Acupuncture & Electro-Therapeut. Res. Vol. 1, pp. 3-44, 1975. Pergamon Press. Printed in Great Britain.

EDITORIAL

SOME HISTORICAL ASPECTS OF ACUPUNCTURE AND IMPORTANT PROBLEMS TO BE CONSIDERED IN ACUPUNCTURE AND ELECTRO-THERAPEUTIC RESEARCH

(Received 7 April 1975)

Abstract—The aim and scope of the journal is defined by emphasizing interdisciplinary, multi-parameter, scientific, and objective approaches to both clinical and basic research in Acupuncture and Electro-Therapeutics. By introducing some relatively unknown historical aspects of acupuncture in both Far Eastern countries and the Western world, the adequacy of using "Oriental medicine or Far Eastern Oriental medicine" described for Acupuncture was stressed, rather than emphasizing Acupuncture as associated with nationalism of specific countries. Some of the important parameters and the associated problems in carrying out research in Acupuncture and Electro-Therapeutics are discussed. Among the parameters are: The description of Acupuncture technique; the method of the description of Acupuncture points (Acupuncture loci); placebo effects; hypnotic effects; pre- and post Acupuncture evaluations; CBC & blood chemistry; environmental effects; bio-rhythm and time factors; Electro-Acupuncture and Electro-Therapeutics; four types of electro-acupuncture, including capacitive current and Electro-magnetic field stimulation; advantages of Electro-Acupuncture; important parameters in Electro-Acupuncture; side effects of Electro-Acupuncture; simple techniques of evaluating the safety of electrical stimulators; Kirlian photography and Acupuncture; etc. Brief introductions and comments were made on the papers published in this issue.

Resumé—L'objectif de ce journal est de mettre l'accent sur les approches scientifiques, objectives, interdisciplinaires à paramètres multiples, dans la recherche fondamentale en acuponcture et en électro-thérapie. Nous insistons sur l'usage juste des termes "médecine orientale ou extreme-orientale" en parlant des aspects historiques de l'acuponcture, relativement inconnus, tant en Extrême-Orient que dans le monde occidental. Nous n'insisterous pas sur le caractere national, généralement attribué à l'acuponcture. Nous discuterons les parameteres importants et les problémes associés à la recherche en acuponcture et en électro-thérapie.

Nous traitons les sujets et paramètres suivants: la description de la technique d'acuponcture, en particulier le point (acupuncture loci), l'effet de placebo, les effets hypnotiques, l'examen avant et après l'acuponcture, le CBC, la chimie sanguine, les effets de l'entourage, le rythme biologique et le cateur du temps, l'électro-acuponcture et l'électro-thérapie, quatre types des électro-acuponcture, les avantages de l'électro-acuponcture, les paramètres importants en électro-acuponcture, les effets annexes de le'électro-acuponcture, les méthodes simples pour évaluer le sécurité du stimulateur electrique, photographie et acuponcture par Kirlian etc. Nous ajoutons une brève introduction et quelques commentaires aux articles publiés dans ce numéro.

Zusammenfassung—Der Nachdruck der Zeitschrift liegt auf interdisziplinären, mit vielfachen Parametern definierten, wissenschaftlichen und objektiven Methoden der klinischen und Grundlagenforschung in Akupunktur und Elektrotherapie. Einige relativ unbekannte geschichtliche Aspekte der Akupunktur im sowie im fernen Osten

wurden in die Diskussion eingeführt, um die Adäquanz der "orientalischen oder fernöstlichen Medizin" statt der üblichen nationalistischen Fragen in den Mittelpunkt zu stellen. Einige der bedeutsamen Parameter und die mit ihnen verbundenen Proleme der Akupunktur- und Elektrotherapieforschung werden besprochen, darunter: die Beschreibung der Akupunkturtechniken; Methoden der Beschreibung von Akupunkturpunkten; placebo Effekte; Auswertungen vor und nach Akupunktur; CBC und Blutzusammensetzung; Einwirkungen der Umgebung; Biorhythmus und Zeitfaktoren; Elektroakupunktur und Elektrotherapie; vier Typen der Elektroakupunktur, einschliesslich kapazitiver Strom und elektromagnetische Feldstimulation; Vorteile der Elektroakupunktur; wichtige Parameter der Elektroakupunktur; Nebenwirkungen der Elektroakupunktur; einfache Techniken zur Auswertung der Sicherheit elektrischer Stimulatoren; Kirlianische Photographie und Akupunktur, usw. Kurze einführende Kommentare zu den in dieser Ausgabe veröffentlichten Artikeln.

Key Word Index--History of Oriental medicine, acupuncture, electro-acupuncture, Far-Eastern Oriental medicine, acupuncture points, placebo effect, hypnotic effect, CBC, blood chemistry, environmental effects, biorhythm, capacitive current stimulation, electromagnetic field stimulation, side effects of electro-acupuncture, electrolysis of body tissue, polarization phenomena, electrode breakage, necrosis of tissue, capillaries, arterioles, safety criteria, Kirlian photography, Infra-red thermography, Skin temperature.

The aim of this journal is to provide an international forum for the exchange of ideas and for the promotion of basic and clinical research in Acupuncture, electro-therapeutics and related fields, without being influenced by nationalism, political ideology, or any other non-scientific purposes. The journal was established in order to make Acupuncture and Electro-Therapeutics a universally acceptable branch of medicine through multi-disciplinary research based on scientific disciplines. The final goal is to provide a better understanding of both the beneficial and adverse effects of these treatments in order to supplement or improve existing methods of diagnosis, prognosis, treatment and prevention of diseases in both Western and Oriental medicine.

