850's to establish optimal or 'motor' points for electrode placement, a task to which Remak also made important contributions. Remak, in fact, did for German medicine what Duchenne did for medical electrotherapy in France, namely, re-established research in electrotherapy and electrodiagnostics as a valid scientific interest. Remak concluded from his observations on the therapeutic effects of electricity, particularly on the neuralgias, that inflammatory products were the cause of neuralgia and that the pathogenic factor was 'electrolized' by the galvanic current and so therapeutically altered (Stainbrook 1948).

Duchenne's book of 1855, '*De l'Electrisation localisee*', was the major electrotherapy event of the century; it established electrotherapy (Licht 1959). In it, he proposed the use of faradic (induced) current, preferring it to galvanic current because of its electrolytic and warming action. He also introduced moistened pads to be used as surface electrodes, finding that they admitted electric current into the body less painfully than dry electrodes (McNeal 1977). The work of Duchenne was repeated in many countries including the USA, Hammond, who for a while was the Surgeon General of the Union Army, used localised electrization on wounded soldiers in a Philadelphia Hospital (Licht 1959).

The analgesic effects of electrostimulation went on to receive wider recognition and acclaim throughout the nineteenth century especially in Europe (Stillings 1975a). In France, Hermel (1844), employed galvanic 'electro-puncture' for the treatment of sciatica and lumbo-sacral neuralgia, using two needles for electrodes and placing the positive needle-pole over the site of the pain. However, the method of 'galvanic acupuncture' was at the time a more common therapeutic procedure in Italy than it was in France, and it was used by Milani and Matteucci in the treatment of neurological diseases such as chorea, the various neuralgias and epilepsy (Stainbrook 1948).

Armed with a better understanding of electrophysiology and new devices such as the battery and the induction coil, electrical practitioners set off in pursuit of cures for diseases. The later half of the nineteenth century might be called the Golden Age of Medical Electricity (McNeal 1977). The Norwegian Engelskjon, in 1855, treated hemicrania by electricity and based his selection of the kind of effective current upon his consideration that there were two essential forms of hemicrania, one being a disease of vasoconstriction and the other, a headache caused by vasodilation. Faradic current was used as an anti-vasoconstrictor, and galvanic electricity was employed as to constrict the pain-producing assumed vasodilation. Indirect support for this rationalisation of the electric therapy of hemicrania was derived from Engelskjon's experience that those cases of hemicrania relieved by the inhalation of amyl nitrite also derived benefit from faradic current (Stainbrook 1948). In the 1860's headaches and neuralgia were frequently given electrical treatment, Brunelli, in the 1867 '*Gazetta Medica Italiano'* reported a cure of spasmodic facial neuralgia with electricity after 18 sittings. Eulenberg in Berlin (1871) however, more carefully appraised the whole subject of the electrical treatment of the neuralgias and concluded that in the case of centrally produced neuralgia, a true cure by galvanism was doubtful and rare but that palliation of the pain was equally striking and frequent (Stainbrook 1948).

In 1883, the illustrious Wilhelm Erb wrote:

> *"At the present time we possess in the electrical current one of the most certain and brilliant remedies for neuralgia, although we must admit that much progress has not been made in our knowledge concerning its mode of action in these forms of disease* (Stillings 1975a)

Bedwetting and 'sexual neurasthenia' also came within the province of 19th Century electrotherapy. Dommer in Germany (1898), for example, treated these conditions with reported partial success by passing faradic current between one electrode placed in the urethra and the other, in the rectum! (Stainbrook 1948).

1.1.7. Electroanalgesia in 19th Century United States of America

In America in 1802, Thomas Gale wrote a book, which indicated that the author had been practising electrotherapy since 1776, in New York State, and entitled: '*Electricity, or Ethereal Fire, Considered: 1st. Naturally, as the Agent of animal and vegetable life: 2nd. Astronomically, or as the Agent of Gravitation and Motion: 3rd. Medically, or its artificial Use in Diseases. Comprehending both the Theory and Practice of Medical electricity; and demonstrated to be an infallible Cure of Fever, Inflammation, and other Diseases: Constituting the best Family Physician ever extant'.* And that is just the title, the book goes on to extol the virtues of electricity and McNeal suggests that "in spite of Mr Gale, or perhaps partly because of him, the initial flood of enthusiasm for electrotherapy began to wane toward the end of the eighteenth century in the USA and little serious work was attempted or reported during the first third of the nineteenth century" (McNeal 1977). Electricity then, was little used in American medicine in the early part of the nineteenth century. Even so, Brown of Troy N.Y., influenced by the reading of Wesley's '*Desideratum'* published a book on the subject in 1817. Although he was able to reproduce strong testimonials from prominent physicians whose patients he had treated, he was unable to influence other American physicians to engage in electrotherapy (Licht 1959). In 1858, Francis, a little known physician from Philadelphia, was the first to describe the relief of dental pain by electricity. He produced analgesia during a tooth extraction by the application of one electrode to the 'offending tooth' while another was held in the patient's hand. He described 164 successful tooth extraction's using 'galvanism', the majority of which resulted in 'no pain'. His 'controls', who received stimulation with the same set-up but with an open switch, did feel pain. A committee, appointed by the Pennsylvania Association of Dental Surgeons to study the use of electricity in dentistry, reported equivocal results, however, and did not recommend his apparatus for general use. Nevertheless. his technique spread almost immediately throughout America to Europe (Kane and Taub 1975). Garrett also recommended these techniques in peripheral neuralgias, hyperalgesias, tic douloureux and jaw ache etc, the electrodes being placed on the edge of the painful site for 3-5 minutes with just a bearable current. Oliver in 1857-8, in Buffalo, attached the negative pole electrode directly to the dental forceps. He also experimented with electrodes placed upon the limbs to produce surgically useful anaesthesia (Kane and Taub 1975).

George M.Beard assisted by Alphonse Rockwell (inventor of the electric chair), wrote their first book on the Medical Uses of Electricity in 1871. This was translated into German and went through ten American editions. Shortly after the publication of their book, Rockwell asked permission to present a paper on the subject before the New York Medical Society but was turned down on the ground that electrotherapy was advocated only by 'quack's (Licht 1959).

In 1872, a Dr Powell said:

> *There is nothing more striking in recent therapeutics than the change that has grown over the attitude of the profession in regard to the employment of electricity in medicine. Only 10 years ago to announce one's self a believer in electricity as a remedy of positive value was a hazardous thing* (quoted in Licht 1959)

By 1875, Rockwell, Byrd and Rockwell published the second edition of their book that summarised the history of electrotherapy with long descriptions of its application. There were multiple chapters of specifics relating to system-related diseases, including asthma, rheumatism, gout, progressive muscular dystrophy, local motor ataxia, neuralgia, migraine and back pain. In addition, afflictions such as alcoholism, a variety of gastro-intestinal tract disorders, and skin diseases were also treated. A specific chapter on neuralgia and low back pain treated by electrical stimulation consisted primarily of case reports. Complications of chronic stimulation, such as scars and ulcerations of the skin, were also noted (Hymes 1984).

With the improvement in quality of static electricity machines in the latter part of the nineteenth century, they became increasingly popular and by the turn of the century most practitioners in America had a static electricity machine in their offices. Typically American was the race to have the 'largest machine in the world' and it was eight feet tall and each of the eight glass plates was five feet in diameter. Electrotherapy reached its peak of popularity towards the end of the nineteenth century and it was used for everything. The journals of the day indicated its use from psoriasis in Moscow to neurasthenia in Philadelphia (Licht 1959).

1.1.8 "Electroquackery" in the 19th Century

So during the latter part of the nineteenth century, electricity rose to its greatest popularity as a therapeutic agent in Europe and America. But in addition to the dedicated medical men, the charlatan made his appearance too, making wild promises of health and beauty to a gullible public (Medronic 1977). The electric belt, for example, which appeared soon after the 'terrible tractoration' fad had died out, was destined for a less spectacular but much longer career. Originally developed in England in the 1870's, the Pulvermacher Electric Belt spread to the USA and enjoyed a degree of popularity throughout the latter part of the nineteenth century, although they never achieved the notoriety of some other patent devices of the period (Medronic). Interestingly, piscine electricity was still being used in orthodox and 'quack' medicine as late as the 1860's especially in Europe (Schechter 1971). However, the golden age of electrotherapy was coming to an end. Even though, as in 1890, Dr. J.B.Mattison called his colleagues attention to the value of Galvanism and Faradism for the relief of pain - neuralgic and myalgic, "*some of the best attested clinical facts that have ever gone into history have been along the line of Galvanism for relief of neuralgic pain".* But this appears to be one of the last testimonials to electroanalgesia, for after 1900, the use of electrical stimulation for pain is scarcely even mentioned in the literature, and a giant unexplained gap extends from that time to the present day (Stillings 1975a). However, static electricity retained some of its popularity during the first quarter of the twentieth century and was not fully eclipsed until the advent of short wave diathermy (Licht 1959).

1.1.9 Electroanalgesia in the 20th Century

The early twentieth century brought many truly marvellous medical advances following the two previous centuries of electrical science which had shown great and continuous progress in the development of instrumentation and theory in electricity, and the credit for many fundamental accomplishments must go to British scientists. Even the colourful, if spotty, history of electroanalgesia revealed many possibilities, since the early inventors had few preconceived ideas about what electricity could or could not do, and in almost every instance a modern application of medical electricity can be traced to its eighteenth-century source (Stillings 1974). Nevertheless the piscean theme of electrotherapy which introduced this chapter remains of interest in the twentieth century, in that many primitive African tribes still employ the shock of *Malopterurus electricus* as a medicinal agent, a practice which is of very ancient origin and which may perhaps date from the time of the early Greek and Roman invasions of North Africa (Kellaway 1946).

1.1.10 Electroanalgesia in 20th Century Europe

The Golden Age of Electroanalgesia in Europe and Britain ended in the early twentieth century, probably for several reasons; the association with 'quackery' which had been established in the public imagination, the growth of the drug industry which competed for much the same market, and the appearance of x-ray treatments, had produced much more dramatic and documentable results than had earlier electrical techniques such as electrographic diagnostic techniques (Medronic 1977 and Gadsby 1991;1993).

However the following exceptions are recorded: Peterson and LeDuc, (1902-3), rediscovered local electroanaesthesia at the turn of the century. Robinovitch in 1910, recommended local application of current in place of general anaesthesia, even for major operations using a modified LeDuc (interrupted D.C) technique. She found that optimal levels for anaesthesia were: 40V, 40mA peak, with pulse widths of about 1.0msec, and frequencies of 100imp/sec. With this arrangement, and with application of electrodes to appropriate nerves in the leg, several successful major lower limb amputations were performed in 1910 at St. Francis Hospital in Hartford (Kane and Taub 1975).

Hughson in 1922, Shaw in 1924, Guenot in 1953, also recognised the phenomenon of electrical anaesthesia but did not develop the interest further. Guenot recommended its clinical use but apparently did not employ it himself. Following the work of Thompson and Inman in 1933, Paraf in 1948 reported successful therapy in 127 patients with sciatic pain, lumbago, postherpetic neuralgia and tic douloureux. Guenot in 1953, described the work of Perrin, Barnard, LeGo, Presle, Wild and Prolest, all of whom used local and regional electroanaesthesia. Prolest experimented with 50-100 Hz monophasic and diphasic waves, which caused initial 'excitation' and paraesthesias, but soon caused 'inhibition' and raised the sensory threshold to the current (Kane and Taub 1975).

During World War I, there was considerable activity to hasten recovery of peripheral nerve injuries with electro-therapy. But this was a period of slow advance in electrical technology and virtually nothing new developed in the field then for many years (Licht 1959). During the later stages of World War II, and soon after, the emphasis in the field of physical therapy shifted to active participation by the patient and electroanalgesia rapidly diminished in importance, especially in Britain (Licht 1959).

> Herin's (1968) study reviews the literature of electroanesthesia in great detail and concludes that, *"after weighing the pros and cons of electroanaesthesia, it is a tool which is not yet ready for the practitioner, except the research minded ones who want to use it on experimental animals"* (Herin 1968).

Local electrical analgesia as a phenomenon then lay dormant until its republication by Wall and Sweet in 1967 under the impetus of investigations originally initiated to study the effects of 'gating' peripheral input (Kane and Taub 1975). They reported temporarily abolishing chronic pain by electrically stimulating peripheral nerves via electrodes on the surface of the skin; the technique soon became known as 'Transcutaneous Electrical Nerve Stimulation (TENS)' (Wall and Sweet 1967).

1.1.11 Electroanalgesia in 20th Century United States

The early 1900's saw a proliferation of questionable therapeutic applications in the United States of America. This proliferation, coupled with an upsurge of promotion by paramedical and occult practitioners, brought about federal and medical society reaction so that many manufacturers of crude stimulators were forced out of business (Barr 1991). However, by 1900 most doctors in America had at least one electrical machine in their office, and what an array of machines there was to choose from (McNeal 1977). There were machines for pain relief in the arm; a tub for gouty or rheumatic feet; a stool for electricization by sparks; an electrostatic bath with cephalic douche; electrical poison extractors; Dr Karshner's electric baths with vaginal tubes and fountain; the solenoid cage; electrical belts - especially the Pulvermacher belt, described earlier, for weak and debilitated conditions of the generative organs; Dr Scott's Electric Hair Brush, at 1 Dollar, to prevent baldness, falling hair, dandruff and headache; electric tonics and so on. But electrotherapy again rapidly diminished in importance in the United States of America where it was regarded by some as old-fashioned (Licht 1959).

1.1.12 "Electroquackery" in the United States - Revisited:

It might be assumed that, with the passage of time, the increase in knowledge and knowledgeable people would make it increasingly difficult for a charlatan to establish himself, and to some extent this was true. Between the time of Elisha Perkins and Albert Abrams, more than a century later, there had not been a truly successful fraud in Medical Electricity in America. However at the beginning of the 20th Century, Albert Adams, a distinguished American professor of psychiatry recommended electrical treatments, based on a diagnosis which could be made only by the use of his secret machine, for which he charged physicians high prices in addition to a monthly royalty. The secret machine was analysed in 1925 and found to contain an electromagnet and a single turn of wire on a wooden disc but there was no complete circuitry. By 1925, it was estimated that hundreds of physicians in the United States alone were exponents of the system and as the books on Abrams treatments were also published in England, it is fair to assume that there were a few exponents here also (Licht1959). Since the 1900's, a few manufacturers sold treatment machines such as the "Electreat" directly to consumers. These instruments became popular, and all imaginable types of claims, including the cure of cancer, were ascribed to these units, but the FDA banned their sale in the early 1950's (Hymes 1984).

1.1.13 Electroanalgesia in China.

So far the study has centred on the US/Europe axis, but no discussion on pain relief and electroanalgesia would be complete without a review of Chinese Traditional Medicine and their alternative theory of medicine, especially the use of acupuncture and electroacupuncture techniques. For acupuncture has been used in the treatment of pain and a variety of illnesses in China, and more widely in the Orient, for more than 2000 years. The practice of acupuncture is based on a theoretical system different from our understanding of human anatomy and physiology in the West and has developed through experience and observation. Stimulation of selective acupoints situated along 'meridians' is believed to restore bodily functions by promoting the flow of 'vital energy called 'Qi' throughout the system. Advances in technology in the twentieth century brought about new developments in acupuncture in China too and an electric current was first used with acupuncture in 1930. Although the early history of electroacupuncture may well be European (after Sarlandière 1825), it recurred in China in the late 1950's and spread widely throughout the country (Lu 1980). In 1958, Chinese physicians and anaesthesiologists began to apply acupuncture analgesia for major surgery. It was not long before electrical stimulation was found to be more convenient and effective than manual stimulation in many cases and the technique is in wide use today (Lu 1980). Electro-acupuncture is also a rapidly developing field in the West too, as technologically minded orthodox and unorthodox practitioners rise to the occasion (Fulder 1989). This aspect of electroanalgesia will also be considered in detail later in this study.

1.1.14 Contemporary Electroanalgesia.

Following the demonstration by Wall and Sweet (1967) that stimulation of peripheral nerves in man produced control of pain, there was a new interest in stimulation as a potential pain control technique (Long 1991). Interest in the clinical application of electrical stimulation appeared higher then than at any other time in its history, wrote McNeal in 1977. Thousands of patients are being treated for chronic pain with both permanently implanted and nonsurgically applied devices and without doubt, electrical stimulation will continue to play an important role in the future course of the field of medicine (McNeal 1977). Shealy and Long in the USA, were pioneers in this area of pain relief, initially using surgically implanted dorsal and anterior column electrodes for stimulation and later developing TENS in response to the observation that pre-operative TENS seemed to reduce the perception of pain almost as well as the dorsal column implant (Hymes 1984). While the original goal of transcutaneous stimulation was screening of patients for spinal cord stimulators, it became apparent quickly that stimulation of the skin was often sufficient to provide pain control alone (Long 1991).

The participation of private industry was an important factor in the early development of this rediscovered modality of TENS and these companies in the USA supported many of the studies. Secondly, the technical features of the instruments that were developed by these companies were an extremely important part of these investigations (Hymes 1984). The decade of the 80's produced more than 200 varieties of TENS and biofeedback devices and dozens of other pain-relieving modalities and techniques. Hymes writing in 1984 commented "it is interesting to note that electrotherapy had little use in the mainstream of modern medicine in the first 70 years of the 20th century in spite of the well-documented use of this modality in previous times". As such, little clinical research and few publications have appeared in the medical literature until recently. Basic research, however, was being conducted (see Licht 1967) who reviewed the available historical literature and reported a comprehensive study citing more than 900 references. For the 20-year period from 1967-1987, Nolan (1991) compiled a bibliography of over 600 papers concerning TENS from clinical and basic science literature. In addition special journal issues and several books have been devoted to this subject (Barr 1991) and since 1967 an increasing number of orthodox and unorthodox health professionals have employed electroanalgesia, (TENS/EAP), in a wide range of acute and chronic pain conditions.

The efficacies of TENS/EAP, as a modality in the treatment of pain has now been well established, even if it cannot be seen as a panacea. It would appear that contemporary orthodox and unorthodox practitioners, over the last two decades, have rediscovered a modality that has been in the hands of various medical/other practitioners for the last two centuries or more. Although electrical stimulation was commonly used in the 18th and 19th centuries, reports were mainly anecdotal, often as case studies, and probably would not have withstood the critical, objective analysis demanded by 20th Century medical science. Albeit contemporary medical science itself is said to have only verified around 15% of its own contemporary clinical interventions (Smith 1991), partly because only 1% of the articles in medical journals are scientifically sound and partly because many treatments have never been assessed at all (Eddy quoted by Smith 1991). The main aim, therefore, of this programme of study is to strengthen the scientific bases of both conventional and unconventional electroanalgesic techniques as we head for the twenty-first century.

1.1.15 Discussion

From the mid 1700's, when investigators began meticulously to explore the effects of static electricity on the human body, to this century, when physicians routinely use electrical instruments to diagnose and heal, electromagnetism and the life sciences have been inextricably linked. Ideas from the past catalyze many of today's technological advances. But for all those ideas transformed into reality, many more still await exploration. Amongst them are important inventions waiting to be rediscovered, such as D'Arsonval's high frequency general anaesthesia. Electroanalgesia has itself been alternatively hailed as a panacea and damned as 'quackery' over more than two centuries of European and American medicine. So why did the 19th and early 20th century physicians reject these treatment methods? Quen (1975b) doubts that this rejection was based on simple selfish economics. Requiring no scientific training or knowledge, their widespread acceptance might have threatened the livelihood of the practising physician. It was also a confirmed observation, in the history of electroanalgesia and other methods such as 'Perkins Tractoration', that electroanalgesia and 'Tractoration' relieved patients, who had not been relieved by conventional treatments of the day (Quen 1963, 1964, 1975a). What factors in the medical and scientific communities determined the responses to these methods. Gunther Stent (1972) suggests that some scientific discoveries are premature because their implications cannot be connected by a series of simple logical steps to canonical, or generally accepted knowledge. This would appear to be the case with electroanalgesia and 'Tractoration' theories that provided no acceptable rationale for the medical communities of the time. It appears that electroanalgesia was met with 'selective inattention' by the medical scientific community as in the case of Perkinism, or as nineteenth century Western acupuncture, receiving no theoretical explanation, was ignored by those who needed a 'normal science' rationale to allow themselves to acknowledge or use it. We see then, a group psychological mechanism for rejection of those methods that do not provide an explanation. The absence of a scientifically orthodox theory of the mode of action, and the consequent implication of the imagination or the placebo effect are the dominant traits of these therapies according to the 19th and early 20th Century scientific communities (see also Saks 1995 for discussion of explanations). A situation which still persists to this day in respect of many alternative and complementary therapeutic interventions, if not in the case of conventional electroanalgesia in the form of TENS, it certainly does in the form of electroacupuncture as an alternative or complementary therapy. It is also an interesting observation that electroanalgesia and other treatment methods, rejected by the scientific medical community, provided relief and palliation for many people who did not benefit from 'normal science' medical treatment. Something was utilised, with apparently remarkable therapeutic efficacy, by the patients who responded to these anomalous methods (Quen 1975b). So today, the effects of electricity on the body are again the subjects of considerable interest among orthodox and unorthodox physicians and engineers alike (Medronic 1977) and that this interest is the motivating force behind this study. For if nineteenth century medicine was unable to distinguish between fallacious theory and therapeutic fact, are we really better able to do so at the end of the twentieth century? If not, which appears to be the case at the time of writing, then we must produce and publish strong research evidence to support, or reject, the theories and efficacies of electroanalgesia before we lose the methods yet again. I end this chapter with a quotation from D'Arsonval (1851-1940 - inventor of a high frequency unit) that I believe is as true today, nearly 100 years later, as it was then:

> *"I am convinced that the therapy of the future will employ heat, light, electricity and agents yet unknown. Toxic drugs shall cede their place to physical agents the employment of which at least has the advantage of not introducing any foreign body into the organism"* Arsene D'Arsonval, 1896.

In the course of reading for, and in the preparation of this section of the thesis, it became of increasing interest that the pioneering work of the Rev John Wesley had made a considerable contribution to electroanalgesia, not only in the eighteenth century but in the influence he had on its development in the centuries that followed. This early application of electrotherapy was well documented in his books, '*The Desideratum'*, '*Primitive Physick'* and also in his Journals. These writings show more than just a passing interest in this new treatment of 'electrifying' his sick followers. The next section is a history of medicine case study and is devoted entirely to Wesley's pioneering work of healing the sick - with an emphasis on his therapeutic use of electricity.

Electrotherapy Thesis - References and Bibliography

AARONSON, N.K., AHMEDZAI, S., BERGMAN, B. *et al.* (1993) The European Organization for Research and Treatment of Cancer QLQ C-30: A quality-of-life instrument for use in international clinical trials in oncology. Journal of the National Cancer Institute, Vol. 85, pp.365- 76.

ABENYAKAR, S. and BONEVAL F. (1994) Increased plasma beta-endorphin concentrations after acupuncture: Comparison of electroacupuncture, Traditional Chinese Acupuncture, TENS and placebo TENS. Acupuncture in Medicine, Vol. 12(1), pp.21-23.

ABRAM, S.E., REYNOLDS A.C. and CHANCELLOR, M.B. (1983) A comparison of analgesic effects of electroacupuncture, placebo electroacupuncture and transcutaneous electrical stimulation. Anaesthesiology Review, Vol. 10(10), pp. 26-31.

ANDERSON, R.T., AARONSON, N.K., WILKIN, D. (1993) Critical review of the international assessments of health-related quality of life. Quality of Life Research, Vol. 2, pp.369-95.

ANDERSONN, S.A., HANSSON, G., HOLMGREN, E. *et al.* (1976) Evaluation of the pain suppressive effect of different frequencies of peripheral electrical stimulation in chronic pain conditions. Acta. Orthop. Scand., Vol. 47, pp.149-57.

ANDREWS, S. (1969) John Wesley and the age of reason. History Today, Vol. 19, pp.25-32.

AUNG, S. (1993) The clinical use of acupuncture in oncology: symptom control. Acupuncture in Medicine, Vol. 12(1), pp.37-40.

AVELLANOSA, A. and WEST, C.R. (1983) Experience with transcutaneous electrical nerve stimulation for relief of intractable pain in cancer patients. Journal of Medicine, Vol. 13(3), pp. 203-13.

AYLING, S. (1979) John Wesley, London, Collins.

BAKX, K. (1991) The 'eclipse' of folk medicine in western society. Sociology of Health, Vol. 13(1), pp.20-38.

BALDRY, P.E. (1993a) Acupuncture, Trigger Points and Musculo-skeletal Pain. London, Churchill Livingstone.

BARAGAR, C.A. (1928) John Wesley and medicine. Annals Medical History, Vol. 10, pp.59-65.

BARDELL. E.B. (1979) Primitive Physick: John Wesley's receipts Pharmacy in History, Vol. 21, pp.111-21.

BARR, J.O., WEISSENBUEHLER, S.A. and BANDATRA, E.J. (1987) Effectiveness and comfort level of transcutaneous electrical nerve stimulation (TENS) in elderly with chronic pain. Physical Therapy, Vol. 67(5), pp.775.

BARR, J.O. (1991) Transcutaneous electrical nerve stimulation for pain management. In: NELSON, M. and CURRIER, D.P. Clinical Electrotherapy. Connecticut, Appleton and Lange, pp.261-316.

BATES, J.A.V. and NATHAN, P.W. (1980) Transcutaneous electrical nerve stimulation for chronic pain. Anaesthesia, Vol. 35, pp.817-22.

BEECHER, H.K. (1955) The powerful placebo, Journal of the American Medical Association, Vol. 159(17), pp.1602-6.

BERLIN, J., MILES, C.G. and CRIGLIANO, M.D. (1997) Does blinding of readers affect the results of meta-analysis? Results of a randomized trial. Online Journal of Current Clinical Trials, Document no 205. and The Lancet, Vol. 350 (9072) Online version without pagination.

BLAIR, A., BURG, J., FORAN, J. *et al.* (1995) Guidelines for application of meta-analysis in environmental epidemiology. Regulatory Toxicology and Pharmacology, Vol. 22, pp.189-197.

BLOM, B. (1995) Holism: Definitions and Principles. International Journal of Alternative and Complementary Medicine, Vol. 13(4), pp.14-17.

BLUESTONE, R. (1985) Ankylosing spondylitis. In: McCARTY, D.J. (Ed) Arthritis and Allied Conditions. (10th Edition), Philadelphia, Lea and Febiger, Vol. 8, pp.19-40.

BORGEN, O. (1988) John Wesley: Sacramental theology no ends without the means. In: John Wesley: Contemporary perspectives. Stacey, J. (Ed), London, Epworth.

BOWMER, J.C. (1959) John Wesley's philosophy of suffering. London Quarterly and Holborn Review, Vol. CLXXXIV, pp.60-6.

BOWSHER, D. (1987) Mechanisms of pain in man. Cheshire, ICI Pharmaceuticals.

BRANTLEY, R.E. (1984) Locke, Wesley, and the Method of English Romanticism. Gainsville, University of Florida Press.

BREEN, AC. (1993) Current concepts in low back pain: a review. Complementary Therapies in Medicine. Vol. 1(4), pp.203-207.

BRILL, M.M. and WHIFFEN, J.R. (1985) Application of 24-hour burst TENS in a back school. Physical Therapy, Vol. 65(9), pp. 1355-57.t

CALAIS de SILVA, F. (1993) Quality of life in prostatic cancer. European Journal of Urology, Vol. 2, (suppl. 2), pp.113-17.

CALLAWAY, C.W. (1974) John Wesley's Primitive Physick. Mayo Clinic Proceedings, Vol. 49, pp.318-24.

CAMPBELL, J. (1995) CSAG report on back pain. British Journal of Therapeutics and Rehabilitation. Vol. 2(9), pp.505-7.

CASSUTO, J., LISS, S. and BENNETT, A. (1993) The use of modulated energy carried on a high frequency wave for the relief of intractable pain. International Journal of Clinical Pharmacy Research, Vol. 13(4), pp. 239-41.

CHALMERS, I. (1993) The Cochrane Collaboration: Preparing, Maintaining, and Disseminating Systematic Review of the Effects of Health Care. Annals of the New York Academy of Science, Vol. 703, pp.156-65.

CHALMERS, I., and ALTMAN, D.G. (1995). Systematic Reviews. London, BMJ Publishing Group.

CHALMERS, T.C., CELANO, P., SACKS, H.S. *et al.* (1983) Bias in treatment assignment in controlled clinical trials, New England Journal of Medicine Vol. 309, pp.1358-61.

CHALMERS, T.C., SMITH, H. Jr., BALACKBURN, B. (1981) A method for assessing the quality of a randomized control trial. Controlled Clinical Trials Vol. 2, pp.31-49.

CHEING, G. and HUI-CHAN, C.W.Y. (1996) Repeated applications of transcutaneous electrical nerve stimulation (TENS) produce cumulative effects on chronic clinical pain but not acute experimental pain in chronic low back pain patients. World Congress of Pain - Abstracts, Aug 18:85.

CHENG, R. (1989) Neurophysiology of Electroacupuncture Analgesia. In: Stux, G. and POMERANZ, B. (Eds.), Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.119-36.

CHENG, R.S.S. and POMERANZ, B. (1987) Electrotherapy of chronic musculoskeletal pain: Comparison of electroacupuncture and acupuncture-like transcutaneous electrical nerve stimulation. The Clinical Journal of Pain, Vol. 2, pp.143-9.

CHILTON, S.A. (1993) TENS for back pain. Acupuncture in Medicine, Vol. 11(1), p.49-50.

COCHRANE COLLABORATION THE, (1997) Preparing, maintaining and disseminating systematic reviews of the effects of health care. Oxford, The Cochrane Collaboration.

COCHRANE LIBRARY (1997/8) The Cochrane Collaboration, [Database on disk and CDROM], Issue 1. Oxford: Update Software, (Updated quarterly).

CODERRE. J., KATZ, J., VACCARINO, A.I. *et al.* (1993) Contribution of central neuroplasticity to pathological pain: review of clinical and experimental evidence. Pain, Vol. 52, pp.259-85.

COLETTA, R., MAGGIOLO, F. and DI TIZIO, S. (1988) Etofenamate and transcutaneous electrical nerve stimulation treatment of painful spinal syndromes. International Journal of Clinical Pharmacy Research, Vol. 8(4), pp. 295-98.

COLI, A. and LARI, S. (1992) Elettroterapia analgesica nelle rachialgie: confronto tra la stimolazione elettrica transcutanea del nervo (TENS) tradizionale e correnti di tipo diverso in associazione... Giornale Ital Riflessot Agopunt, Vol. 4, pp.13-19.

CONE, T.E., Jr. (1978) The Reverend John Wesley as a Pediatrician. Pediatrics, Vol. 61 p.416.

COOK, D.J., GUYATT, G.H., RYAN, G. *et al.* (1993) Should unpublished data be included in meta-analysis? Journal of the American Medical Association, Vol. 268(21), pp.2749-53.

CORINTHIANS 1:12:25-26. The Holy Bible. Authorized King James Version, New York, Oxford University Press, 1972.

CSAG (1994) Back Pain: Report of a Clinical Standards Advisory Group Committee on Back Pain. London HMSO, p35-36.

CULE, J. (1983) The contribution of John Wesley (1703-1791) to medical literature. XXVIIIth International Congress for History of Medicine, Actes Proceedings, Vol. 1, pp.328-31.

CULE, J. (1990) The Rev. John Wesley, M.A. (Oxon), 1703-1791: "The naked empiricist" and orthodox medicine. History Medicine Journal, Vol. 45(1), pp.41-63.

CURNOCK, N (1909) The Journals of the Rev. John Wesley, A.M. Vols. 1-8, Standard Edition, London, Epworth Press.

DAVIS, R. and LENTINI, R. (1975) Transcutaneous nerve stimulation for treatment of pain in patients with spinal cord injury. Surgical Neurology, Vol. 4, pp. 100-1.

DAVIS, P. (1985) Positive pain relief. Nursing Mirror, Vol. 11(11), pp.36-9.

DENNING, M.L. (1988) Retrospective review of long-term transcutaneous nerve stimulation in the management of chronic back pain. Physiotherapy, Vol. 74(3), pp.149-51.

DEYO, R.A., WALSH, N., MARTIN, D.C. *et al.* (1990) Transcutaneous electrical nerve stimulation (TENS) and exercise for chronic low back pain. The New England Journal of Medicine, Vol. 322(23), pp.1627-34.

DOCK, G. (1915) The 'Primitive Physic' of Rev. John Wesley. Journal of the American Medical Association, Vol. 64(8), pp.629-38.

DUNCOMBE, A. and HOPP, J.F. (1991) Modalities of physical treatment: State of the art review. Physical Medicine and Rehabilitation, Vol. 5(3), pp.493-519.

DUNDEE, J.W., GHALY, R.G., FITZPATRICK, K.T.J. *et al.* (1989a) Acupuncture prophylaxis of cancer chemotherapy-induced sickness. Journal of the Royal Society of Medicine, Vol. 82, pp.268-71.

DUNDEE, J.W., GHALY, R.G., BILL, K.M. *et al.* (1989b). Effect of stimulation of the P6 antiemetic point on postoperative nausea and vomiting. British Journal of Anaesthesia, Vol. 63, pp.612-18.

DUNDEE, J.W., GHALY, R.G. and YANG, J. (1990a) Scientific observations on antiemetic action of stimulation of P6 acupuncture point. Acupuncture in Medicine, Vol. 7, pp.2-5.

DUNDEE, J.W. and YANG, J. (1990b) Prolongation of the antiemetic action of P6 acupuncture by acupressure in patients having cancer chemotherapy. Journal of the Royal Society of Medicine, Vol. 83, pp.360-2.

DUNDEE, J.W., YANG, J., McMILLAN, C.M. *et al.* (1991a) Some factors influencing chemotherapy sickness. British Journal of Clinical Pharmacology, Vol. 31, p.601.

DUNDEE, J.W., YANG, J. and McMILLAN, C. (1991b) Non invasive stimulation of P6 antiemetic acupuncture point in cancer chemotherapy. Journal of the Royal Society of Medicine, Vol. 84(4), pp.210-2.

DUNDEE, J.W. (1991c) Acupuncture and postoperative sickness. Anaesthesia, Vol. 46, p.512.

DUNDEE, J.W., YANG, J. and McMILLAN, C.M. (1991d) Non invasive stimulation of P6 antiemetic acupuncture point in cancer chemotherapy. Journal of the Royal Society of Medicine, Vol. 84 (4), pp.210-2.

DUNDEE, J. and McMILLAN, C.M. (1991e) Positive evidence of P6 acupuncture antiemesis. Journal of Postgraduate Medicine, Vol. 67, pp.417-22.

DUNDEE, J.W. and McMILLAN, C.M. (1992a) Some problems encountered in the scientific evaluation of acupuncture antiemesis. Acupuncture in Medicine, Vol. 10(1), pp.2-9.

DUNDEE, J. and McMILLAN, C.M. (1992b) P6 acupressure and postoperative vomiting. British Journal of Anaesthesia, Vol. 68, pp.225-6.

DUNLOP, R. (1964) John Wesley: Medical missionary in the New World. Today's Health, Vol. 42(12), pp.20-23 and pp.70-72.