As is pointed out in the Aim and Scope of this journal along with Instructions to Authors on the inside cover of each issue, the journal will accept original, basic or clinical research papers, worthwhile review papers on methods, applications, limitations, theories or principles of Acupuncture and Electro-therapeutics including Electro-Analgesia treatment through the application of various types of electrical or electromagnetic field stimulii or any other related method of treatment such as Shiatsu, Applied Kinesiology, Moxibustion and Herbal Medicine. In general, submitted papers must be based either on the documentation of data through scientifically proven or accepted methods or on the explanation of new theories in the field with critical evaluation of such ideas. For example, a paper may present data such as the effects of acupuncture on the cardiovascular or nervous systems studied from blood chemistry, hemodynamics, enzymes, other bio-chemical, patho-physiological, pharmacological, immunological studies, ECG, EEG, EMG, nerve conduction velocity, threshold stimulation for pain, somato-sensory evoked potentials or any other electro-physiological methods that are scientifically acceptable. Papers not directly dealing with Acupuncture, Electro-Therapeutics or the related methods of treatment mentioned above will also be considered, provided that they have important implications for either improving diagnostic methods and treatment or for elucidating the underlying principles or the historical or medico-legal aspects in these fields.

Some of the important functions of this international scientific journal are not only to provide a suitable international forum for the exchange of both old and new ideas evaluated by means of critical scientific disciplines and the communication of new findings, but also to encourage the development of serious research. This is of particular importance in the fields of Acupuncture and Electro-Therapeutics research. These fields have often been associated with

mysticism and empirical findings. Up until now, testimonial reports of beneficial effects have often been accepted in place of scientific quantitiative documentation and explanation of observed phenomena associated with Acupuncture.

In this editorial I intend to raise questions on the subject and discuss some of the parameters and problems associated with serious research in Acupuncture and Electro-Therapeutics through my personal experience. When acupuncture is given to the patient, not only is the nervous system influenced but also the circulatory system is simultaneously affected [1-7, 35-73]. As the author's previous study indicated, Acupuncture-induced circulatory effects are detected not only in the local area where Acupuncture is given, but also with relatively short time delays in distal parts of the body, including the microcirculatory network of the brain. These are classified by the author into the following three consecutively-changing phases: 1st phase, vaso-constriction; 2nd phase, quasi-control; 3rd phase, vaso-dilation. These circulatory changes were found by the author in 1972 in the majority of more than 206 human experimental subjects. Therefore, to understand the various types of Acupuncture effects, it is of the utmost importance to simultaneously study both the nervous and the circulatory systems as well as their peripheral and central regulatory mechanisms.

Unfortunately some of the researchers are studying only limited parameters in the nervous system. For example, some investigators only study the problem of pain and its threshold before and after Acupuncture, with or without comparing the effects of drugs or hypnosis. The pain's threshold, *per se,* is one parameter and is a variable factor. If there are N number of factors influencing the pain threshold, and if N is larger than 10, to quantitatively define the pain threshold, one must solve N numbers of simultaneous equations. This is particularly so when the different parameters influencing the pain threshold are inter-related. However, among the many parameters one can experimentally eliminate some of the minor parameters. If one simply picks up a few and carries out research on them without first finding the important parameters experimentally, the scientific value may be considerably limited. Science begins with faithful documentation of data, whether it is desirable or not to the investigator. Any parameter studied should first be documented either through note taking, photographic recording or by quantitative numbers or graphs, the ideal form being the creation of the simplest equations which faithfully include all the involved parameters and can actually predict the response of the system under study to the given conditions or stimulations.

Some of the parameters will be discussed together with associated problems to be considered in designing reproduceable acupuncture research, in order to properly evaluate the effects of Acupuncture and Electro-Therapeutics. Before discussing some of the problems, the author will first clarify some of the documented historical facts which are often exaggerated.

SOME HISTORICAL ASPECTS OF ACUPUNCTURE AS FAR EASTERN ORIENTAL MEDICINE

Historical accounts of some professionals and laymen often imply that acupuncture is uniquely a part of traditional Chinese medicine, with a "history of "more than 3000 years" or sometimes "about 5000 years" in so-called scientific papers presented in scientific meetings on acupuncture, teaching workshops on acupuncture, or in the mass media. It is often claimed that since Acupuncture has been used for such a long time, it must be effective. One must be very critical of such an assumption. It cannot be accepted because of legend. As the following selective review of Far Eastern oriental medical history will demonstrate, acupuncture has been practiced as part of the important routine medical treatment not only in China, but in Far Eastern countries such as Japan and Korea for more than 1400 years, although historical background and legend indicate that acupuncture has probably been practiced for more than 2000 years in Japan and Korea.

In Chinese literature there is a tendency to glorify or dignify written books or manuscripts

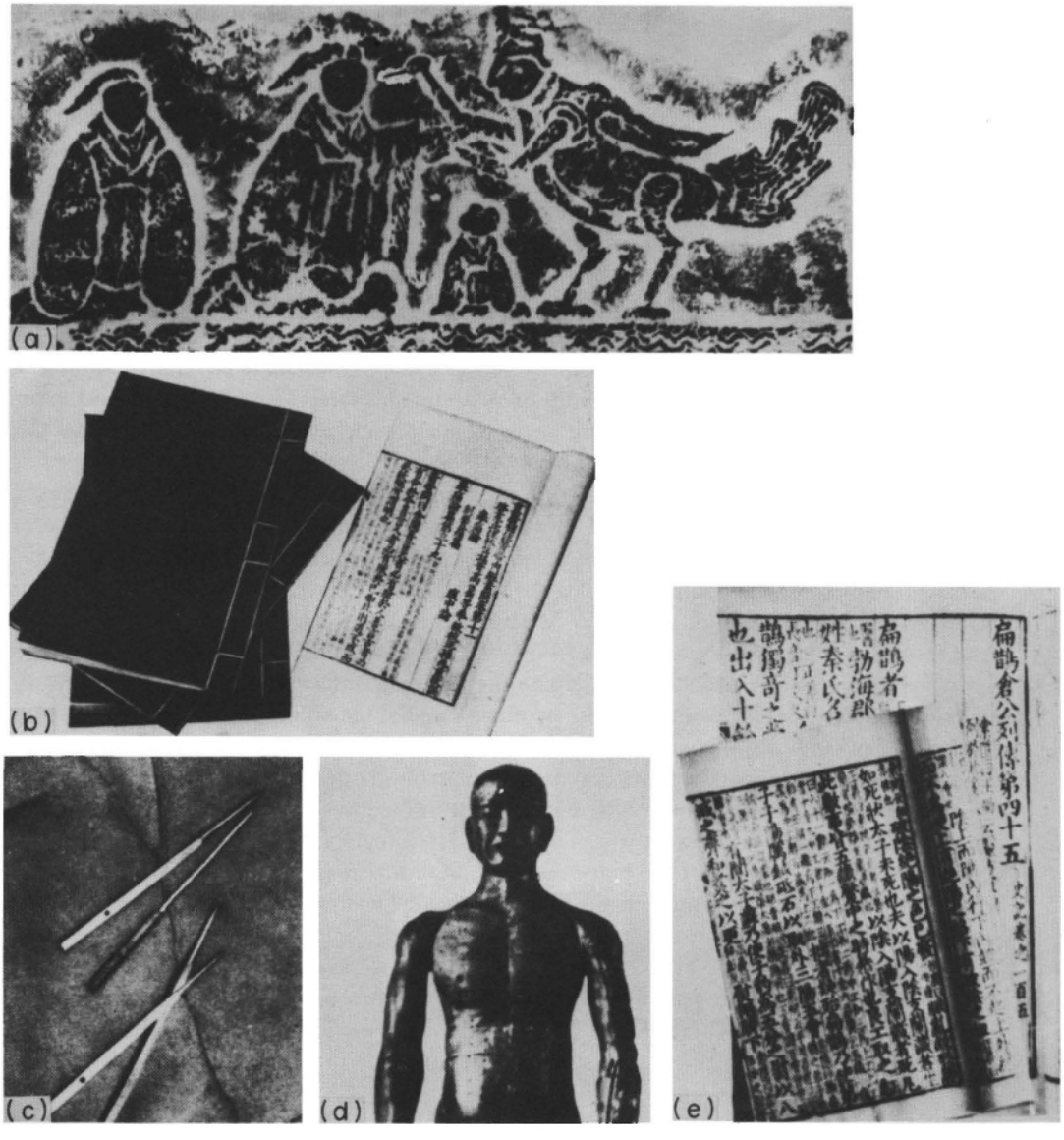

Fig. 1. The illustrations in this figure show the oldest existing historical evidence of the case of acupuncture in China. (a) *Treatment by Acupuncture*, a rubbing of an Eastern Han Dynasty (25-220 A.D.) stone carving unearthed in Shantung Province. The half-man-half-bird doctor is needling a patient with one hand while taking his pulse with the other. The patient on the left is waiting his turn. In ancient times the bird was the totem of clans living in eastern China, especially in Shantung. (b) The oldest existing copy of *Nei Ching* in China, a Ming Dynasty edition (1550 A.D.) The oldest copy of Nei Ching in the world is in Ninnaji Temple in Kyoto, Japan a handwritten copy of 1167 A.D. (c) The earliest acupuncture needles. Gold needles unearthed in the tomb of Lin Sheng who died about 100 B.C. during the Western Han Dynasty (Note: Their diameter is much larger than that of present day needles). (d) Bronze figure marked with acupuncture points cast in 1027 A.D. during the Sung Dynasty. This is the earliest existing model of its kind. (e) The oldest existing book describing Pien Chueh (Pien Ch'iao) and his acupuncture treatment, written in the Ming Dynasty edition of the Historical Records (1525 A.D.). The original description of Pien Ch'iao was presumably written by Szuma Chine more than 2000 years ago. The book recorded that Pien Chueh (Pien Ch'iao) of the Warring States Period used acupuncture to revive a patient already in a coma.
None of these items dates much before 100 B.C. (This figure is adapted from official Chinese pictorial magazines published in the Peoples Republic of China in 1973).

by using the names of respected legendary people as authors, rather than using the author's own name. When this author was in middle school in Japan as one of the last students under the old system that was terminated a few years after World War II, classical Chinese literature was an integral part of the curriculum. It was often emphasized by the teachers of classical Chinese literature (in middle school and later on in the universities) that when size or lengths of things are mentioned in Chinese literature, one should be very critical before taking the given numbers on face value. For example, the direct translation of a phrase which is "three thousand feet of white hair" is actually used to express a "very old person with very long hair."

In Chinese literature these are hyperboles of expression. In writings of a scientific nature, there is also a tendency to use legendary characters as authors and participants.