ERIKSSON, M.B.E., SJOLUND, B.H. and MIELZEN, S. (1979) Long term results of peripheral conditioning stimulation as an analgesic measure in chronic pain. Pain, Vol. 6, pp.325-47.

ERSEK, R.A. (1976) Low-back pain: prompt relief with transcutaneous neuro-stimulation. Orthopaedic Reviews, Vol. 5(12), pp.27-31.

EVANS, A.T., SAMUELS, S.N., MARSHALL, C. *et al.* (1993) Suppression of pregnancy-induced nausea and vomiting with sensory afferent stimulation. Journal of Reproductive Medicine, Vol. 38(8),pp.603-606.

EVANS, G. and RICHARDS S.H. (1996) Low back pain: An evaluation of therapeutic interventions, Bristol, University of Bristol Report.

FARGAS-BABJAK, A.M., POMERANZ, B., ROONEY, P.J. *et al.* Acupuncture-like stimulation with Codetron for rehabilitation of patients with chronic pain syndrome and osteoarthritis. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 17, pp.95-105.

FIELD, G.M., SPANSWICK, C.C., HUNTER, M.E. *et al.* (1991) A comparison of two modes of transcutaneous electrical nerve stimulation in chronic back pain. Pain, Suppl 5:S231(slide 450).

FLOWERDEW M.W. and GADSBY J.G. (1997) A review of the treatment of chronic low back pain with acupuncture-like transcutaneous electrical nerve stimulation and transcutaneous electrical nerve stimulation. Complementary Therapies in Medicine, Vol. 5(4), pp.193-201.

FOLLICK, M.J., SMITH, T.W. and AHERN, D.K. (1985) The sickness impact profile: a global measure of disability in chronic low back pain. Pain Vol. 21, pp.67-76

FOX, E.J. and MELZACK, R. (1976a) Transcutaneous electrical stimulation and acupuncture: comparison of treatment for low-back pain. Pain, Vol. 2, pp.141-48.

FOX, E.J. and MELZACK, R. (1976b) Comparison of transcutaneous electrical nerve stimulation and acupuncture in the treatment of chronic pain. Advances in Pain Research, Vol. 1:797-801.

FRANKS, A., JOHNSON, I., GADSBY, J.G., JARVIS, P. and DEWHURST, F. (1996) Acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) within palliative medicine: A pilot study. Palliative Medicine, vol. 10, p.78.

FRIED, T., JOHNSON, R. and McCRACKEN, W. (1984) Transcutaneous electrical nerve stimulation: Its role in the control of chronic pain. Archives of Physical Medicine and Rehabilitation, Vol. 65, pp.228-31.

FULDER, S. (1989) The Handbook of Complementary Medicine. Kent, Coronet, pp.129-30.

GADSBY, J.G. (1991) Kirlian Photography: a critical analysis. Complementary Medical Research, Vol. 5(1), pp.23-28

GADSBY, J.G. (1993) Kirlian Photography diagnosis - a recent study. Complementary Therapies in Medicine, Vol. 1(4), pp.179-84.

GADSBY, J.G. (1996) Rev. John Wesley MA: Holistic healing, electrotherapy and complementary medicine. Loughborough, Teamprint.

GADSBY, J.G., FRANKS, A., JARVIS. P., DEWHURST, F. (1997) Acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) within palliative medicine: Complementary Therapies in Medicine Vol. 5, pp. 13-18.

GADSBY J.G, FLOWERDEW M.W, (1997) The effectiveness of transcutaneous electrical nerve stimulation (TENS) and acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) in the treatment of patients with chronic low back pain. In: Bombardier C, Nachemson A, Deyo R, de Bie R, Bouter L, Shekelle P, Waddell G, Roland M, Guillemin F (Eds.) CMSG Back Module of The Cochrane Database of Systematic Reviews, [updated 8 January 1998]. Available in The Cochrane Library [database on disk and CDROM]. The Cochrane Collaboration; Issue 1. Oxford: Update Software; 1998. Updated quarterly.

GADSBY J.G, FLOWERDEW M.W, (1997): Review: Transcutaneous electrical nerve stimulation reduces pain and improves range of movement in chronic low-back pain [Abstract**].** Evidence-Based Medicine. 1997 July-Aug; 2(4): Abstract of GADSBY JG, FLOWERDEW MW, (1997) The effectiveness of transcutaneous electrical nerve stimulation (TENS) and acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) in the treatment of patients with chronic low back pain. In: Bombardier C, Nachemson A, Deyo R, de Bie R, Bouter L, Shekelle P, Waddell G, Roland M, Guillemin F ((Eds.).) CMSG Back Module of The Cochrane Database of Systematic Reviews, [updated 22 May 1997]. Available in The Cochrane Library [database on disk and CDROM]. The Cochrane Collaboration; Issue 3. Oxford: Update Software; 1997. Updated quarterly.

GADSBY G, FLOWERDEW M.W. (1997) Nerve stimulation for low back pain - a review. Nursing Standard, Vol. 43(11), pp32-3.

GADSBY, J.G. and DEWHURST F. (1998) The Reverend John Wesley's contribution to the evolution of alternative and holistic healing. Epworth Review. In press.

GARRISON, D.W. and FOREMAN, R.D. (1994) Decreased activity of spontaneous and noxiously evoked dorsal horn cells during transcutaneous electrical nerve stimulation (TENS). Pain, Vol. 58, pp.309-15.

GEMIGNANI, G., OLIVIERI, I., RUJI. G. *et al.* (1991) Transcutaneous electrical nerve stimulation on ankylosing spondylitis: a double-blind study. Arthritis and Rheumatism, Vol. 34(6), pp.788-9.

GHALY, R.G., FITZPATRICK, K.T.J. and DUNDEE, J.W. (1987). Antiemetic studies with traditional Chinese acupuncture - a comparison of manual needling with electrical stimulation and commonly used antiemetics. Anaesthesia, Vol. 42, pp.1108-10.

GREGOIRE, G., DERDERIAN, F. and LE LORIER, J. (1995) Selecting the language of the publications included in a meta-analysis: Is there a tower of Babel bias? Journal of Clinical Epidemiology, Vol. 48, pp.158-63,

GUNN, C.G. and MILLBRANDT, W.E. (1975) Review of 100 patients with 'low-back sprain' treated by surface electrode stimulation of acupuncture points. American Journal of Acupuncture, Vol. 3(3): 224-32.

HAAS, J.W. (1994) John Wesley's views of science and Christianity: An examination of the charge of antiscience. Church History, Vol. 63, pp.378-92.

HAN, J. (1989) Central neurotransmitters and acupuncture analgesia. In: Stux, G. and POMERANZ, B. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.7-34.

HAN, J.S., CHEN, X.H., SUN, S.L., *et al.* (1991) Effect of low and high-frequency TENS on Met-enkephalin-Arg-Phe and dynorphin A immunoreactivity in human lumbar CSF. Pain, Vol. 47, pp.295-98.

HARRGITT, C.W. (1927) John Wesley and science. Methodist Review, Vol. CX, pp.383-93.

HAZOURI, L.A. and MUELLER, A.D. (1950) Pain threshold studies on paraplegic patients. Archives of Neurolgy and Psychiatry, Vol. 64(5), pp.607-13.

HERIN, R.A. (1968) Electroanesthesia, Activitas Nervosa Superior, Vol. 10, pp.439-54.

HERMAN, E., WILLIAMS, R., STRATFORD, P. *et al.* (1994) A randomized controlled trial of transcutaneous electrical nerve stimulation (CODETRON) to determine its benefits in a rehabilitation program for acute occupational low back pain. Spine, Vol. 19(5), pp.561-8.

HERY, A.K. and SRIVASTAVA, O.P. (1987) Comparative study of epidural anesthesia and transcutaneous nerve stimulation for the management of low backache in India. Abstract of Poster. Pain. Vol. 4 (Suppl), S365.

HETHERINGTON, J. (1997) The Cochrane Collaboration Steering Group. In: The Cochrane Library [database on disk and CDROM]. The Cochrane Collaboration. Oxford: Update Software; 1997. Updated quarterly.

HORNE, J.A. (1995) Sleep research: A lecture given to the Institute of Biology, Loughborough University, 19th October 1995.

HSIEH, C-YU. J., PHILLIPS, R.B., ADAMS, A.A. *et al.* Functional outcomes of low-back pain: comparison of four treatment groups in a randomized controlled trial. Journal of Manipulative and Physiological Therapeutics, Vol. 15(1), pp. 4-9.

HUGHES, T.W., SMITH, T.W., KOSTERLITZ, H.W. (1975) Identification of two related pentapeptides from the brain with potent opiate agonist activity. Nature, Vol. 258, pp.577-9.

HUNTER, R.A. (1956) A brief review of the use of electricity in psychiatry (with special reference to John Wesley). British Journal Physical Medicine, Vol. 20(5), pp.98-100.

HYMES, A. (1984) Introduction: A review of the historical uses of electricity. In: MANNHEIMER, J.S. and LAMPE, G. (1984), Clinical Transcutaneous Electrical Nerve Stimulation, Philadelphia, Davis Company, pp.1-5.

INDECK, W. and PRINTY, A. (1975) Skin application of electrical impulses for relief of pain. Minnesota Medicine Vol. 58, pp.305-9.

JADAD, A.R., MOORE, A., CARROL, D. *et al.* (1996) Assessing the quality of reports of randomized controlled trials; Is blinding necessary? Controlled Clinical Trials, Vol. 17, pp.1-12

JARVIS, P. GADSBY, J.G., and DEWHURST F. (1996) TENS and ALTENS: A Review. Statistical Issues in Biopharmaceutical Environments Conference. Poster Presentation July 1996, De Montfort University, Leicester.

JARZEM, P., HARVEY, E.J., ARCARO, N. *et al.* (1997) Transcutaneous electrical nerve stimulation for non-acute low back pain. A randomized double-blind study of conventional, Nu-Wavefor, acupuncture-type and sham therapies. American Academy of Orthopaedic Surgeons 1997 Annual Meeting - Scientific Program. Paper 315:1-17.

JEANS, M.E. (1979) Relief of chronic pain by brief, intense, transcutaneous electrical stimulation - A double-blind study: In Bonica, J.J. *et al.* Advances in Pain Research and Therapy. Vol. 3, New York, Raven Press, pp. 601-606.

JENSEN, MP., KAROLY, P. and BRAVER, S. (1986) The measurement of clinical pain intensity: a comparison of six methods. Pain, Vol. 27, pp.117-26.

JOHANSSON, F., ALMAY, B.G.L., VON KNORRING, I. *et al.* Predictors for the outcome of treatment with high frequency transcutaneous electrical nerve stimulation. Pain, Vol. 6, pp.55-61.

JOHNSON, M.I. ASHTON, C.H. and THOMPSON, J.W. (1992) Long-term use of transcutaneous electrical nerve stimulation at Newcastle Pain Relief Clinic. Journal of the Royal Society of Medicine, Vol. 85, pp.267-8.

JOHNSON M.I., ASHTON C.H. and THOMPSON J.W. (1992) The clinical use of TENS. Journal of Orthopaedic Medicine, Vol. 14(1), pp.3-12.

JOHNSON, M.I. ASHTON, C.H. and THOMPSON, J.W. (1993) A prospective investigation into factors related to patient response to transcutaneous electrical nerve stimulation (TENS) - the importance of cortical responsivity. European Journal of Pain, Vol. 14(1), pp.1-10.

KANE, K. and TAUB, A. (1975) A History of Local Electrical Analgesia, Pain Vol. 1, pp.125-38

KELLAWAY, P. (1946) The William Osler Medal Essay: The part played by electric fish in the early history of bioelectricity and electrotherapy. Bulletin History Medicine, Vol. 20, pp.112-37.

KING, L.S. (1958) The Medical World of the Eighteenth Century, New York, Krieger.

KING, L.S. (1974) Hideyo Noguchi Lecture: George Cheyne, mirror of eighteenth century medicine. Bulletin History Medicine, Vol. 48, pp.517-39.

LAITINEN, J. (1976) Acupuncture and transcutaneous electrical nerve stimulation in the treatment of chronic sacrolumbalgia and ischialgia. American Journal of Chinese Medicine, Vol. 4(2), pp.169-75.

LAMPE, J. and DUNN, B. (1987) Symmetrical biphasic TENS waveform for treatment of back pain. Clinical Journal of Pain, Vol. 3, pp.145-51.

LAPEER, G.L. (1986) High-intensity transcutaneous nerve stimulation at the Hoku acupuncture point for relief of muscular headache pain. The Journal of Craniomandibular Practice, Vol. 4(2), pp.164-71.

LE BARS, D., DICKENSON, J.H. and BESSON, J-M. (1979a) Diffuse Noxious Inhibitory Controls (DNIC). 1. Effects on dorsal horn convergent neurones in the rat. Pain, Vol. 6, pp. 282-304.

LE BARS, D. DICKENSON, J.H. and BESSON, J-M. (1979b) Diffuse Noxious Inhibitory Controls (DNIC). 2. Lack of effect on non-convergent neurones, supraspinal involvement and theoretical implications. Pain, Vol. 6, pp. 305-27.

LE BARS, D. (1989) Neurophysiological mechanisms involved in the pain-relieving effects of counterirritation and related techniques including acupuncture. In: Stux, G. and POMERANZ, B. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.79-112.

LEDERGERBER, C.P. (1979) Transcutaneous electroacupuncture and electroanalgesia. American Journal of Acupuncture, Vol. 2(7), pp.137-36.

LEHMANN, T.R., RUSSELL, D.W., and SPRATT, K.F. (1983) The impact of patients with nonorganic physical findings on a controlled trial of transcutaneous electrical nerve stimulation and electroacupuncture. Spine, Vol. 8(6), pp.625-34.

LEHMANN, T.R., RUSSELL, D.W., and SPRATT, K.F. (1986) Efficacy of electroacupuncture and TENS in the rehabilitation of chronic low back pain patients. Pain, Vol. 26 (3), pp.277-90.

LERNER, F.N. and KIRSH, D.L. (1981) Micro-stimulation and placebo effect. ACA Journal of Chiropractic, Vol. 15, pp.S102-S106.

LEWITH, G.T. and MACHIN, D. (1982) On the evaluation of the clinical effects of acupuncture. Pain, Vol. 16, pp.111-27.

LICHT, S. (1959) Therapeutic Electricity and Ultraviolet Irradiation: History of Electrotherapy. New Haven, Conn, Physical Medicine Library 4:1. Elisabeth Licht.

LINZER, M. and LONG, D. (1976) Transcutaneous neural stimulation for relief of pain. IEEE Transactions on Biomedical Engineering, Vol. 23(4), pp.341-5.

LOESER, J.D., BLACK, R.G. and CHRISTMAN, A. (1975) Relief of pain by transcutaneous stimulation. Journal of Neurosurgery, Vol. 42, pp.308-14.

LONG, D.M. (1974) External electrical stimulation. Minnesota Medicine, March 1974, pp.195-8.

LONG, D.M. (1979) Transcutaneous electrical stimulation for relief of chronic pain. In BONICA, J.J. *et al.* (Eds.) Advances in Pain Research and Therapy Vol. 3, New York, Raven Press, pp.593-9.

LONG, D. (1991) Fifteen Years of transcutaneous electrical stimulation for pain control. Stereotactic Functional Neurosurgery, Vol. 56, pp.2-19.

LU. S. (1993) Acupuncture and Moxibustion in the treatment of dermatoses. Journal of Traditional Chinese Medicine, Vol. 13(1), pp.69-75.

LUNDEBERG, T. (1984) A comparative study of the pain alleviating effect of vibratory stimulation, transcutaneous electrical nerve stimulation, electroacupuncture and placebo. American Journal of Chinese Medicine, Vol. 12(4), pp.72-9.

LUNDEBERG, T. (1984) The pain suppressive effect of vibratory stimulation and transcutaneous electrical nerve stimulation (TENS) as compared to aspirin. Brain Research, Vol. 294, pp.201-9.

MACDONALD, A.J.R., MACRAE, K.D., MASTER, B.R. *et al.* (1983) Superficial acupuncture in the relief of chronic low back pain. A placebo-controlled randomised trial. Annals of the Royal College of Surgeons England, Vol. 65, pp.44-6.

MAGBAGBEOLA, J., KHAWAKI, Y.N., AL-NANDI, M. *et al.* Transcutaneous electrical nerve stimulation (TENS) for relieving low-back pain in Saudi Arabia, Eastern Province, Pain, Vol. 4(Suppl), Abstract of Poster, p.S368,

MADDOCKS, M. (1988) Health and healing in the ministry of John Wesley; in Stacey, J. Ed, John Wesley: Contemporary Perspectives, London, Epworth.

MANNHEIMER, J.S. and LAMPE, G. (1984) Clinical Transcutaneous Electrical Nerve Stimulation, Philadelphia, Davis Ltd.

MARCHAND, S. CHAREST, J., LI, J. *et al.* (1993) Is TENS purely a placebo effect? A controlled study on chronic low back pain. Pain, Vol. 54(1), pp.99-106.

MAYER, D.J., PRICE, D.D. and RAFII, A. (1977) Antagonism of acupuncture analgesia in man by the narcotic antagonist naloxone. Brain Research, Vol. 121, pp.368-72.

MAYOR, D. (1997) The endorphin theory of acupuncture. The Electrotherapist, Vol. 4(1), pp12-25.

MCDONNELL, D. (1980) TENS in treating chronic pain. AORN Journal, Vol. 32(3), pp.401-10.

McMILLAN, C.M., DUNDEE, J.W. and ABRAM, W.P. (1991) Enhancement of the antiemetic action of ondansetron by transcutaneous electrical stimulation of the P6 antiemetic point, in patients having highly emetic cytotoxic drugs. British Journal of Cancer, Vol. 64, pp.971-2.