But one should not overlook that at the same time there is great accuracy in describing certain Acupuncture and medical procedures. The problem of determining when Acupuncture began in China is very difficult. Before fine strong metal needles became available, the surprisingly refined techniques and knowledge of Acupuncture described in *Nei Ching* (内経) and particularly in *Nan Ching* (難経) probably could not have developed. For instance, the well-known book *I Ching*, known as "Book of Change", believed to have been written between the 8th Century B.C. and the 4th Century B.C., described many concepts related to human health as well as the future of each individual. This description consists of the basic concepts of the Yin and the Yang and the five elements. This important book, which discusses all areas of supposed importance to human beings, including ideas about health and welfare, does not mention acupuncture. If Acupuncture were in use, the *I Ching* (易経) would not ignore its existence. The oldest known book on Acupuncture, *Nei Ching* did not appear before the 4th Century B.C. and historical circumstances indicate that the *Nei Ching* was probably written about the 2nd or 3rd Century B.C. The form of the book is dialogues between the legendary Yellow Emperor and primarily his Prime Minister (who also happens to be a physician) along with 5 other court physicians. The emperor asks questions and the Prime Minister supplies the answers. The legendary Yellow Emperor was supposed to have lived around 2600 B.C. Some people interpret *Nei Ching* as having been written during the reign of the Yellow Emperor himself, without critically examining the available historical documents or before drawing conclusions supported by factual material rather than speculation. Each emperor or dynasty traditionally would document all the important historical accomplishments of his reign, which would include any important books written on medicine, as the history of China indicates.

The oldest known Chinese record of medical practice found in the engraved writing on bones and turtle shells unearthed from the remains of the capital of the SHANG Dynasty (which is believed to have existed between the 16th and 11th centuries B.C.) in China, so far fails to reveal any indication of the use of Acupuncture. Some of the bones and turtle shells are said to show evidence of the use of heat therapy with moxibustion (personal communication from C.Y. Ting). However, Egyptians also used thermocautery with heated metal for many centuries before Christ (such as the use of thermocautery by the Egyptians on certain parts of the ear for the treatment of sciatic neuralgia). It is also said the first written reference to the use of Acupuncture in China can be found in the *Shi Chi* (史記) [14] written by Shi-Ma Quien (also pronounced as Shi-Ma Tsien or Szu-Ma Chine) in B.C. 91, which are annals of the so-called "Spring and Autumn Period" (*ca.* 722-481 B.C.) and the "Fighting (Contending) Countries Period," which cover the past history of the period between 711-221 B.C. while many recent Chinese books speculate on the use of stone needles, bone needles, and bamboo needles for the purpose of Acupuncture going back many centuries B.C. However, some Chinese say that the *Tso Chuan* (左伝) [15], presumably written about 540 B.C., made the first brief reference to Acupuncture.

The basic philosophical concepts of acupuncture in the *Nei Ching* consist of the concept of Yin and Yang, the Five Elements, and Taoism. The concepts of Yin and Yang and the Five Elements, all appeared previously in the *I Ching*. The Concepts of Taoism itself existed a few centuries before the appearance of *Nei Ching*. Although acupuncture might have been in use in China as early as the 6th Century B.C., all historical evidence indicates that the *Nei Ching* could not have been written before the 3rd century B.C. [2, 8, 13, 20].

The oldest stone carving unearthed from China depicting the use of acupuncture is considered to be no earlier than the 1st century A.D. This carving shows a doctor examining and treating human patients, his hands and face resembling a man but with a human-sized body of a bird. This half-bird half-man holds an acupuncture needle in its right hand and its left hand holds the wrist of a human patient, probably taking the pulse (see Fig. 1). It is believed that a small group in China practicing medicine—in particular, acupuncture—worshipped this bird as their ancestral spiritual transformation. One of the most important and one of the earliest books on acupuncture was the *Nan-ching* [16] (consisting of 81 difficult medical questions and their answers: See *Research on Nan-ching* [16] by Shouhaku Homma, published by Ido No Nihon-Sha, Oppama, Yokosuka, Japan, 1968). *Nan-ching* is believed to have been written by Pien Chiao (sometimes spelled "Pien Chueh") who supposedly lived about 430-350 B.C. (It is generally acknowledged that Pien Chiao used pulse diagnosis extensively, as can be seen in the *Nan-ching*). However, this book is supposed to have been written *after* the appearance of *Nei-ching*, the oldest book on acupuncture in China, so *Nan-ching* could not have been written before the 2nd or 3rd century B.C. There is considerable controversy as to when this expert physician actually lived, *if* we consider him as one individual physician. Details surrounding his life are very contradictory in the literature. For example, *Chinese Medicine* [17] (translated from the French to English by Bernard Fielding; published by McGraw-Hill and written by Pierre Huard and Ming Wong) places him in the "Period of Springs and Autumns," which they list as 722-481 B.C., yet their own dates for his lifetime are *ca.* 430-350 B.C., which would actually place him in the "Contending States" Period (475-221 B.C.). *Shih Chi* [14] written by Shi-Ma Qien in 91 B.C., describes Pien Chiao as a famous wandering physician with many episodes of treating noblemen in different parts of China. He was known for diagnosis by inspection, pulse diagnosis, acupuncture, and other modes of treatment.

In fact, the name Pien Ch'iao (扁鵲) may have stood for the expert physician or physicians who practiced acupuncture and whose trademark was the worship of this half-bird, half-man. There appears to have been a very limited number of people who carried on this as a family tradition.

The first character, *Pien,* can mean "flat," "small," "side," "wandering around,"—or it can mean "fast and light as a feather" or even "boat". However, according to the oldest Chinese etymological dictionary, *Shwo Wen Jie Zi* [18] (說文解字) written from 100 to 121 a.d. by *Hsu Shen* (許愼), in the Han Dynasty, the Chinese character *Pien* (扁) consists of two parts (i.e. "door" (戶) and "writing" (冊)). And the word *Pien* has the meaning of "Shu (署) on the door of the gate," which means "signature, title, writing, engraving, or other symbols put on the door of the gate." It may also mean "office" (as written on the door). The Chinese character 冊 or 册 comes from the form of the book or material on which most writing was made at that time. This consisted of a series of banded strips of flattened bamboo and was the most common form of writing material before paper was invented. Therefore, 冊 册 or 冊 has the meaning of "writing," "office where the public goes," "book," "signature," "binding," or "volumes of books." Also, since most proclamations from the emperor or

other public officials were written on this bound bamboo material, the word came to have the additional meaning of "proclamations," "orders" or "announcements."