McMILLAN, C.M. and DUNDEE, J.W. (1991) The role of transcutaneous electrical stimulation of Neiguan antiemetic acupuncture point in controlling sickness after cancer chemotherapy. Physiotherapy, Vol. 77, pp. 499-502.

McMILLAN, C.M., DUNDEE, J.W. and ABRAM, W.P. (1991b) Enhancement of the antiemetic action of ondansetron by transcutaneous electrical stimulation of the P6 antiemetic point, in patients having highly emetic cytotoxic drugs. British Journal of Cancer, Vol. 64, pp.971-2.

McMILLAN, C.M. (1994) Transcutaneous electrical stimulation of Neiguan anti- emetic acupuncture point in controlling sickness following opioid analgesia in major orthopaedic surgery. Physiotherapy, Vol. 80(1), pp.5-9.

McNEAL, D.R. (1977) 2000 Years of electrical stimulation. In: Hambrecht FT, Reswick JB, (Eds.)Functional Electrical Stimulation: Applications in Neural Prostheses. New York, Marcel Dekker, pp.301-35.

MEDRONIC, INC. (1977), Electrotherapy in the United States, Minneapolis, Medronic Inc., unpaginated.

MELZACK, R. and WALL, P. (1965) Pain mechanisms: A new theory. Science, Vol. 150(3699), pp.971-9.

MELZACK, R. (1975) Prolonged relief of pain by brief, intense transcutaneous somatic stimulation. Pain Vol. 1, pp,357-73.

MELZACK, R., JEANS, M.E., STRATFORD, J.G. *et al.* (1980) Ice massage and transcutaneous electrical stimulation: Comparison of treatment for low-back pain. Pain, Vol. 9, pp.209-17.

MELZACK, R. VETERE, P., FINCH, L. *et al.* (1983) Transcutaneous electrical nerve stimulation for low back pain. Physical Therapy, Vol. 63(4), pp.489-93.

MENZIES, S.W. (1980) Rev. John Wesley, A.M. Scalpel and Tongs, Vol. 24, pp.133-5.

MERSKEY, H. and EVANS, P.R. (1975) Variations in pain complaint threshold in psychiatric and neurological patients with pain. Pain, Vol. 1, pp.73-9.

MERSKEY, H. (1979) Pain terms: a list with definitions and notes on usage. Recommended by the IASP sub-committee on taxonomy. Pain, Vol. 6, pp.249-52.

MEYLER, W.J., de JONGSTE, M.J.L. and ROLF, C.A.M. (1994) Clinical evaluation of pain treatment with electro-stimulation: A study of TENS in patients with different pain syndromes. The Clinical Journal of Pain, Vol. 10, pp.22-27.

MOHER, D., JADAD, A.J., NICHOL, G. *et al.* (1996a) Assessing the quality of randomized controlled trials, International Journal of Technology Assessment in Health Care, Vol. 12(2), pp.195-207.

MOHER, D., FORTIN, P., JADAD, A.R. *et al.* (1996b) Completeness of reporting of trials published in languages other the English: Implications for conduct and reporting of systematic reviews. Lancet, Vol. 347, pp.263-6.

MOONEY, V. and CAIRNS, D. (1978) Management in the patient with chronic low back pain. Orthopedic Clinics of North America, Vol. 9(2), pp.543-57.

MOORE, S.R. and SHURMAN, J. (1997) Combined neuromuscular electrical stimulation and transcutaneous electrical nerve stimulation for treatment of chronic back pain: A double-blind repeated measures comparison. Archives of Physical Medicine and Rehabilitation, Vol. 78, pp.55-9.

MOORE, D.E. and BLACKER, H.M. (1983) How effective is TENS for chronic pain. American Journal of Nursing, Vol. 83(8), pp.1175-77.

MOSBY'S, (1994) Medical, Nursing and Allied Health Dictionary. USA, Mosby-Year Book.

MULROW, C.D. and OXMAN A.D. (Eds.), (1997a-j) Cochrane Collaboration Handbook [updated 1 March 1997]. Sections 1-10 In: The Cochrane Library [database on disk and CDROM]. The Cochrane Collaboration. Oxford: Update Software; 1997. Updated quarterly.

NACHEMSON, A. (1983) Work for all: for those with low back pain as well. Clinical Orthopaedics, Vol. 179, pp.77-85.

NATHAN, P.W. (1976) The gate-control theory of pain: A critical review. Brain, Vol. 99. pp.123-58.

NBPA (1996) Back Facts: Back pain at work. National Back Pain Association Fact Sheet.

NIEZGODA, H.E. and PATER, J.L. (1993) A validation study of the domains of the core EORTC Quality of Life Questionnaire. Quality of Life Research, Vol. 2, pp.319-25.

NOLAN, M.F. (1991) The Tens Literature. Virginia, American Physical Therapy Association, pp.1-43.

NOVA ET VETERA (1902) A medical tract by John Wesley. British Medical Journal, Vol. i (March 20th), pp.799-800.

NOVA ET VETERA (1908) John Wesley on the art of healing. British Medical Journal, Vol. I (June30th), pp.799-800.

OSTROWSKI, M.J. (1979) Pain control in advanced malignant disease using transcutaneous nerve stimulation. British Journal of Clinical Practice, Vol. 33, pp.157-62.

OTT, P.W. (1980a) A corner of history: John Wesley and the non-naturals. Preventative Medicine, Vol. 9, pp.578-84.

OTT, P.W. (1980b) John Wesley on health: A word for sensible regimen. Methodist History, Vol. 18, pp.193-204.

OTT, P.W. (1989) John Wesley on mind and body: Towards an understanding of health as wholeness. Methodist History, Vol. 27(2), pp.61-72.

OTT, P.W. (1991) John Wesley on health as wholeness. Journal of Religion and Health, Vol. 30(1), pp.43-57.

OXMAN, A. (Ed.) (1994) The Cochrane Collaboration Handbook. Section VI: Preparing and maintaining systematic reviews. (The Cochrane Collaboration Tool Kit), Oxford, U.K.

PAYNE, L. (1985). A doctor in the house. Journal Royal College of Physicians, Vol. 19(1), pp. 55-6.

PELLOWE, W.C.S. (1927) Wesley's use of science. Methodist Review, Vol. CX, pp.394-403.

POMERANZ, P. (1989) Acupuncture research related to pain, drug addiction and nerve regeneration. In: POMERANZ, B. and STUX, G. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.35-52.

POMERANZ, B. and CHIU, D. (1976) Naloxone blocks acupuncture analgesia and causes hyperalgesia: endorphin is implicated. Life Science, Vol. 19, pp. 316-20.

POMERANZ, B.(1987) Scientific Bases of Acupuncture. In: Stux G, Pomeranz B. Acupuncture Textbook and Atlas. Berlin; Springer-Verlag, pp.1-20.

POMERANZ, B. and STUX, G. (Eds.)(1989) Scientific Bases of Acupuncture, Berlin, Springer-Verlag.

POMERANZ, B. (1990) Scientific Bases of Acupuncture. In: Stux, G., and Pomeranz, B. Basics of Acupuncture. Berlin; Springer-Verlag, pp.4-36.

POMERANZ, B. (1995) Scientific Bases of Acupuncture. In: Stux, G., Pomeranz, B. and Sahm, K. Basics of Acupuncture. Berlin, Springer-Verlag, pp.1-36.

POMERANZ, B. (1996) A seminar presented by the British College of Acupuncture, London, October. Reported by: MAYOR, D.F. (1997) The endorphin theory of acupuncture. The Electrotherapist, Vol. 4(2), pp.12-25.

PONTINEN, P.J. (1979) Acupuncture in the treatment of low-back pain. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 4, pp.53-7.

POPE, M.H., PHILLIPS, R.B., HAUGH, L.D. *et al.* A prospective randomised three-week trial of spinal manipulation, transcutaneous muscle stimulation, massage and corset in the treatment of subacute low back pain. Spine, Vol. 19(22), pp.2571-7.

PORTER, R. (1987) Medical fringe and medical orthodoxy 1750-1850. London, Croom-Helm.

PORTER. R. (1989) Health for Sale: Quackery in England 1660-1850, Manchester and New York, Manchester University Press.

PRICE. A.P. (1984) The frequency of electroacupuncture determines the nature of endogenous opioid release. In: MULLER, E.E. and GENAZZANI, A.R. (Eds.)Central and Peripheral Endorphins: Basic and Clinical Aspects. New York, Raven Press, pp.157-60.

PROCACCI, P., ZOPPI, M. and MARESCA, M. (1982) Transcutaneous electrical stimulation in low-back pain: a critical evaluation. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 7, pp.1-6.

QUEN, J.M. (1963). Elisha Perkins, Physician, Nostrum-vendor, or Charlatan? Bulletin of the History of Medicine, Vol. 37, pp.159-66.

QUEN, J.M. (1964). Perkinism and terrible Tractoration. Journal of the History of Medicine and Allied Sciences, Vol. 19, pp. 296-7.

QUEN, J.M. (1975a). Case Study in nineteenth century scientific rejection: Mesmerism, Perkinism, and Acupuncture. Journal of the History of the Behavioural Sciences, Vol. 11(2), pp.149-156.

QUEN, J.M. (1975b) Acupuncture and western medicine. Bulletin of the History of Medicine. 49,(2), pp.196-205.

RACK, H.D. (1982) Doctors, Demons and Early Methodist Healing. In SHEILS, W.J. (ed.) The Church and Healing. Papers read at the 20th summer meeting and the 21st winter meeting of the Ecclesiastical History Society. Edited by W.J.S. (Studies in Church History, Vol.19).

RACK, H.D. (1993) Young Mr Wesley, old Mr Wesley: The making of an evangelist. Journal Lincolnshire Methodist Society, Vol. 4(5) pp.107-14.

RACK, H.D. (1996) Personal communication.

RATHER, L.J. (1968) The "six things non-natural": A note on the origins and fate of a doctrine and a phrase. Clio Medica, Vol. 3, pp.337-47.

REEVE J. MENON, D. and CORABIAN, P. (1995/6) Transcutaneous electrical nerve stimulation (TENS) - a Technology Assessment. Canada, Canadian Coordinating Office for Health Technology Assessment.

RICHARDSON, P.H. and VINCENT, C.A. (1986) Acupuncture for the treatment of pain: a review of evaluative research. Pain, Vol. 24, pp. 15-40.

RICHARDSON, R.R., ARBIT, J. and ZAGAR, R. (1980) Evaluation of transcutaneous electrical neurostimulation. Journal of Psychosomatic Research, Vol. 24, pp.79-83.

RICHARDSON, R.R., ARBIT, J., SEQUEIRA, E.B. *et al.* Transcutaneous electrical neurostimulation in functional pain. Spine, Vol. 6(2), pp.185-8.

RICHARDSON, S.Y. (1996) Personal Communications

RICO, R.C. and TRUDNOWSKI, R.J. (1983) Studies with electro-acupuncture. Journal of Medicine, Vol. 13(3), pp. 247-51.

RINGDAL, G.I. and RINGDAL, K. (1993) Testing the EORTC Quality of Life Questionnaire on cancer patients with heterogenous diagnoses. Quality of Life Research, Vol. 2, pp.129-40.

ROBINSON, A.J. (1996) Transcutaneous electrical nerve stimulation for the control of pain in musculoskeletal disorders. Journal of Orthopaedic and Sports Physical Therapy, Vol. 24(4):208-226.

ROGAL, S.J. (1978) Pills for the poor: John Wesley's Primitive Physick. Yale Journal of Biology and Medicine, Vol. 51, pp.81-90.

ROGAL, S.J. (1989) Electricity: John Wesley's "Curious and important subject" Eighteenth-century Life, Vol. 13, pp.79-90.

RUTKOWSKI, B., NIEDZIALKOWSKA, T. and OTTO, J. (1977) Electrical stimulation in chronic low-back pain. British Journal of Anaesthesia, Vol. 49, pp.629-32.

ROSSETTI, L. (1993) Is proper methodology associated with the use of a clinically relevant outcome measure. Online Journal of Current Clinical Trials. (Doc. No 100).

ROUSSEAU, G.S. (1968) John Wesley's Primitive Physic (1747). Harvard Library Bulletin, Vol. 16, pp.242-56.

SAAL, J.A. and SAAL, J.S. (1991) Later stage management of lumbar spine problems. Physical Medicine Rehabilitation Clinics of North America, Vol. 2(1), pp.205-21.

SACKETT, D.L. (Ed), (1994) The Cochrane Collaboration Handbook. The Cochrane Collaboration. Oxford, UK.

SACKETT, D.L., ROSENBERG, W.M.C., GRAY, J.A.M., HAYNES, R.B. and RICHARDSON, W.S. (1996) Evidence-based Medicine: what it is and what it isn't. British Medical Journal, Vol. 312:71-2.

SACKETT, D.L., (1997a) The Centre for Evidence-Based Medicine - Prospectus, Preamble. Oxford University, Oxford, UK. Internet address - http://cebm.jr2.ox.ac.uk/docs/prospect.htm, pp1-6.

SACKETT, D.L., RICHARDSON, W.S., ROSENBERG, W., HAYNES, R.B. (1997b) Evidence-based Medicine: How to practice and teach EBM. London, Churchill Livingstone.

SAKS, M. (1995) Professions and the Public Interest: Medical Power, Altruism and Alternative Medicine. London, Routledge.

SAKS, M. (1996) From quackery to complementary medicine: The shifting boundaries between orthodox and unorthodox medical knowledge. In: CANT, S and SHARMA, U. (Eds.), Complementary and Alternative Medicine, London, Free Association Books; pp.27-43.

SANDFORD, P. (1996) Completeness of reporting trials published in languages other than English. (letter), The Lancet, Vol. 347, pp.907-8.

SCHECHTER, D.S. (1971) Origins of electrotherapy. New York State Journal of Medicine, (May 1st), pp.997-1008.

SCHILLER, F. (1981) Reverend Wesley, Doctor Marat and their electric fire. Clio Medica, Vol. 15(3/4), pp.159-176.

SCHOFIELD, R.E. (1953) John Wesley and science in 18th Century England. Isis, Vol. 44, pp.331-40.

SCHUSTER, G., INFANTA, M. (1980) Pain relief after low-back surgery: the efficacy of transcutaneous electrical nerve stimulation. Pain, Vol. 8, pp.299-302.

SHEALY, C.N. (1974) Transcutaneous electrical stimulation for control of pain. Clinical Neurosurgery, Vol. 21, pp.269-77

SHEALY, C.N. (1974) Six years experience with electrical stimulation for control of pain. Advances in Neurology, Vol. 4, pp.775-82.

SHEALY, C.N. and MAULDIN, C.C. Jr. (1994) Modern medical electricity in the management of pain. Clinics in Podiatric Medicine and Surgery, Vol. 11(1), pp.161-75.

SMITH, R. (1991) Editorial: Where is the wisdom...? The poverty of medical evidence. British Medical Journal, Vol. 303, pp.798-9.

SODIPO J.O.A. (1981) Transcutaneous electrical nerve stimulation and acupuncture: Comparison of therapy for low-back pain. Pain, Supp1, Abstract S337.

SPRANGERS, M.A.G., CULL, A., BJORDAL, K. *et al.* (1993) The European Organisation for Research and Treatment of Cancer approach to quality of life assessment: guidelines for developing questionnaire modules. Quality of Life Research, Vol. 2, pp.287-95.

STAINBROOK E. (1948) The use of electricity in psychiatric treatment during the nineteenth century, Bulletin History Medicine, Vol. 22, pp.156-77.

STAMP, J.S. (1845) The Rev Charles Atmore (Notes to Text). Wesleyan Methodist Magazine, Vol. 68, pp.9-10.

STENT, G.S. (1972). Prematurity and Uniqueness in Scientific Discovery. Scientific American, Dec, pp.84-93.

STEWART, A.L., GREENFIELD, S., HAYS, R.D. *et al.* (1989) Functional status and well-being of patients with chronic conditions. Journal of the American Medical Association Vol 262(7), pp.907-913.

STEWART, D. (1969) John Wesley, The Physician. Wesleyan Theological Journal, Vol. 4, pp.27-38.

STILLINGS, D. (1973) ARTIFACT: John Wesley: Philosopher of electricity. Medical Instrumentation, Vol. 7(5), pp.307-8.

STILLINGS, D. (1973a) ARTIFACT: The piscean origin of medical electricity. Medical Instrumentation, Vol. 7 (2), pp.163-4.

STILLINGS, D. (1974) A short history of electrotherapy in England to 1880, Medronic Publishing. USA, pp.1 -40.

STILLINGS, D. (1974a) ARTIFACT: John Wesley: Electrotherapist. Medical Instrumentation, Vol. 8(1), p.66.

STILLINGS, D. (1975a) A survey of the history of electrical stimulation for pain to 1900. Medical Instrumentation, Vol. 9 (6), pp.255-9.

STILLINGS, D. (1975b) ARTIFACT: Electrical stimulation for foot drop, 1772. Medical Instrumentation Vol. 9 (6), pp.276-7.

STUX, G. and POMERANZ, B. (1987) Acupuncture: Textbook and Atlas, Berlin Heidleberg, Springer-Verlag, p.86.

STUX, G. and POMERANZ, P. (1991 and 1995) Basics of Acupuncture. Berlin, Springer Verlag.

SWEETMAN, B.J., HEINRICH, I. and ANDERSON, J.A.D. (1992) Clinical tests and patterns of low-back pain. Journal of Orthopaedic Rheumatology Vol. 5, pp.209-22.

THOMPSON, J.W. (1988) Acupuncture or TENS for pain relief? Scientific and clinical comparisons. New Zealand Journal of Acupuncture, August 88, pp. 21-33.

THORSTEINSSON, G., STONNINGTON, H.H., STILLWELL, G.K. *et al.* (1977) Transcutaneous electrical stimulation: A double-blind trial of its efficacy for pain. Archives of Physical Rehabilitation, Vol. 58, pp.8-12.

THORSTEINSSON, G. STONNINGTON, H.H., STILLWELL, G.K. *et al.* (1978) The placebo effect of transcutaneous electrical stimulation. Pain, Vol. 5, pp.31-41.

THORSTEINSSON, G. (1987) Chronic pain: Use of TENS in the elderly. Geriatrics, Vol. 42(12), pp.75-82.

THURIN, E., MEEHAN, P.F, and GILBERT, B.S. (1980) Treatment of pain by transcutaneous electric nerve stimulation in general practice. Medical Journal of Australia, Vol. 5, pp.70-1.

TIMM, K.E, (1994) A randomized-control study of active and passive treatments for chronic low-back pain following L5 laminectomy. Journal of the Society of Physical Therapists, Vol. 20(6), pp.276-86.

TOURNIER, P. (1957) The Meaning of Persons, London, SCM Press Ltd.

TOURNIER, P. (1972) Learning To Grow Old, London, SCM Press Ltd.

TULGAR, M., MCGLONE, F., BOWSHER, D. *et al.* (1991) Comparative effectiveness of different stimulation modes in relieving pain. Part I. A pilot study. Pain, Vol. 47, pp.151-5.

TULGAR, M., MCGLONE, F., BOWSHER, D. *et al.* ((1991) Comparative effectiveness of different stimulation modes in relieving pain. Part II. A double-blind controlled long-term clinical trial. Pain, Vol. 47, pp.157-62.

TURNER, J.A., DEYO, R.A., LOESER, J.D. *et al.* (1994) The importance of placebo effects in pain treatment and research, Journal of the American Medical Association, Vol. 271(20): pp.1609-14.

TURRELL. W.J. (1921) Three electrotherapists of the eighteenth century: John Wesley, Jean Paul Marat and James Graham. Annals of Medical History, Vol. 3, pp.361-7.

ULETT, G.A. (1989) Studies supporting the concept of physiological acupuncture. In: Stux, G. and POMERANZ, B. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag. pp.177-96.

van DOORN, J.N. and SPIERIJK, J. (1981) Transcutaneous electrical nerve stimulation for relief of pain. Acta Anaesth Belgium, Vol. 3(1), pp.21-31.

van TULDER, M.W., KOES, B.W. and BOUTER, L.M. (1996) Low back pain in primary care, Amsterdam, EMGO Institute.

VENTAFRIDDA, V., SGANZERLA, E.P., FOCHI, C. *et al.* (1979) Transcutaneous nerve stimulation in cancer pain. In: BONICA, J.J. and VENTAFRIDDA, V. (Eds.)Advances in Pain Research and Therapy Vol. 2. New York, Raven Press, pp.509-15.

VERRILL, P. (1990) Does the gate theory of pain supplant all others. British Journal of Hospital Medicine, Vol. 43, p.325.

VICKERS, A. (1995) Critical appraisal: How to read a clinical research paper. Complementary Therapies in Medicine Vol.3(3), pp.158-66

VICKERS, J.A. (1996) Personal Communication.

VINCENT, C.A. (1989) The methodology of controlled trials of acupuncture. Journal of the British Medical Acupuncture Society, Vol. 6, pp.9-13.

VINCENT, C.A. and RICHARDSON, P.H. (1986) The evaluation of therapeutic acupuncture: concepts and methods. Pain, Vol. 24, pp.1-13.

WALL, P.D. and SWEET, W.H. (1967) Temporary abolition of pain in man. Science, Vol. 155, pp.108-9.

WALL, P.D. (1992) The placebo effect: an unpopular topic. Pain, Vol. 51, pp.1-3.

WALMSLEY, R.P. and FLEXMAN, N.E. (1979) Transcutaneous nerve stimulation for chronic low-back pain: a pilot study. Physiotherapy Canada, Vol. 31(5), pp.245-49,

WALSH, D.M. (1997) TENS: Clinical applications and related theory, Edinburgh, Churchill Livingstone.

WEBBERN, M. (1996), The British Holistic Medical Association. Complementary Therapies in Medicine, Vol. 4(1), pp.67-8.

WEINSTEIN, A.A. (1956) John Wesley, Physician and Apothecary. Georgia Review, Vol. X, pp.48-54.

WEN. H.L. (1977) Cancer pain treated with acupuncture and electrical stimulation. Modern Medicine in Asia, Vol. 13(2), pp.12-17.

WESLEY, J. Rev. (1747) Primitive Physic, (and 23rd Edition (1791)) as Reference edition (1960), London, Epworth Press.

WESLEY, J. Rev. (1759) The Desideratum: or Electricity made plain and useful by a lover of mankind and of common sense, London, Bailliere, Tindall and Cox (1898 reprint).

WESLEY, J. Rev. (1831) The Works of the Rev. John Wesley, A.M. JACKSON, T. (Ed), 14 Volumes, 3rd Edition, London. Wesleyan Methodist Book-Room.

WESLEY, J. Rev. (1909) The Journals of the Rev. John Wesley, A.M. CURNOCK, N (Ed), Vols. 1-8, Standard Edition, London, Epworth Press.

WESLEY, J. Rev. (1931) The Letters of the Rev. John Wesley, A.M., Telford, J.(Ed), 8 Volumes, London, Epworth.

WESLEY, J. Rev. (1961) Wesley's Standard Sermons. Ed. SUGDEN, E.H., 2 Volumes, London, Epworth.

WESLEY HILL, A. (1955-6) Was John Wesley a Methodist. Proceedings of the Wesley Historical Society, Vol. XXX, pp.82-5.

WESLEY HILL, A. (1958) John Wesley among the Physicians. London, Epworth Press.

WILDER, F. (1978) The Remarkable World of John Wesley, Pioneer in Mental Health. New York, Exposition Press.

WOLF, S.L., GERSH, M.R. and VADDADI, B.R. (1981) Examination of electrode placements and stimulating parameters in treating chronic pain with conventional transcutaneous electrical nerve stimulation (TENS). Pain Vol. 11, pp.37-47.

WOODWARD, M.W. (1962) Wesley's electric machine. Nursing Mirror, Vol. 114(2978), Suppl x, p.xvi-xvii.

WYNN PARRY, C.B. and GIRGIS, F. (1988) The assessment and management of the failed back Part II. International Disability Studies, Vol. 10(1), pp.25-8.

ZELASCHI, F., MAINI, M., GALLI, M. et al. (1982) Valutazione del potere analgesico dell'elettroanalgesia di stimolazione transcutanea al variare dei parametri: frequenza di stimolazione e durata della seduta terapeutica in pazienti affetti da dolore di tipo cronico. Europa Med Phys, Vol. 18, pp.177-84

Background Reading to the Thesis:

ABENYAKAR, S. and BONEVAL, F. (1994) Increased plasma B-endorphin concentrations after acupuncture: comparison of electroacupuncture, Traditional Chinese Acupuncture, TENS and placebo TENS. Acupuncture in Medicine. Vol. 12(1), pp.21-3.

ABRAM, S.E. (1981) Failure of naloxone to reverse analgesia from transcutaneous electrical stimulation in patients with chronic pain. Anesthesia and Analagesia, Vol. 60(2), pp.81-4.

ABRAM S.E. (1993) 1992 Bonica Lecture: Advances in chronic pain management since gate control. Regional Anesthesia, Vol. 18(2), pp. 66-81.

ALLAN, D.B. (1989) Understanding and management of low back pain. Acta Orthop Scand, Vol. 60(Suppl 234), pp.1-23.

ALMAY, B.G.L., JOHANSSON, F., von KNORRING, L. *et al.* (1985) Long term high frequency transcutaneous electrical nerve stimulation (hi-TENS) in chronic pain. Clinical response and effects on CSF-endorphins, monoamine metabolites, substance P-like immunoreactivity (SPLI) and pain measures. Journal of Psycho-somatic Research, Vol. 29(3), pp.247-57.

ALON, G. (1989) Electro-orthopedics: a review of present electrophysiological responses and clinical efficacy of transcutaneous stimulation. Advances in Sports Medicine and. Fitness, Vol.(2), pp.295-24.

ALTMAN, D.G. (1980) Statistics and ethics in medical research. British Medical Journal, Vol. 281(1), pp.1182-84; 1267-69; 1473-75.

ALTMAN, D.G. (1982) Statistics in Medical Journals. Statistics in Medicine, Vol. 1, pp.59-71.

ANDERSSON, S.A. (1979) Pain control by sensory stimulation. In Bonica, J.J., ed. Advances in Pain Research and Therapy Vol. 3, New York, Raven Press, pp.601-6.

ANDERSSON, G.B.J. and WEINSTEINN J.N. (1994) Introduction: Health outcomes related to low back pain. Spine, Vol. 19(18S).

ANDERSSON, G., BOMBARDIER, C., CHERKIN, D.C. *et al.* (1994) An introduction to therapeutic trials for low back pain. Spine, Vol. 19(18S).

APT (1994) Antiplatelet Trialists Collaboration. Collaborative overview of randomised trials of antiplatelet therapy-I: Prevention of death, myocardial infarction, and stroke by prolonged therapy in various categories of patients. British Medical Journal, Vol. 308, pp.81-106.

AQUILANTE, B.J. and SNYDER-MACKLER, L. (1986) A comparison of pain modulation of conventional TENS applied at traditional versus acupuncture points in patients with low-back pain. Physical Therapy, Vol. 66(5), p.761

ARMITAGE. P. (1975) Sequential Medical Trials. Oxford, Blackwell.

BAKER, F. (1947) Notes and Queries. Proceedings of the Wesley Historical Society, Vol. 27(1), p.24.

BAKER, D.W. (1984) An introduction to the theory and practice of German electroacupuncture and accompanying medications. American Journal of Acupuncture, Vol. 12(4), pp.327-32.

BALDRY, P.E. (1993b) A review of low-power laser pain-relieving controlled clinical trials. Acupuncture in Medicine, Vol. 11(1), pp.2-10.

BANERJEE, T. (1974) Transcutaneous nerve stimulation for pain after spinal injury. New England Journal of Medicine, Vol. 291, p.96.

BANNING, A., SJOGREN, P. and HENRIKSEN, H. (1991) Pain causes in 200 patients referred to a multidisciplinary cancer pain clinic. Pain, Vol. 45, pp.45-8.

BASBAUM, A.I. and FIELDS, H.L. (1984) Endogenous pain control systems: brainstem spinal pathways and endorphin circuitry. Annual Review of Neurosciences, Vol. 7, pp.309-38.

BATES, M.S., EDWARDS, W.T. and ANDERSON, K.O. (1993) Ethnocultural influences on variation in chronic pain perception. Pain, Vol. 52(1) pp.101-12.

BAXTER, K.G. (1983) Transcutaneous nerve stimulation. Kansas Medical Society, Vol. 84(1) pp.18-26.

BEECHER, H.K. (1955) The powerful placebo. Journal of the American Medical Association, Vol. 159(17), pp.1602-6.

BEECHER, H.K. (1962) Non-specific forces surrounding disease and the treatment of disease. Journal of the American Medical Association, Vol. 179(6), pp.437-40.

BERLANT, S.R. (1984) Method of determining optimal stimulation sites for transcutaneous electrical nerve stimulation. Physical Therapy, Vol. 64(6) pp.924-8.

BLACK, N. (1994) Experimental and observational methods of evaluation. British Medical Journal, Vol. 309, p.540.

BOMBARDIER, C., KERR, M.S., SHANNON, H.S. *et al.* (1994). A guide to interpreting epidemiologic studies on the etiology of back pain. Spine, Vol. 19(18S).

BONICA, J.J. (1990) The Management of Pain. Vol. 2. Pennsylvania, Lea and Febiger.

BORKOVEC, T.D. and NAU, S.D. (1972) Credibility of analogue therapy rationales. Journal of Behavavioural. Therapy and Experimental Psychiatry, Vol. 3, pp.257-60.

BOSSY, J. (1984) Morphological data concerning the acupuncture points and channel network. Acupuncture and Electro-therapeutics Res. Int. J., Vol. 9, pp.79-106.

BOURKE, D. (1994) TENS vs. placebo. Pain, Vol. 56(1) pp.122-3.

BOWSHER, D. (1990) Physiology and pathophysiology of pain. Journal of the British Medical Acupuncture Society, Vol. VII pp.17-20.

BOWSHER, D. (1991) The physiology of stimulation-produced analgesia. Journal of the British Medical Acupuncture Society, Vol. IX(2) pp.58-62.

BRAITMAN, L. (1991) Confidence Intervals assess both clinical significance and statistical significance. Annals of Internal Medicine, Vol. 114(6), pp.515-7.

BRIGGS, H.V. (1947) Notes and Queries. Proceedings of the Wesley Historical Society, Vol. 27(1), p.24.

BULL, J.P. (1959) The historical development of clinical therapeutic trials. Journal of Chronic Diseases, September, pp.218-48.

BYINGTON, R.P., CURB, J.D. and MATTSON, M.E. (1985) Assessment of double-blindness at the conclusion of the b - blocker heart attack trial. Journal of the American Medical Association, Vol. 253(12), pp.1733-36.

CADY, R.K. and SHEALY, C.N. (1990) Electrotherapy in medicine. Medical Electronics, Vol. 121, pp.122-8.

CAMP, V. (1993). Examination of the back. Acupuncture in Medicine, Vol. 11(1), pp.36-41.

CAMPBELL, A. (1991) Hunting the snark: The quest for the Perfect Acupuncture Placebo. Acupuncture Medicine, Vol. 9, pp.83-4.

CAMPBELL, M J, and MACHIN, D. (1993) Medical Statistics: a commonsense approach. Chichester England, J. Wiley and Sons.

CAPEL, I.D., DORRELL, H.M. and SPENCER, E.P. (1989) Interrupted currents are more analgesic than continuous currents in some models of acute pain. Journal of Bioelectricity, Vol. 8(1) pp.59-71.

CARLIN, J.B. (1992) Meta-analysis for 2 x 2 tables: A Bayesian approach. Statistics in Medicine, Vol., 11, pp.141-58.

CARETTE, S., MARCOUX, S., TRUCHON, R. *et al.* (1991) A controlled trial of corticosteriod injections into facet joints for chronic low back pain. New England Journal of Medicine, Vol. 325(14), pp.1002-7.

CARROLL, D., TRAMER, M., McQUAY, H. *et al.* (1997) Transcutaneous electrical nerve stimulation. British Journal of Obstetrics and Gynaecology, Vol. 104, pp.169-75.

CHALMERS, I. (1983) Scientific inquiry and authoritarianism in perinatal care and education. Birth, Vol. 10(3), pp.151-66.

CHALMERS, I. (1991) Improving the quality and dissemination of reviews of clinical research. In LOCK, S. (Ed), The future of medical journals. In commemoration of 150 years of the British Medical Journal. London, British Medical Journal, pp.127-46.

CHALMERS, I., ENKIN, M. and KEIRSE, M.J.N.C. (1993) Preparing and updating Systematic Reviews of Randomised Controlled Trials of Health Care. The Millbank Quarterly, Vol. 71(3), pp.411-37.

CHALMERS, I., and HAYNES, B. (1994). Reporting, updating, and correcting systematic reviews of the effects of health care. British Medical Journal, Vol. 309, pp.862-65.

CHALMERS, T.C. CELANO, P., SACKS, H.S. *et al.* (1983) Bias in treatment assignment in controlled clinical trials. New England Journal of Medicine, Vol. 309, pp.1358-61.

CHANG-YU, J., HSIEH, D.C., PHILLIPS, R.B. *et al.* (1992) Functional outcomes of low back pain: comparison of four treatment groups in a randomized controlled trial. Journal of Manipulation and Physiological Therapy Vol. 15(1), pp.4-9.

CHAPMAN, C.R. and BENEDETTI, C. (1977) Analgesia following transcutaneous electrical stimulation and its partial reversal by a narcotic antagonist. Life Sciences, Vol. 21, pp.1645-8

CHEE, E.K. and WALTON, H. (1986) Treatment of trigger points with microamperage transcutaneous electrical nerve stimulation (TENS) - (The Electro-Acuscope 80). Journal of Manipulative Physiology and Therapy, Vol. 9(2), pp.131-4.

CHEN, A. (1992) An introduction to sequential electric acupuncture (SEA) in the treatment of stress related physical and mental disorders. Acupuncture and Electro-therapeutics Research International Journal, Vol. 17, pp.273-83.

CHEN, H. (1993) Recent studies on auriculoacupuncture and its Mechanisms. Journal of Traditional Chinese Medicine Vol. 13(2), pp.129-43.

CHENG, R. and POMERANZ, B. (1979) Electroacupuncture analgesia could be mediated by at least two pain relieving mechanisms; endorphin and non-endorphin systems. Life Sciences, Vol. 25, pp.1957-62.

CHENG, R. and POMERANZ, B. (1979) Electroacupuncture analgesia is mediated by stereospecific opiate receptors and is reversed by antagonists of type 1 receptors. Life Sciences, Vol. 26, pp.631-8.

CHESTNUTT, W.N. and DUNDEE, J.W. (1985) Acupuncture for relief of meptazinol-induced vomiting. British Journal of Anaesthesia, Vol. 57, pp.825-6.

CHEUNG, J.Y.T. (1985). Effect of electro-acupuncture on chronic painful conditions in general medical practice - a 4 years' study. American Journal of Chinese Medicine, Vol. XIII(1-4), pp33-8.

CHOH-LUH, L. (1974) A brief outline of Chinese medical history with particular reference to acupuncture. Perspectives in Biology and Medicine, Vol. 18(1), pp.132-43.