The meaning of *Ch'iao* (鵲) is the bird, "magpie." The oriental tradition is that good tidings are associated with the singing of the magpie. The Chinese character for "magpie" is itself divided into two parts, the right half meaning "bird" (鳥) and the left half meaning "old." (昔).

According to legend, *Pien Ch'iao* is also said to be the famous physician in the era of the legendary Yellow Emperor. However, the name is more well known as the famous physician with the family name of *Ch'in* (秦). And *Ch'in* also denotes the Ch'in Dynasty, 221-206 B.C. In addition, *Ch'in's* given name, *Yue Ren* (or *Jen*), (越人) also means "man (人) from *Yue*" (越) (an actual geographic district of ancient China).

Therefore, the author's following speculation cannot be excluded: that Pien Ch'iao is a name given to a class of outstanding physicians, probably over a number of generations, who had the trademark of the half-bird (magpie) and half-human, and who were particularly expert on diagnosis (by inspection, pulse, etc.) and acupuncture. Some of these, often itinerant physicians, probably existed, from the 5th century B.C. to up to recent modern time. A further note of interest is that the oldest god of medicine in ancient Egypt was a human with the head of a *bird*, the god, Thout [20] which dates even before the famous Imhotep (2900 B.C.), physician, high priest, prime minister and builder of the pyramid.

Around the time of Christ, acupuncture was already known in Korea. In the early part of the history of Japan many important elements of Chinese culture were transmitted to Japan indirectly through Korea or directly from China itself [8, 13, 17, 20]. According to the legendary story, acupuncture was brought from China to Japan a few centuries before Christ. The same emperor who first built the oldest part of the Great Wall had heard from Jofuku as he is known in Japan about the sacred oranges growing around 3 sacred mountains (one of which is Mt. Fuji) in eastern sea that would prevent aging and would confer immortality to those who ate it. On June 20, 218 B.C. in the 3rd year of his reign, he sent Jofuku as the leader of a large party of families consisting of 558 men and women off to Japan, in 85 boats equipped with supplies and physicians that would enable them to survive for many years. Although the party arrived at Kii in the southern part of Japan, the boats never returned to China and Jofuku died in Japan in 208 B.C. The rest of the party remained. There are detailed accounts of this expedition and its arrival in Japan as well as their life style there. This ancient record provided descriptions of these events and Acupuncture using golden needles as well as the requirements to practice Acupuncture. (See *Puzzle of Japanese Ancient Documents* [19] by Teiichi Suzuki published by Tairiku-Shobou Tokyo Japan in 1972.) Although there are Chinese documents as well as Japanese archeological findings supporting the existence of communications between China and Japan a few centuries B.C., official Japanese annals of history simply record that many books on Acupuncture were brought into Japan from Korea as well as directly from China, during the 6th and 7th century A.D. Before that time detailed recording of historical events were not customarily done. This was partly due to the time-consuming Japanese pictorial writing techniques which existed before Chinese characters were adapted as official writing methods. Also, important historical events were passed from mouth to mouth by families of professional story tellers.

According to the *Chinese Annals of the Former Han Dynasty* (202 B.C. to A.D.) there is a geographical section describing the existence of the communication between China and Japan. Some of the Japanese historians say that acupuncture has been used in Japan before the time of Christ, because stone instruments with a sharp edge that were used for medical treatments

were found by archaeologists. According to the *Su Wen* of the *Nei Ching* the treatment using sharp stone instruments came from the East. Some speculated that acupuncture might have come from Japan (See *History of Medicine* [20] written by Teizou Ogawa and published by Chuoukoron-sha, Tokyo Japan 1964).

The first document of the foreign physician in Japan was in 414 A.D. A Korean physician, named Konmu treated the disease of the emperor. In 562 A.D. a Chinese monk-physician, Chisou, who remained to become a Japanese citizen, came to Japan with an acupuncture diagram and 164 volumes of medical books including books on acupuncture. In 608 A.D. Imoko Ono, the Japanese ambassador to China, accompanied two Japanese to China for the specific purpose of studying medicine. After these two physicians returned to Japan following 15 years of study in China, knowledge of Chinese medicine soon spread all over Japan. In accordance with the Medical Laws established in 701 A.D. (*Tai Hou Ritsurei*) and 718 A.D., (*Yourou Ritsurei*), the Japanese government established a medical college. Tuition was free, and children of physicians were given preference to enter the college. When there was room, brilliant youths from the public were also admitted.

There was an age limit of above 13 years, but less than 16 years of age. Different specialities were established; Internal medicine required 7 years, Pediatrics and surgery required 5 years, Ear- eye- mouth- teeth required 4 years, The speciality of acupuncture-moxibustion required 7 years of study. Massage, chanting and healing prayers required three years of study. Internal medicine and acupuncture-moxibustion required the longest period of study in the Japanese medical college of the 8th century. Those who successfully completed and passed the required examinations were given the title of Master of Medicine, in their respective specialities. Following graduation, those who had achieved considerable experience and were qualified to teach at the medical college were given the title of Doctor of Medicine. In 808 A.D., there appeared 100 volumes of *Daido-Ruiju Hou* (大同類聚方) (direct translation means "Collection of Similar Methods of Treatment in Daido Period"), which was a collection of all the known medical treatments in Japanese medicine of the time, edited by Manao Abe & Hirosada Izumo in the 3rd year of Daido Period. This book played an important role in medical training. (See *History of Medicine,* by T. Ogawa.) Only a few copies exist of an abridged version in Japan at the present time. For various reasons Chinese medicine was actively transmitted to Japan, along with Buddhism, until the 8th century A.D.