CHUNG, J.M. (1989) Neurophysiological mechanisms of acupuncture analgesia in experimental animal models. In: Stux, G. and POMERANZ, B., (Eds.) Scientific Bases of Acupuncture. Berlin, Springer-Verlag, pp.137-56.

COHEN, A., NASELLI, F.P. and CRAIG, M. (1947) Treatment of sciatica with alternating currents. Archives of Physical Medicine and Rehabilitation, Vol. 27, pp.219-22.

CONRAD, D.A. and DEYO, R.A. (1994) Economic decision analysis in the diagnosis and treatment of low back pain: A methodologic primer. Spine, Vol. 19(18S)

CONSUMERS' ASSOCIATION LTD (1989). Transcutaneous electrical nerve stimulation to relieve pain. Drug and Therapeutics Bulletin, Vol. 27(7), pp.25-6.

COOK, D.J., SACKETT, D.L. and SPITZER, W.O. (1995) Methodological guidelines for systematic reviews of randomized controlled trials in health care from the Potsdam consultation on meta-analysis. Journal of Clinical Epidemiology, Vol. 48(1), pp.167-71.

CURNOCK, N. (1909) The Journal of the Rev. John Wesley, A.M. Vols. 1-8, Standard Edition, London, Epworth Press.

DALE, R.A. (1993) Acupuncture electrodiagnosis: which acupoints can most easily provide the best diagnostic information. American Journal of Acupuncture, Vol. 21(2), pp.171-6.

DEBRECENI, L. (1993) Chemical releases associated with acupuncture and electric stimulation. Critical Reviews in Physical and Rehabilitation Medicine, Vol. 5(3), pp.247-75.

DEVINSKY, O. (1993) Electrical and magnetic stimulation of the central nervous system. Advances in Neurology, Vol. 63, pp.1-16.

DEYO, R.A.(1983) Conservative therapy for low back pain. Journal of the American Medical Association, Vol. 250, pp.1057-62.

DEYO, R.A., DIEHL, A.K. and ROSENTHAL, M. (1990). How many days of bed rest for acute low back pain? New England Journal Medicine, Vol. 315(17), pp.1064-70.

DEYO, R.A., WALSH, N.E., SCHOENFELD, L.S. *et al.* (1990) Can trials of physical treatments be blinded. American Journal of Physical Medicine and Rehabilitation, Vol. 69(1), pp.6-10.

DEYO, R.A. (1991) Fads in the treatment of low back pain. New England Journal of Medicine, Vol. 325, pp.1039-41.

DEYO, R.A., ANDERSSON, G., BOMBARDIER, C. *et al.* (1994) Outcome measures for studying patients with low back pain. Spine, Vol. 19(18S).

DEYO, R.A., HASELKORN, J., HOFFMAN, R. *et al.* (1994) Designing studies of diagnostic tests for low back pain or radiculopathy. Spine, Vol. 19(18S).

DICKERSIN, K. (1990) The existence of publication bias and risk factors for its occurrence. Journal of the American Medical Association, Vol. 263(10), pp.1385-9.

DICKERSIN, K., HEWITT, P., MUTCH, L. *et al.* (1985) Perusing the literature: Comparison of MEDLINE searching with a perinatal trials database. Controlled Clinical Trials, Vol. 6, pp.306-17.

DICKERSIN, K., CHAN, S., CHALMERS, T.C. *et al.* (1987) Publication bias and clinical trials. Controlled Clinical Trials, Vol. 8, pp.343-53.

DICKERSIN, K. and BERLIN, J.A. (1992) Meta-analysis: State-of-the-Science. Epidemiologic Reviews, Vol. 14, pp.154-76.

DICKERSIN, K., SCHERER, R. and LEFEBRE, C. (1994) Identifying relevant studies for systematic reviews. British Medical Journal, Vol. 309, pp.1286-91.

DON, R.G. (1982) Transcutaneous electrical nerve stimulation for the relief of chronic pain. Singapore Medical Journal, Vol. 23(6), pp.322-5.

DOONGAJI, D.R., VAHIA, V.N. and BHARUCHA, M.P.E. (1978) On placebos, placebo responses and placebo responders. Parts 1 and 2. Journal of Postgraduate Medicine, Vol. 24(2), pp.91-97;147-157.

DUDLEY, H.A.F. (1983) The controlled clinical trial and the advances of reliable knowledge: an outsider looks in. British Medical Journal, Vol. 287, pp.957-60.

DUNCOMBE, A and HOPP, J.F. (1991) Modalities of physical treatment. Physical Medicine and Rehabilitation: State of the Art Reviews, Vol. 5(3), pp.493-519.

DUNDEE, W., CHESTNUTT, W.N., GHALY, R.G. *et al.* (1986) Traditional Acupuncture: a potentially useful antiemetic. British Medical Journal, Vol. 293, pp.583-4.

DUNDEE, J.W. (1987) Acupuncture to prevent Cisplatin-associated vomiting. Lancet, May 9th, pp.1083.

DUNDEE, J.W., GHALY, R.G. and FITZPATRICK, K.T.J. (1988) Randomised comparison of the antiemetic effects of metoclopramide and electroacupuncture in cancer chemotherapy. British Journal of Clinical Pharmacology, Vol. 25, pp.678-9.

DUNDEE, J.W., SOURIAL, F.B.R., GHALY, R.G. *et al.* (1988) P6 Acupuncture reduces morning sickness. Journal of the Royal Society of Medicine, Vol. 81, pp.456-7.

DUNDEE, J.W., GHALY, R.G., BILL, K.M. *et al.* (1989) Effect of stimulation of the P6 antiemetic point on postoperative nausea and vomiting. British Journal of Anaesthesia, Vol. 63, pp.612-8.

DUNDEE, J.W. ((1989) Letter: Research on Traditional Chinese acupuncture: science or myth. Journal of the Royal Society of Medicine, Vol. 82, pp.244-5.

DUNDEE, J.W. (1991) Acupuncture and postoperative sickness. Anaesthesia, Vol. 46, pp.512-5.

DUNDEE, J.W. and GHALY, R.G. (1991) Local anaesthesia blocks the antiemetic action of P6 acupuncture. Clinical Pharmacology and Therapeutics, Vol. 50, pp.78-80.

EDITORIAL. (1991) TENS for chronic-low-back pain. Lancet, Vol. 337, pp.462-3.

EMERSON, J.D., BURDICK, E., HOAGLIN, D.C. *et al.* (1990) An empirical study of the possible relation of treatment differences to quality scores in controlled randomized clinical trials. Controlled Clinical Trials, Vol. 11, pp.339-42.

EMERSON, J.D. (1994) Combining estimates of the odds ratio: The state of the art. Statistical Methods in Medical Research, Vol. 3, pp.157-78.

ENGLISH, J.C. (1991) John Wesley and Isaac Newton's "System of the World". Proceedings of the Wesley Historical Society, Vol. 48(3) pp.68-86.

ERIKSSON, S.V., LUNDEBERG, T. and LUNDEBERG, S. (1991) Interaction of Diazepam and Naloxone on acupuncture induced pain relief. American Journal of Chinese Medicine, Vol. 19(1), pp.1-7.

ERSEK, R.A. (1977) Transcutaneous electrical neurostimulation. Clinical Orthopaedics and Related Research, Vol. 128, pp.314-24.

ERSEK, R.A. (1981) Pain control with T.E.N.S. St. Louis, Missouri, Warren H. Green.

ERNST, M. and LEE, M. (1987) Influence of Naloxone on electro-acupuncture analgesia using an experimental dental pain test. Review of possible mechanisms of action. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 12, pp.5-22.

ERNST, E. (1996) Acupressure for nausea: A best evidence analysis. European Journal Physical and Medical Rehabilitation, Vol. 6(1), pp.28-9.

EYSENCK, H.J. (1978) An exercise in mega-silliness. American Psychologist, Vol. 33, pp.517-18.

EYSENCK, H.J. (1994) Meta-analysis and its problems. British Medical Journal, Vol. 309, pp.789-92.

FEINSTEIN, A.R., (1995) Meta-analysis: Statistical alchemy for the 21st Century. Journal of Clinical Epidemiology, Vol. 48(1), pp.71-9.

FERGUSON, F.R., DAVEY, A.F.C., TOPLEY, W.W.C. (1927) The value of mixed vaccines in the prevention of the common cold. Journal of Hygiene, Vol. 26, pp.98-109.

FERRELL, B.A. (1991) Pain management in elderly people. Journal of the American Geriatrics Society, Vol. 39(1), pp.64-73.

FILSHIE, J. and REDMAN, D. (1985) Acupuncture and malignant pain problems. European Journal of Surgical Oncology, Vol. 11, pp.389-94.

FILSHIE, J. and MORRISON, P.J. (1988) Acupuncture for chronic pain: a review. Palliative Medicine, Vol. 2, pp.1-14.

FILSHIE, J. (1990) Acupuncture for malignant pain. Journal of the British Medical Acupuncture Society, Vol. 8(1), pp.38-9.

FILSHIE, J. and ABBOT, P. (1991) Acupuncture for chronic pain: A Review. Journal of The British Medical Acupuncture Society, Vol. 9(1), pp.4-14.

FISHER, H.W. (1992) Acute low back pain treated by spinal manipulation and electronic acupuncture. Journal of Manipulative and Physiological Therapeutics, Vol. 5(3), pp.199-202.

FITZPATRICK, K.T.J., DUNDEE, J.W., GHALY, G. *et al.* (1988) A clinical approach to acupuncture anti-emesis. Irish Journal of Medical Sciences, Vol. 157, pp172.

FLEISS, J.L. (1993) The statistical basis of meta-analysis. Statistical Methods in Medical Research, Vol. 2, pp.121-45.

FLINK, G. and WHALLEY, L.J. (1982), (Eds.), Neuropeptides, Basic and Chemical Aspects, London, Churchill Livingstone.

FLOTER, T. (1986) TENS treatment at home: Dependence of the efficacy on frequency of use. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 11, pp.153-60.

FOLEY, G.H. (1972) John Wesley's dental therapeutics. Journal American Dental Association, Vol. 85, pp.249-50.

FORROW, L., WARTMAN, S.A. and BROCK, D.W. (1988) Science, Ethics, and the making of clinical decisions. Journal of the American Medical Association, Vol. 259(21), pp.3161-67.

FOSTER, J.M.G. and SWEENEY, B.P. (1987) The mechanisms of acupuncture analgesia. British Journal of Hospital Medicine, Vol. 34(4), pp.308-12.

FRAMPTON, V.M. (1982) Pain control with the aid of transcutaneous nerve stimulation. Physiotherapy, Vol. 68(3), pp.77-81.

FRANCINI, F., MARESCA, M., PROCACCI, P. and ZOPPI, M. (1981) The effects of non-painful transcutaneous electrical nerve stimulation on cutaneous pain threshold and muscular reflexes in normal men and in subjects with chronic pain. Pain, Vol. 11, pp.49-63.

FREEMAN, T.B., CAMPBELL, J.N. and LONG, D.M. (1983) Naloxone does not affect pain relief induced by electrical stimulation in man. Pain, Vol. 17, pp.189-95.

FREEMANTLE, N., GRILLI, R., GRIMSHAW, J. *et al. (*1996) Implementing findings on medical research: the Cochrane Collaboration on effective practice. Quality in Health Care, Vol. 4, pp.45-7.

FRY, E.N.S. (1986) Acupressure and postoperative vomiting. Anaesthesia, Vol. 41, pp.661-2.

GELBER, R.D. and GOLDHIRSH, A. (1993) From the overview to the patient: How to interpret meta-analysis data. Recent Results in Cancer Research, Vol. 127, pp.167-76.

GERSH, M.R. and WOOLF, S.L. (1984) Applications of transcutaneous electrical nerve stimulation in the management of patients with pain. Physical Therapy, Vol. 65(3), pp.314-36.

GLASS, G. (1976) Primary, secondary. and meta-analysis of research. Educational Researcher, Vol. 5, pp.3-8.

GORE, S.M., JONES, I.G. and RYTTER, E.C. (1977) Misuse of statistical methods: critical assessment of articles in British Medical Journal from January to March 1976. British Medical Journal, 8th January, pp. 85-87.

GREENLAND, S. (1994) Invited commentary: A critical look at some popular meta-analytic methods. American Journal of Epidemiology, Vol. 140(3), pp.290-6.

GROSS, D. (1979) Multifactorial diagnosis and therapy for low back pain. In Bonica, J.J. *et al.* Advances in Pain Research and Therapy, Vol. 3. New York, Raven Press, pp.601-6.

GROSSMAN, S.A. and STAATS, P.S. (1994) Current management of pain in patients with cancer. Oncology, Vol. 8(3), pp.93-115.

GUYATT, G., SACKETT, D., TAYLOR, D.W. *et al.* (1986) Determining optimal therapy - Randomised trials in individual patients. New England Journal of Medicine, Vol. 314(14), pp.889-92.

GUYATT, G.H., SACKETT, D.L. and COOKE, D.J. (1993) Users guide to the medical literature II. How to use an article about therapy or prevention. A. Are the results of the study valid? Journal of the American Medical Association, Vol. 270(21), pp.2596-601.

GUYATT, G.H., SACKETT, D.L. and COOKE, D.J. (1994) Users guide to the medical literature II. How to use an article about therapy or prevention. Journal of the American Medical Association, Vol. 271(1), pp. 59-63.

HAAS, J.W. (1994) Eighteenth century evangelical responses to science: John Wesley's enduring legacy. Science and Christian Belief, Vol. 6(2), pp.83-100.

HACKETT, G.I., SEDDON, D. and KAMINSKI, D. (1988) Electroacupuncture compared with paracetamol for acute low back pain. The Practitioner, Vol.22, pp.163-4.

HAGBARTH, K.E. and KERR D.I.B. (1954) Central influence on spinal afferent conduction. Journal of Neurophysiology, Vol. 17, pp.295-307.

HALLER, J.S. (1973) Acupuncture in nineteenth century western medicine. New York State Medical Journal, May 15, pp.1213-21.

HAN, J.S. CHEN, X.H. SUN, S.L. *et al.* (1991) Effect of low and high-frequency TENS on Met-enkephalin-Arg-Phe and dynorphin A immunoreactivity in human CSF. Pain Vol. 47, pp. 295-8.

HAN, J., CHEN, X., YUAN, Y. *et al.* (1993) Transcutaneous electrical nerve stimulation for treatment of spinal spasticity. Chinese Medical Journal, Vol. 107(1), pp 6-11.

HAN, J.S. and ZHANG, R.L. (1993) Suppression of morphine abstinence syndrome by body electroacupuncture of different frequencies in rats. Drug and Alcohol Dependence Vol. 31, pp.169-75.

HARRGITT, C.W. (1927) John Wesley and science. Methodist Review, Vol. CX, pp.383-93.

HASELKORN, J.K., TURNER, J.A., DIEHR, P.K. *et al.* (1994) Meta-analysis: A useful tool for the spine researcher. Spine, Vol. 19, (18S).

HAYNES, R.B. (1990). Loose connections between peer-reviewed clinical journals and clinical practice. Annals of Internal Medicine, Vol. 11, pp.724-8.

HE, L.F. (1987) Involvement of endogenous opioid peptide in acupuncture analgesia: a review. Pain, Vol. 31(1), pp.99-121.

HELME, R.D., GIBSON, S. and KHALIL, Z. (1990) Neural pathways in chronic pain. Medical Journal of Australia, Vol. 153, pp.400-6.

HELME, R.D. and KATZ, B. (1993) Management of chronic pain. The Medical Journal of Australia, Vol. 158, pp.478-81.

HILL, A.B. (1953) Observation and experiment. New England Journal of Medicine, Vol. 248(24), pp.995-1001.

HO, W.K.K. and WEN, H.L. (1989) Opioid-like activity in the cerebrospinal fluid of pain patients treated by electroacupuncture. Neuropharmacology, Vol. 28(9), pp.961-6.

HOFFMAN, R.M., TURNER, J.A., CHERKIN, D.C. *et al.* (1994) Therapeutic trials for low back pain. Spine, Vol. 19(18S).

HOWLETT, T.Y. *(*1984) Exercise-induced release of Met-enkephalin and B-endorphin. In: MULLER, E.E. and GENAZZANI, A.R., (Eds.) Central and Peripheral Endorphins: Basic and Clinical Aspects. New York, Raven Press, pp.285-8.

HURNY, C., BERNHARD, J., JOSS, R., *et al.* (1993) 'Fatigue and malaise' as a quality-of-life indicator in small-cell lung cancer patients. Support Care Cancer, Vol. 1(6), pp.316-20.

HYDE, E. (1989) Acupressure therapy for morning sickness: A controlled clinical trial. Journal of Nurse-Midwifery, Vol. 34(4), pp.171-8.

HUGHES, T.J. (1988) A pharmacological basis to the rational use of potent analgesics. Hospital Update, Nov 1988, pp. 2159-65.

JAMES, I. (1989) Tactics and Practicalities. Complementary Medical Research, Vol 3(3), pp.7-10.

JAMESON, E. (1961) The Natural History of Quackery. London, Michael Joseph Ltd.

JENICEK, M. (1989) Meta-analysis in medicine. Journal of Clinical. Epidemiology, Vol. 42, pp.35-44.

JENSEN, J.E., ETHERIDGE, G.L. and HAZELRIGG, G. (1986) Effectiveness of transcutaneous electrical neural stimulation in the treatment of pain. Recommendations for use in the treatment of sports injuries. Sports Medicine, Vol. 3, pp.79-88.

JONES, D.R. (1995) Meta-analysis: Weighing the evidence. Statistics in Medicine, Vol. 14, pp.137-49.

JUSTINS, D.M. (1994) Chronic pain management. British Journal of. Hospital Medicine, Vol. 52(1), pp.12-16.

KANTOR, G. ALON, G. and HO, H.S. (1994) The effects of selected stimulus waveforms on pulse and phase characteristics at sensory and motor thresholds. Physical Therapy. Vol. 74(10), pp.951-62.