There are some people who think that acupuncture may have come from India, although acupuncture is not well known there in recent centuries. Buddhist texts known to be formed about the 4th century B.C. describe the goddess of medicine who was born with an acupuncture needle in one hand and a jug containing medicine in the other (See Buddhist Text (金光明最勝王経) *Kin Kou Myo Sai Shyo Ou Kyo*–direct meaning: "Golden Light Shining Most Splendid King's Text," particularly the section (除病品) *Jyo Byo Hon,* which means "Methods of Eliminating Disease"). The Buddha born in 468 B.C. was very much concerned about all kinds of human suffering, just as Christ was. And such a Buddhist text was written before the estimated time of the appearance of the *Nei Ching.* Some people believe that Acupuncture might have come from ancient India. The nature of Buddhism which existed before the time of Christ in India was quite different from the Buddhism presently found in India. The early stages of Buddhism were closely associated with practical things like helping people by healing their diseases. Because of this, the possibility that Acupuncture might have come from India cannot be entirely excluded.

Acupuncture was most highly developed and used in Japan after the 7th century A.D., particularly after Yasunari Tamba, Doctor of Acupuncture, and chief court physician wrote, in 982

A.D., one of the most important classics in medicine. This classical text book, (醫心方) *Ishin-Hou* [21] which means *Methods (or Principles) of Essential Medicine* included a section on acupuncture and consisted of 30 volumes. The *Ishin-Hou* quotes 204 books asreferences, including all the known medical books written in China, Japan and Korea before that time. A few original copies of the book are still in Japan today. Many of the quoted reference books do not exist any longer but *Ishin-Hou* gives some idea about the lost books and is therefore considered to be one of the most important books in the history of medicine.

EARLY DOCUMENTED HISTORY OF THE INTRODUCTION OF ACUPUNCTURE TO THE WESTERN WORLD

One of the first great European travellers to visit and stay in China for a long time in Kublai Khan's court—and who was able to write of this experience—was Marco Polo. Although some Italian Acupuncture specialists have told the author that Marco Polo mentions acupuncture in his writings, thus far the author has not found any statement on acupuncture in the English translations of Marco Polo's book (although his writings describe many interesting customs in China, including herb medicine).

Another curious thing was that in the narratives and letters of Franciscan missionaries in Mongolia and China (including Peking) in the 13th and 14th centuries [22] e.g., *(Mission to Asia: Narratives and Letters of the Franciscan Missionaries in Mongolia and China in the Thirteenth and Fourteenth Centuries* [22] Translated by a Nun of Stanbrook Abbey; Edited with an Introduction by Christopher Dawson. 1st Harper Torchbook Edition published 1966 by Harper & Row Publishers Inc., New York) many customs and habits are described. Among those described is the use of herbal medicine, but nothing was mentioned about acupuncture. If both Marco Polo and the missionaries saw or heard of the use of acupuncture, they must have mentioned it, since many customs in China are described in detail by them. On the other hand, at the time that Marco Polo was visiting China, the rulers were Mongols and they might not have accepted acupuncture as medical treatment, for the purpose of supplementing their own traditional herbal medicine. Even if acupuncture was used in China at that time, it was probably not in common use among the population compared with the widespread use of it among the people in Japan at that time.

A Portuguese named Fernam Mendez Pinto is considered to be the first European to visit Japan, on the Southern Island of Tanegashima, after his ship was wrecked in 1543. He is known as the first European to introduce the gun to Japan. [9, 10, 11].

As his one gun brought so much Japanese gold and silver from a Japanese duke with whom he stayed (Pinto presumably saw the treatment of the duke's joint pains with acupuncture), he later organized another trip to Japan after his return to Portugal. On this trip he brought many firearms, hoping to make an extraordinary profit. When he arrived in Japan for the second time, more than ten years later, he found that not only had many guns been manufactured during his absence, but that they were considerably improved by the Japanese. He was unable to sell his merchandise for the great profits he had anticipated. He wrote a book about his travels in Japan, known as *Fingimentos (Peregrinations in the East)* [10, 11], translated into Spanish in 1620, French in 1628 and finally into English in 1663. In this book he is said to have mentioned the custom of using acupuncture as a part of medical treatment in Japan. One of the earliest medical reports on acupuncture, *Dissertatio de Arthritide; Mantissa Schematica; de Acupunctura; et Orationes Tres* [23] was written in 1683 by Willem Ten Rhyne (1647-1700).

Rhyne was a Dutch physician working for the Dutch East India Company, in Java, who was sent to Nagasaki in 1647, in the southern sea port of Japan. Here he stayed two years and taught western medicine and science to Japanese physicians. In return he learned about Japanese medicine including acupuncture and moxibustion.

One of the earliest monographs on Acupuncture is said to have been written in *Secrets de la Medicine des Chinois* [24] published in 1671 at Grenoble, France. It was probably written by one of the Jesuit missionaries in Canton, China. The book was translated into Italian in 1676 and English in 1707. The book *Secret de Pouls* which describes Chinese pulse diagnosis was translated into English, German and Russian. The most well known early introduction on Acupuncture to the western world was published by a German born physician, Engelbert Kaempfer (1651-1716). While he was working for the Dutch East India Company, he visited Japan during 1690-1692 as a secretary to the Dutch Ambassador to Japan. In 1712, he described acupuncture in *Amoenitatum Exoticarum Politico Physico-Cedicarum* which was not well known. titled: "*Acupuncture, a Japanese Cure for Colic* and *Moxa, a Most Efficacious Substance for Cautery Frequently Used by the Chinese and Japanese*". In the famous Kaempfer's History of Japan, published in 1716 (translated to English in 1727) there is a description of the methods of Acupuncture and Moxibustion with illustrations of Japanese acupuncture needles and a patient under treatment.* Following the introduction of Acupuncture and Moxibustion to the western world by these early authors, there were sporadic reports and monographs published on Acupuncture in the Western world before the 19th Century.