KATIMS, J.J. LONG, D.M. and NG, L.K.Y. (1986) Transcutaneous nerve stimulation: Frequency and waveform specificity in humans. Applied Neurophysiology, Vol. 49, pp.86-91.

KENNER, D.J. (1994) Pain Forum: Part.2. Neuropathic pain. Australian Family Physician Vol. 23(7), pp.1279-83.

KENYON, J.N. (1985) Modern Techniques of Acupuncture, Vol. 3, Wellingborough, Thorsons.

KLAWNSKY, S., YEUNG, A., BERKEY, C. *et al.* (1995) Meta-analysis of randomised controlled trials of cranial electrostimulation. Journal of Nervous and Mental Disorders, Vol. 181(7), pp.478-84.

KOES, B.W., ASSENDELFT, W.J.J., van der HEIJDEN, G.J.M.G. *et al.* (1991) Spinal manipulation and mobilisation for back and neck pain: a blinded review. British Medical Journal, Vol. 303, pp.1298-1303.

KYLE, R.A. and SHAMPO, M.A. (1978) John Wesley. Journal of the American Medical Association, Vol. 240, p.2008.

LANGLEY, G.B., SHEPPEARD, H. and WIGLEY, R.D. (1983) Placebo therapy in rheumatoid arthritis. Clinical and Experimental Rheumatology, Vol. 1, pp.17-21.

LANGLEY, G.B., SHEPPEARD, H., JOHNSON, M. *et al.* (1984) The analgesic effect of transcutaneous electrical nerve stimulation and placebo in chronic pain patients. Rheumatology International, Vol. 4, pp.119-23.

LANGLEY, G.B. (1987) Transcutaneous electrical nerve stimulation (TNS) and its relationship to placebo therapy. New Zealand Medical Journal, Vol. 100, pp.215-7.

LEARY, W. (1983) The Methodist Archives. Archives, Vol. 16, pp.16-27.

LEE, M.H.M. and ERNST, M. (1989) Clinical and research observations on acupuncture analgesia and thermography. In: Stux, G. and POMERANZ, B. ((Eds.).) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.157-76.

LEO, K.C., DOSTAL, W.F., BOSSEN, D.G. *et al.* (1986) Effect of transcutaneous electrical nerve stimulation characteristics on clinical pain. Physical Therapy, Vol. 66(2), pp.200-205.

LEVIN, M.F. and HUI-CHAN, C.W. (1993) Conventional and acupuncture-like transcutaneous electrical nerve stimulation excite similar afferent fibres. Archives of Physical Medicine and Rehabilitation, Vol. 74, pp54-60.

LEWITH, G. (1983) Transcutaneous nerve stimulation (TNS), a new frontier in the treatment of pain. Printed privately by Permission of Talkback.

LEWITH, G., (1984) Can we assess the effects of acupuncture. British Medical Journal, Vol. 288, pp.1475-6.

LEWITH, G.T. (1986) Acupuncture. The Practitioner, Vol. 230(1422), pp.1057-62.

LEWITH, G. and ALDRIDGE, D. (1993) Clinical Research Methodology for Complementary Therapies. London, Hodder and Stoughton.

LIANG, M.H., ANDERSSON, G., BOMBARDIER, C. *et al.* (1994) Strategies for outcome research in spinal disorders: An introduction. Spine, Vol. 19(18S).

LICHTENSTEIN, MJ., MULROW, CD. and ELWOOD, PC. (1987) Guide-lines for reading case-control studies. Journal of Chronic Diseases, Vol. 40, pp.893-903.

LICHTWARDT, H.A. (1934) Ancient therapy in Persia and in England. Annals Medical History, Vol. 6, pp.280-4.

LIPSCHITZ D.A. and SULLIVAN D.H. (1993) The ageing patient. In: ANDREOLI T.E. *et al.* (Eds.)Cecil Essentials of Medicine, 3rd ed. Philadelphia, Saunders. pp.870-73.

LOCKE, R. (1972) The history of acupuncture and its relation to dentistry. Bulletin of the History of Dentistry, Vol. 20, pp.66-75.

LONG, A.F. and MERCER, G. (1995) Reviewing the state of the evidence and effectiveness of complementary therapies. Le (Ed.): Collaborating Centre for HSR, Nuffield Institute for Health.

LONG, D.M. and HAGFORS, N. (1975) Electrical stimulation in the nervous system: The current status of electrical stimulation of the nervous system for relief of pain. Pain, Vol. 1, pp.109-23.

LOWE, H.J. and BARNETT, G.O. (1994) Understanding and using the medical subject headings (MeSH) vocabulary to perform literature searchers. Journal of the American Medical Association, Vol. 271(14), pp.1103-8.

LYNAS, A.G.A., CHESTNUTT, W.N., DUNDEE, J.W. *et al.* (1988) Neiguan, the P6 anti-emetic acupuncture point: effect on nalbuphine emetic sequelae. British Journal of Clinical Pharmacology, Vol. 22, p.223.

MADILL, P. (1984) The uses and limitations of acupuncture point measurement, German Electroacupuncture or Electroacupuncture according to Voll (EAV). American Journal of Acupuncture, Vol. 12(1), pp.33-42.

MAERTENS de NOORDHOUT, A., ROTHWELL, J.C., THOMPSON, P.D. *et al.* Percutaneous electrical stimulation of lumbosacral roots in man. Journal of Neurology, Neurosurgery and Psychiatry, Vol. 51, pp.174-81.

MAO, W., GHIA, J.N., SCOTT, D.S. *et al.* (1980) High versus low intensity acupuncture analgesia for treatment of chronic pain: Effects on platelet serotonin. Pain Vol. 8, pp.331-42.

MATHER, L.E. (1986) Pharmacology of opioids, Part 1. The Medical Journal of Australia. Vol. 144, pp.424-27.

MAYER, D. (1985) Non-pharmacologic management of pain in the person with cancer. Journal of Advanced Nursing, Vol. 10, pp.325-30.

McGEE, H.M., O'BOYLE, C.A., HICKEY, A. *et al.* (1991). Assessing the quality of life of the individual: the SEIQoL with a healthy population and a gastroenterology unit population. Psychological Medicine, Vol. 21, pp.749-59.

MEINERT, CL. (1989) Meta-analysis: Science or Religion. Controlled Clinical Trials, Vol. 10, pp.257S- 263S.

MELZACK, R. (1978) Pain mechanisms: Recent research. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 3, pp.109-12.

MELZACK, R., STILLWELL, D.M. and FOX, E. (1977) Trigger points and acupuncture points for pain: Correlations and implications. Pain, Vol. 3, pp.3-23.

MELZACK. R. and WALL, P. (1988) The challenge of pain, Harmondsworth, Penguin.

MENDELSON, G., SELWOOD, T.S., KRANZ, H. *et al.* (1983) Acupuncture treatment of chronic back pain. American Journal of Medicine, Vol. 74, pp.49-55.

MERCER, G. and LONG, A.F. (1995) Researching and evaluating complementary therapies. The state of the debate. Le (Eds.), Collaborating Centre for HSR, Nuffield Institute for Health.

MEYERSON, B. (1983) Electrostimulation procedures: effects. Presumed rationale and possible mechanisms. Advances in Pain Research and Therapy, Vol. 5, pp.495-534.

MILNE, R. and CHAMBERS, L. (1993) Assessing the scientific quality of review articles. Journal of Epidemiology and Community Health, Vol. 47, pp.169-70.

MOORE, M.J., OSOBA, D., MURPHY, K. *et al.* (1994) Use of palliative end points to evaluate the effects of Mitoxantrone and low-dose Prednisolone in patients with hormonally resistant prostate cancer. Journal of Clinical Oncology, Vol. 12(4), pp.689-94.

MORUS, I.R. (1992) Marketing the machine: The construction of electrotherapeutics as viable medicine in early Victorian England. Medical History, Vol. 36, pp.34-52.

MULLER, E.E. and GENAZZINI, A.R. (1984), (Eds.)Central and Peripheral Endorphins, New York: Raven Press.

MULROW, C. (1987) The medical review article: State of the science. Annals of Internal Medicine, Vol. 106, pp.485-8.

MURGO A.J. and FAITH R.E. (1986) Enkephalins and Endorphins; Stress and the Immune System, New York. Plenum Press.

NACHEMSON, A. (1976) The lumbar spine: an orthopaedic challenge. Spine, Vol. 1(1), pp.59-71.

NACHEMSON, A. (1983) Work for all: for those with low back pain as well. Clinical Orthopaedics and Related Research, Vol. 179, pp.77-85.

NAPPI, G. FACCHINE, F. BONO, G. *et al.* (1982) Plasma opioid levels in post-traumatic chronic headache and trigeminal neuralgia; maintained responses to acupuncture. Headache, Vol. 22(6), pp.276-9.

NAPPI, G., TACCHINETTI, F., LEGNANTE, G. *et al.* (1982) Different releasing effects of traditional manual acupuncture and electroacupuncture on pro-opiocortin-related Peptides. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 7, pp.93-103.

NAPPI, G., *et al.* (1984) Central and peripheral endorphins as biological markers in headache. In: MULLER, EE. and GENAZZANI, AR. (Eds.)Central and Peripheral Endorphins: Basic and Clinical Aspects, New York, Raven Press, pp.301-7.

NEEDHAM, J and GWEI-DJEN, L. (1980) Celestial Lancets. Cambridge, Cambridge University Press.

NELSON, D.A. (1991) Coccydynia and lumbar disk disease - historical correlations and clinical cautions. Perspectives in Biology and Medicine, Vol. 34(2), pp.229-38.

NELSON, R.M. and CURRIER, D.P. (1991) Clinical Electrotherapy. New Jersey, USA. Appleton and Lange.

NEUMANN, V. (1993) Editorial: Electrotherapy. British Journal of Rheumatology, Vol. 32, pp.1-3.

NICHOLAS, J.J. (1994) Physical modalities in Rheumatological rehabilitation. Archives of Physical Medicine and Rehabilitation, Vol. 75, pp.994-1001.

NIENHUIS, R.L.F. and HOEKSTRA, A.J. (1984) Transcutaneous electronic nerve stimulation in ankylosing spondylitis. Arthritis and Rheumatism, Vol. 27, pp.1074-75.

NISSEL, H. (1993) Pain treatment by means of Acupuncture. Acupuncture and Electro-Therapeutics Research International Journal, Vol18, pp.1-8.

NOLAN, MF. (1988) Selected problems in the uses of transcutaneous electrical nerve stimulation for pain control - an appraisal with proposed solutions. Physical Therapy, Vol. 68(11), pp.1694-8.

NOORDERGRAAF A and SILAGE, D. (1973) Electroacupuncture. IEEE Transactions on Biomedical Engineering, September, pp.364-6.

NOUWEN, A. (1983) EMG Biofeedback used to reduce standing levels of paraspinal muscle tension in chronic low back pain. Pain, Vol. 17, pp.353-60.

OLDHAM, J. (1993) Statistical Tests. (Parts 1-3), Nursing Standard, Vol. 7; (43)pp.30-35; (44)pp.28-30;(45)pp.28-30.

OMURA, Y. (1987) Basic electrical parameters for safe and effective electro-therapeutics for pain, neuromuscular skeletal problems and circulatory disturbances. Acupuncture and Electro-Therapeutics Research International Journal Vol. 12, pp.201-25.

ORDOG, G.J. (1987) Transcutaneous electrical nerve stimulation versus oral analgesic. American Journal of Emergency Medicine, Vol. 5(1), pp.6-10.

OTT, P.W. (1994-95) Medicine as a metaphor: John Wesley on therapy for the soul. Methodist History, Vol. XXXIII, pp.178-91.

OVERMIER. J.A. and SENIOR, J.E. (1992). Books and Manuscripts of The Bakken. Metuchen, Scarecrow Press.

OXMAN, A.D. and GUYATT, G.H. (1988) Guidelines for reading literature reviews. Canadian Medical Association Journal, Vol. 138, pp.697-703.

OXMAN, A.D., SACKETT, D.L. and GUYATT, G.H. (1993) Users' guide to the medical literature: 1. How to get started. Journal of the American Medical Association, Vol. 270(17), pp.2093-5.

OXMAN, A.D., COOKE, D.J. and GUYATT, G.H. *et al.* (1994) Users' guide to the medical literature: VI. How to use an overview. Journal of the American Medical Association. 272(17), pp.1367-71.

OXMAN, A.D. (1994) Checklists for review articles. British Medical Journal, Vol. 309, pp.648-51.

PAIN. (1987) Abstracts of the fifth world congress on pain, Hamburg, FRG, 2-7 August 1987.Journal of the International Association for the Study of Pain, Supplement 4, Amsterdam, Elsevier.

PEETS, J.M. and POMERANZ. B. (1985) Acupuncture-like transcutaneous electrical nerve stimulation analgesia is influenced by spinal cord endorphins but not serotonin: An intrathecal pharmacological study. Advances in Pain Research and Therapy, vol. 9, pp.519-25.

PETRIE, J. and HAZLEMAN, B. (1985) Credibility of placebo transcutaneous nerve stimulation and acupuncture. Clinical and Experimental Rheumatology, Vol. 3, pp.151-3.

PETITTI, D.B. (1994) Meta-Analysis, Decision Analysis, and Cost-Effectiveness Analysis, Oxford, Oxford University Press.

PETITTI, D.B. (1994) Of babies and bathwater. American Journal of Epidemiology, Vol. 140(9), pp.779-82.

PHILLIPS, B. (1993) Modern options in pain management. Nursing RSA Verpleging, Vol. 8(7), pp.12-13.

PLUM, F. and POSNER J.B. (1993) Neurological Diseases. In: ANDREOLI T.E *et al.* (Eds.)Cecil Essentials of Medicine, 3rd ed. Philadelphia, Saunders, pp.731-868.

POCOCK, S J. (1983/1991) Clinical Trials: A Practical Approach, Chichester, J Wiley and Sons.

POCOCK, S.J. (1985) Current issues in the design and interpretation of clinical trials. British Medical Journal, Vol. 290, pp.39-42.

POCOCK, S.J., HUGHES, M.D. and LEE, R.J. (1987) Statistical problems in the reporting of clinical trials. New England Journal of Medicine, Vol. 317(7), pp.426-32.

POMERANZ, B. and CHIU, D. (1976) Naloxone blockade of acupuncture analgesia: endorphin implicated. Life Sciences, Vol. 19, pp.1757-76.

POMERANZ, B. (1987) Acupuncture Neurophysiology: In Adman, G. (Ed), Encyclopaedia of Neuroscience, Boston. Birkhaven, pp.6-7.

POMERANZ B. and WARMA, N. (1988) Electroacupuncture suppression of a nociceptive reflex is potentiated by two repeated electroacupuncture treatments: the first opioid effect potentiates a second non-opioid effect. Brain Research, Vol. 452. Pp.232-36.

POMERANZ, B. and STUX, G. (Eds.)(1989) Scientific Bases of Acupuncture, Berlin, Springer-Verlag.

PRANCE, S.E., DRESSER, A., WOOD, C. *et al.* (1988) Research on traditional Chinese acupuncture - science or myth: a review. Journal of the Royal Society of Medicine, Vol. 81, pp.588-90.

PRICE, D.D., RAFII, A., WATKINS, L.R. *et al.* (1984) A psychophysical analysis of acupuncture analgesia. Pain, Vol. 19, pp.27-42.

PRICE, P. and REES, L.H. (1982) Research: The chemical basis of acupuncture analgesia. British Journal of Acupuncture, Vol. 5,(2), pp.13-15.

QUEBEC TASK FORCE ON SPINAL DISORDER. (1987) Treatment of activity-related spinal disorders. Spine, Vol. 12, (PT Suppl), pp.522-30.

RABIN, A.G. (1987) Letter to the editor on dead battery placebo. Pain, 29, pp.399-400.

RACK, H.D. (1989) Reasonable Enthusiast; John Wesley and the Rise of Methodism. London, Epworth.

REICHMANIS, M. MARINO, A.A. and BECKER, R.O. (1975) Electrical correlates of acupuncture points. IEEE Transactions on Biomedical Engineering, Nov.1975, pp.533-5.

REICHMANIS, M. MARINO, A.A. and BECKER, R.O. (1976) D.C. Skin conductance variation at acupuncture loci. American Journal of Chinese Medicine, Vol. 4(1), pp.69-72.

REUSS, R. and MEYER, S.C. (1985) The use of TENS in the management of cancer pain. Physical Therapy and Clinical Management, Vol. 5(5) pp.26-28.

RICHARDSON, C. (1985) Plugged into pain control. Nursing Mirror, Vol. 160(5), pp.7-8.

RICHARDSON, P.H. (1992) Pain and the placebo effect. Acupuncture in Medicine, Vol. 10(1), pp.9-11.

RICHARDSON, R.R., MEYER, P.R. and CERULLO, L.J. (1980) Transcutaneous electrical neurostimulation in musculoskeletal pain of acute spinal cord injuries. Spine, Vol. 5(1), pp.42-45.

RIEB, L. and POMERANZ, B. (1992) Alterations in electrical pain thresholds by use of acupuncture-like transcutaneous electrical nerve stimulation in pain-free subjects. Physical Therapy, Vol. 72(9), pp.658-67.

ROCHE, P.A. and WRIGHT, A. (1989) An investigation into the value of transcutaneous nerve stimulation (TENS) for arthritic pain. Physiotherapy Theory and Practice, Vol. 6, pp.25-33.

ROONEY, S-M., JAIN, S. and GOLDINER, P.L. (1983) Effect of transcutaneous nerve stimulation on postoperative pain after thoracotomy. Journal of Anesthesia and Analgesia, Vol. 62, pp.1010-12.