During the period between 1600 (particularly after 1639) and 1858, about 100 European physicians (most of them Dutch physicians) were regularly stationed in Nagasaki and they influenced the Japanese with Western medicine and science. In return they introduced Japanese medicine, plants used for herbal medicine and Japanese cultures, to the western world.

More than 100 European physicians who were stationed in Japan between 1600 and 1853 and among them was Philipp von Siebold, a physician who most greatly influenced both Japanese and Western medicine. In August 1823 this 27-year-old German physician (who graduated from Wurtzburg University in 1820) went to Nagasaki, Japan with many scientific instruments and books. During his 6½ year stay in Japan as a physician for the Dutch East India Company, he taught Japanese physicians Western medicine and science and in return he learned Japanese medicine from them. Before his departure on January 2, 1830 from Japan, he had not only learned about acupuncture and practiced it, but also translated many Japanese medical books into Dutch and Latin. Among them was a book on Acupuncture and moxibustion written by Soutetsu Ishizaka, a well-known Japanese Acupuncturist. Between 1832 and 1850 (following his return to Leiden) he published 3 volumes of books entitled *Nippon* in which he described his experience in Japan, including Acupuncture and Moxibustion. He was the first person to conceive the idea of modern hypodermic needles. He thought that if acupuncture could produce significant improvements without drugs, it could be even better if one could inject drugs into the same area through a hollow needle. Soon his idea of the hypodermic needle spread and it became one of the most important tools in modern Western medical treatment.

By the early 19th century knowledge of Acupuncture introduced from Japan to Holland by many Dutch physicians, soon spread to other European countries. In 1802 British physician W. Coley published one of the first clinical reports entitled "On Acupuncturation" *(Medical and Physical Journal (London)* vii; 235-38, 1802) [25]. In it he describes the following acupuncture techniques originally developed by a Japanese Shogun's court physician named Waichi Sugiyama (and commonly used in Japan for a long time): For the treatment of abdominal

* See Fig.2.