ROSENBERG, W.F. and LACHIN, J.M. (1993) The use of response-adaptive designs in clinical trials. Controlled Clinical Trials, Vol. 14, pp.471-84.

ROSENBERG, W. and DONALD, A. (1995) Evidence based medicine: an approach to clinical problem-solving. British Medical Journal, Vol. 310, pp.1122-27.

SACKETT, DL. (1996) The Doctor's (ethical and economic) dilemma. OHE Annual Lecture. London, Office of Health Economics.

SACKS, H.S., CHALMERS, T.C. and SMITH, H. (1983) Sensitivity and specificity of clinical trials. Archives of Internal Medicine, Vol. 143, pp.753-5.

SACKS, H.S., BERRIER, J. and REITMAN, D. (1987) Meta-analysis of randomized controlled trials. The New England Journal Of Medicine, Vol. 316(8), pp.450-5.

SALANSKY, N. and FEDOTCHEV A. (1994) Endogenous opioid peptide level changes under electrostimulation and their assessment by the EEG. International Journal of Neuroscience, Vol. 78, pp.193-205.

SANTIESTEBAN, A.J. (1983) The role of physical agents in the treatment of spinal pain. Clinical Orthopedics and Related Research, Vol. 179. pp.24-30.

SANTIESTEBAN, A.J. (1984) Comparison of electroacupuncture and selected physical therapy for acute spine pain. American Journal of Acupuncture, Vol. 12(2), pp.257-61.

SCHAEFER, A. (1982) The ethics of the randomized clinical trial. The New England Journal of Medicine Vol. 307(12), pp.719-24.

SCHEFER, N. and KITAY, G. (1987) Transcutaneous electrical Nerve stimulation and pain relief: An overview. American Journal of Electromedicine, Vol. 2(1), pp.9-12.

SCHERDER, E.J.A. and BOUMA, A. (1993) Possible role of the nucleus raphe dorsalis in analgesia by peripheral stimulation: Theoretical considerations. Acupuncture and Electro-Therapeutics Research International Journal, Vol. 18, pp.195-205.

SCHMIDT, W. and SMITH, J.L. (1939) The sciatic syndrome and its management. Archives of Physical Therapy, Vol. 20, pp.494-500.

SCHWARTZ, D. and LELLOUGH, J. (1967) Explanatory and pragmatic attitudes in therapeutic trials. Journal of Chronic Diseases, Vol. 20, pp.637-48.

SERES, J.L. and NEWMAN, R.J. (1976) Results of treatment of chronic low-back pain at the Portland Pain Center. Journal of Neurosurgery, Vol. 45, pp.32-6.

SERRATO, J.C. (1979) Pain control by transcutaneous nerve stimulation. Southern Medical Journal, Vol. 72(1), pp.67-71.

SHAPIRO, A.K. (1960) A contribution to a history of the placebo effect. Behavioural Science Journal, pp.109-35.

SHAPIRO, S. (1994) Meta-analysis/shmeta-analysis. American Journal of Epidemiology Vol., 140(9), pp.771-8.

SHAUGHNESSY, A.F., SLAWSON, D.C., BENNETT, J.H. (1994) Becoming an information master: A guidebook to the medical information jungle. Journal of Family Practice, Vol. 39(5), pp.489-99.

SHEALY, C.N. (1974) Six years' experience with electrical stimulation for control of pain. Advances in Neurology, Vol. 4, pp.775-82.

SHEALY, C.N. (1987) Vitamin B6 and other vitamin levels in chronic pain patients. The Clinical Journal of Pain, Vol. 2(3), pp.203-4.

SHEALY, C.N., CADY, R.K., WILKIE, R.G. *et al.* (1989) Depression: A diagnostic, neurochemical profile and therapy with cranial electrical stimulation (CES). Journal of Neurological and Orthopaedic Medicine and Surgery, Vol. 10(4), pp. 301-3.

SHEALY, C.N. and MAULDIN, C.C. (1994) Modern medical electricity in the management of pain. Clinics in Podiatric Medicine and Surgery, Vol. 11(1), pp.161-75.

SHEKELLE, P.G., ANDERSSON, G., BOMBARDIER, C. *et al.* (1994) A brief introduction to the critical reading of the clinical literature. Spine, Vol. 19(18S).

SHELDON, T.A. (1994) Please bypass the PORT. British Medical Journal, Vol. 309, pp.142-3.

SHEON, R.P. (1984) Transcutaneous electrical nerve stimulation. Post-graduate Medicine Vol. 75(5), pp.71-4.

SILVETTE, H. (1939) On Quacks and quackery in seventeenth-century England. Annals of Medical History, Vol. 3(1), pp.239-51.

SIMMONDS, M. WESSEL, J. and SCUDDS, R. (1992) The effect of pain quality on the efficacy of conventional TENS. Physiotherapy Canada, Vol. 44 (3), pp.35-40.

SIMMONDS, M.J. and KUMAR, S. (1994) Pain and the placebo in rehabilitation using TENS and laser. Disability and Rehabilitation, Vol. 16(1), pp.13-20.

SJOLUND, B.H. and ERIKSSON, M.B. (1979) The influence of Naloxone on analgesia produced by peripheral conditioning stimulation. Brain Research, Vol. 173, pp. 295-301.

SJOLUND, B. (1985) A quantitative determination of stimulation parameters of transcutaneous electrical nerve stimulation for pain relief. Applied Neurophysiology Vol. 48, pp.281-2.

SLAVIN, R.E. (1986) Best evidence synthesis: An alternative to meta-analysis and traditional reviews. Educational Researcher, Vol. 15, pp.5-11.

SLAWSON, D.C., SHAUGHNESSY, A.F., BENNETT, J.H. (1994) Becoming an information master: Feeling good about not knowing everything. Journal of Family Practice, Vol. 38(5), pp.505-13.

SMEDLEY, F., TAUBE, M. and WASTELL, C. (1988) Transcutaneous electrical nerve stimulation for pain relief following inguinal hernia repair: A controlled trial. European Surgery Research, Vol. 20, pp.233-37.

SMITH, M.J. (1983) Electrical stimulation for relief of musculoskeletal pain. Physician and Sportsmedicine, Vol. 11(5), pp.47-55.

SMITH, R. (1991) Where is the wisdom.? British Medical Journal, Vol. 303, pp.798-9.

SNYDER-MACKLER, L. and ROBINSON, A.J. (1989) Clinical Electrophysiology, Baltimore, Williams and Wilkins.

SORIC, R. and DEVLIN, M. (1985) Transcutaneous electrical nerve stimulation. Postgraduate Medicine, Vol. 78(4), pp.101-7.

STAMP, J.M. (1982) A review of transcutaneous electrical nerve stimulation (TENS). Journal of Medical Engineering and Technology, Vol. 6, pp.99-103.

STEIG, RL. (1976) New Methods for achieving pain control with Transcutaneous Nerve Stimulation. Reprint of paper presented to the annual meeting of the American Academy of Neurology, Toronto, April, 1976.

STEWART, A.L., GREENFIELD, S., HAYS, R.D. *et al.* (1989) Functional status and well-being of patients with chronic conditions. Journal of the American Medical Association, Vol. 262(7), pp.907-13.

STEWART, D., THOMSON, J. and OSWAID, I. (1977) Acupuncture analgesia: an experimental investigation. British Medical Journal, Jan 8th, pp.67-70.

STEWART, L.A. and PARMAR, M.K.B. (1994) Meta-analysis of the literature or of individual patient data: Is there a difference. Lancet, Vol. 341, pp.418-22.

STILLINGS, D. (1973b) ARTIFACT: Acupuncture. An ancient Chinese method of healing. Medical Instrumentation, Vol. 7(1), p.16.

STILLINGS, D. (1973c) ARTIFACT: The first observation of electrical stimulation. Medical Instrumentation, Vol. 7(3), p.202.

STILLINGS. D. (1973d) ARTIFACT: Benjamin Franklin's celebrated kite experiment. Medical Instrumentation, Vol. 7(4), p.234.

STILLINGS, D. (1973e) ARTIFACT: John Wesley: philosopher of electricity. Medical Instrumentation, Vol. 7(5), pp. 307-8.

STILLINGS, D. (1974c) ARTIFACT: Absolutely mad electrical patents. Medical Instrumentation, Vol. 8(2), pp. 84-5.

STILLINGS, D. (1974d) ARTIFACT: Healing fractures electrically. Medical Instrumentation, Vol. 8(4), pp.258-9.

STILLINGS, D. (1975c) ARTIFACT: "Quid dicet de magnete, de electro", Medical Instrumentation Vol. 9 (2), p.116.

STILLINGS, D. (1975d) ARTIFACT: Darwin and Duchenne. Medical Instrumentation, Vol. 9(1), p.37.

STILLINGS, D. (1975e) ARTIFACT: The taste of dissimilar metals. Medical Instrumentation, Vol. 9(3), p.149.

STILLINGS, D. (1975f) ARTIFACT: Martinus Van Marum and the Great Electrical Machine of Harlem. Medical Instrumentation, Vol. 9(4), p.195-6.

STILLINGS, D. (1975g) ARTIFACT: Did Jan Swammerdam Beat Galvani by 134 Years. Medical Instrumentation, Vol. 9(5), p.226.

STILLINGS, D. (1976a) ARTIFACT: A medical cure by Benjamin Franklin. Medical Instrumentation, Vol. 10(1), p.27.

STILLINGS, D. (1976b) ARTIFACT: Charles Bew and Tic Douloureux. Medical Instrumentation, Vol. 10(2), pp.138.

STILLINGS, D. (1976c) ARTIFACT: The First Defibrillation. Medical Instrumentation, Vol. 10(3), p.168.

STILLINGS, D. (1976d) ARTIFACT: 'The power to strengthen the movements of the heart'. Medical Instrumentation, Vol. 10(4), p. 213.

STUBBING, J.F. and JELLICOE. J.A. (1988) Transcutaneous electrical nerve stimulation after thorocotomy. Anaesthesia, Vol. 43, pp.296-8

STUX, G. and POMERANZ B. (1987) Acupuncture: Textbook and Atlas, Berlin, Springer-Verlag.

STUX, G. and POMERANZ, B. (1989) Introduction. In: Stux, G. and POMERANZ, B. ((Eds.).) Scientific Bases of Acupuncture. Berlin, Springer Verlag, pp.1-5.

TAKESHIGE, C. (1989) Mechanisms of acupuncture analgesia based on animal experiments. In: STUX, G. and POMERANZ, B. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.53-78.

THOMPSON, S.G. and POCOCK, S.J. (1991) Can Meta-analysis be trusted. Lancet, Vol. 338, p.1127.

THORSTEINSSON, G., STONNINGTON, H.H., STILLWELL, G.K. *et al.* (1978) The placebo effect of transcutaneous electrical stimulation. Pain Vol. 5, pp.31-41.

THORSTEINSSON, G. (1987) Chronic pain: Use of TENS in the elderly. Geriatrics, Vol. 42(12), pp.75-82.

THORSTEINSSON, G. (1990) Can trials of physical treatments be blinded. American Journal of Physical Medicine and Rehabilitation, Vol. 69(4), pp.219-20.

THOMPSON, S.G. (1994). Why sources of heterogeniety in meta-analysis should be investigated. British Medical Journal, Vol. 309, pp.1351-5.

THOMPSON, J.W. (1995) Transcutaneous electrical nerve stimulation for the relief of pain. Acupuncture in Medicine, Vol. 13(1), pp.35-40.

TOURNIER, P. (1963) The Strong and the Weak, London, SCM Press Ltd.

TOREBJöRK H.E. and HALLIN R.G. (1974) Responses in human A and C fibres to repeated electrical intradermal stimulation. Journal of Neurology, Neurosurgery and Psychiatry, Vol. 37, pp.653-64.

TRANTER, J. (1989) John Wesley's Primitive Physic. An easy and natural method of curing most diseases. International Journal of Dermatology, Vol. 28, pp.92-3.

TSAI, H., LIN, J-G. and INOKI, R. (1989) Further evidence for possible analgesic mechanisms of electroacupuncture: Effects on neuropeptides and serotonergic neurons in rat spinal cord. Japan Journal of Pharmacology, Vol. 49, pp.181-5.

TSOU, K. (1989) Activation of the enkephalinergic system by acupuncture. In: Stux, G. and POMERANZ, B. (Eds.) Scientific Bases of Acupuncture, Berlin, Springer-Verlag, pp.113-8.

TURNER, J.A., DEYO, R.A., LOESER, J.D. *et al.* (1994) The importance of placebo effects in pain treatment and research. Journal of the American Medical Association, Vol. 271(20), pp.1609-14.

TURRELL, W.J. (1938) John Wesley: Physician and Electrotherapist, Oxford, Basil Blackwell.

URBAN, B.J. (1984) Treatment of chronic pain with nerve blocks and stimulation. General Hospital Psychiatry Vol. 6, pp.43-7.

VERNON, D.T.A. and BLAKE, R.L. (1993) Does problem-based learning work? A meta-analysis of evaluative research. Academic Medicine, Vol. 68(7), pp.550-61.

VICKERS, A. (1995) Critical appraisal: how to read a clinical research paper. Complementary Therapies in Medicine, Vol. 3(3), pp.158-66.

VICKERS, A.J. (1996) Can acupuncture have specific effects on health? A systematic review of acupuncture antiemesis trials. Journal of The Royal Society of Health, Vol. 89, pp.303-11.

VINAR, O. (1969) Dependence on a placebo: a case report. British Journal of Psychiatry, Vol. 115, pp.1189-90.

VINCENT, C.A. and RICHARDSON, P.H. (1987) Acupuncture for some common disorders: a review of evaluative research. Journal of Royal College of General Practitioners, February 87, pp.77-81.

VINCENT. C.A. (1989) The methodology of controlled trials of acupuncture. Journal Of The British Medical Acupuncture Society, Vol. 6, pp. 9-13.

VINCENT, C.A. and CHAPMAN, C.R. (1989) Pain measurement and the assessment of acupuncture treatment. Acupuncture in Medicine, Vol. 6, pp.14-19.

VON KORFF, M. (1994) Studying the natural history of back pain. Spine, Vol. 19(18S).

WALL, P.D. (1985) Future trends in pain research. Philosophical Transactions of the Royal Society (London), B308, pp.393-401.

WALL, P. (1992) The placebo effect: an unpopular topic. Pain, Vol. 51(1), pp.1-3.

WALSH, D.M. (1996) Transcutaneous electrical nerve stimulation and acupuncture points. Complementary Therapies in Medicine, Vol. 4, pp.133-7.

WALSH, D.M. (1997) TENS: Clinical applications and related theory, Edinburgh, Churchill Livingstone.

WANG, W.C., GEORGE, S.L. and WILIMAS, J.A. (1988) Transcutaneous electrical nerve stimulation treatment of sickle cell pain crises. Acta Haemat, Vol. 80, pp.99-102.

WANG, J.Q. MAO, L. and HAN, J-S. (1992) Comparison of the antinociceptive effects induced by electroacupuncture and transcutaneous electrical nerve stimulation in the rat. International Journal of. Neuroscience, Vol. 65(1-4), pp.117-29.

WARFIELD, C., STEIN, J.M. and FRANK, H.A. (1985) The effect of transcutaneous electrical nerve stimulation on pain after thoracotomy. The Annals of Thoracic Surgery, Vol. 39(5), pp.462-5.

WATKINS L.R. and MAYER, D.J. (1982) Organization of endogenous opiate and non-opiate pain control systems. Science, Vol. 216, pp.1185-92.

WATKINS L.R. and MAYER, D.J. (1986) Multiple endogenous opiate and non-opiate analgesia systems: evidence of their existence and clinical implications. Annals of New York Academy of Sciences, Vol. 467, pp.273-99.

WEIBAN, G. *et al.* (1993) Electroacupuncture treatment of spinal compression. International Journal of Clinical Acupuncture, Vol. 4(2), pp.211-2.

WEINTRUB, M., PETURSSON, S., SCHWARTZ, M. *et al.* (1975) Acupuncture in musculoskeletal Pain: Methodology and results in a double-blind controlled clinical trial. Abstracts of Papers: in Clinical Pharmacology and Therapeutics, Vol. 17, p.248.

WESLEY, J. Rev. (1891) Wesley his own biographer: Selections from the Journals of the Rev. John Wesley A.M., London, C H Kelly.

WESLEY, J. Rev. (1954) Explanatory Notes upon the New Testament, London, Epworth.

WILCOXON, C.D. (1958-59) The Whole Man: A study of John Wesley's Healing Ministry. Religion in Life, Vol. XXVIII, pp.580-6.

WILSON, D.H. (1972) Treatment of soft-tissue injuries by pulsed electrical energy. British Medical Journal, April 29, pp.269-70.

WOLF, F.M. (1993) Problem-based learning and meta-analysis: Can we see the forest through the trees. Academic Medicine, Vol. 68(7), pp.542-4.

Xu X, Shibasaki H, Shindo K (1993) Effects of acupuncture on somatosensory evoked potentials: A review. Journal of Clinical Neurophysiology, Vol. 10(3), pp.370-7.

YOUNG, R.F. and BRECHNER, T. (1986) Electrical stimulation of the brain for relief of intractable pain due to cancer. Cancer, Vol. 57, pp.1266-72.

YUSUF, S., WITTES, J., PROBSTFIELD, J. *et al.* (1991) Analysis and interpretation of treatment effects in subgroups of patients in randomized clinical trials. Journal of the American Medical Association, Vol. 266(1), pp.93-8.

ZELEN, M. (1979) A new design for randomised clinical trials. New England Journal of Medicine, Vol. 300, pp.1242-45.

ZHANG, A., PAN, X., XU, S. *et al.* (1980) Endorphins and acupuncture analgesia. Chinese Medical Journal (Eng. Ed), Vol. 93(10), pp.673-680.

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