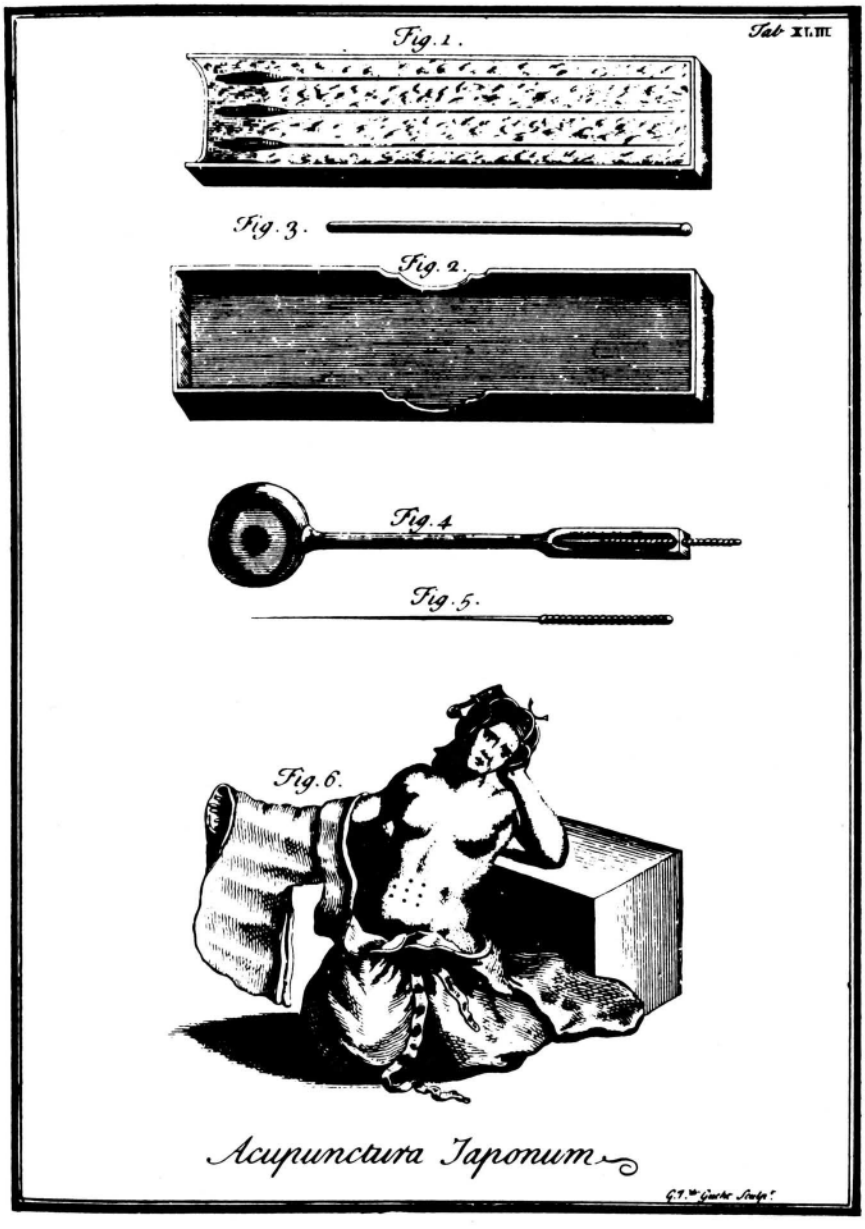

Fig. 2. Taken from: Engelbert Kaempfer's book: *Histoire Naturelle, Civile, et Ecclésiastique de l'Empire du Japon*, translated by La Haye, in 1729, after Kaempfer's death in 1716. This schematic illustration of Japanese acupuncture needles, their accessories, and of a Japanese woman who is receiving acupuncture treatment, was made by Kaempfer (1651–1716), a German born physician who received his medical degree from Leiden University. Kaempfer made these observations of Japanese customs when he was visiting Japan in 1690–1692 as a part of his studies on Japanese history, politics, religion, customs, medical practices, products, as well as flora and fauna. He travelled throughout the major parts of Japan, from Nagasaki to Edo (present Tokyo), where he met with Shogun Tsunayoshi in 1691. The upper diagrams of this figure represent some of the typical needles and accessories used for acupuncture in Japan in the early 1690's. Notice that the shaft of the acupuncture needle gradually tapers toward the tip. In present-day Japan, this type of tapering needle is used less frequently, and more often the needle has a constant diameter throughout the shaft except around the tip. However, in Korea, the tapering type of needle is still widely used. Notice the two types of handle for the acupuncture needles, both of which are very easy to use for manual twirling. At the bottom, the half-naked "Japanese" woman with kimono supposedly shows symmetrical acupuncture needle marks on her abdomen around the area of the conception vessel and probably the stomach meridian on both sides.

pain and distension, he inserted gold or silver needles into the patient's body through a copper guiding tube by tapping the top of the handle of the acupuncture needle with a small percussion hammer.

The first introductory book on acupuncture without involving any classical theory or scientific aspect of acupuncture, was published by Simpkin & Marshall, London, England in 1821 by Dr. James Morse Churchill, Member of Royal College of Surgeons in London. The book was titled: *Treatise on ACUPUNCTURATION, Being a Description of a Surgical Operation Originally Peculiar to the Japanese and Chinese, and By Them Demonstrated ZIN-KING, Now Introduced into European Practice, With Directions for its Performance and Cases Illustrating its Success.* [26].

According to Churchill in (pp.5 and 6).

"It is of Asiatic origin, and China and Japan peculiarly claim it as their own. A writer in the year, 1802, mentions a discovery of its having been practiced by natives of America, and refers to (Captain) Dampier's voyages for an account of it."

In this book he describes the American Indian custom of treating pain and certain diseases by shooting special small arrows into the skin. This technique produces light hemorrhaging but does not penetrate any deeper than the superficial body surface. He considers this treatment different from acupuncture, as he thought acupuncture does not produce hemorrhages. According to him the first person to use acupuncture in England was his friend Mr. Scott of West-Minster. As described on page 10 of his book:

"...and the names of Ten-Rhyne, Bidloo, Koempfer, and Vicq-d'Azyr, stand conspicuous on the list of those who speak in its favour; but still, neither of them had undertaken to put its merits to the test, by actual experiment. Several practitioners in France, however, have now taken up this neglected operation, and their report verifies the praises which have bestowed by others upon it. My attention was lately directed to it by my friend, Mr. Scott of Westminster, who, as far as my knowledge goes, was the first who performed it in England, and some successful cases which I witnessed in his practice assured me of its efficacy and led me to its adoption. The success of my own subsequent practice warrants a recommendation of it, in almost any terms I could give . . ."

He also mentions L.V.J. Berlioz, D.M. of Paris, on (pp.24 and 25).

"Mr. Berlioz of Paris had practiced it extensively and has recently published an account of the success which it has had in his hands.

As a general summary of acupuncture treatment Churchill states in his book:

"The eulogia given to acupuncturation by Koempfer and Ten-Rhyne are just and merited. We have reason to feel surprised that, although an age or more has elapsed since this curative measure has been known in Europe, no physician has made trial of its efficacy. The practice of the operation is attended with but little pain and the success of it so prompt, that the disease is alleviated or entirely ceases as soon as the needle has been introduced the depth of a few lines; most frequently, however, the pain is not removed by the first introduction of the instrument, and it is not until after the use of it for a second and third or fourth time, that cure is completed."

Churchill also published in 1823 an article about his clinical experience with acupuncture titled "On Acupuncturation (in Rheumatism)," [27] in the section of the Original Communications in the *London Medical Repository* (Vol. 29: pp. 372-374).

One of the first accounts of clinical experiences in the use of acupuncture by Europeans was published by a French physician Louis-Joseph Berlioz (1776-1858). It was published in Paris in 1816 in *Memoirs sur les Maladies Chroniques, les Evacuations Sanguines et L'Acupuncture.* In this, he describes acupuncture as beneficial in relieving pains of various origins such as lumbago, rheumatism and various neuralgias. However, it was soon forgotten, until the use of acupuncture was revived in France after the late 1920's (particularly after 1934) following the reintroduc-

tion of Chinese acupuncture through detailed important French books written by George Soulié de Morant. . He was not a physician but was in the French Council General of Shanghai, China, working as a member of the International Court.

In looking for the oldest literature on acupuncture published in the U.S. (according to the Surgeon General's catalogue) it appears that Franklin Bache, M.D. (who was then an assistant physician in one of the state penitentiaries) was the first physician to report a case history of experiences with acupuncture treatment in the U.S. His clinical case report "Cases Illustrative of the Remedial Effects of Acupuncture", [28] was published in 1826 in the *North American Medical and Surgical Journal* (Vol. 1: pp. 311-321). According to his case histories his first patient was treated on June 30, 1825, in Philadelphia, in one of the state penitentiaries. His patient was 33 years old, a prisoner who had a pain in "the small of the back."

One other early clinical report on the use of acupuncture in the U.S. was "Acupuncture as a remedy for Rheumatism," [29] by W.M. Lee, published in the *Boston Medical and Surgical Journal* (Vol: 15 pp. 85-87, 1836). In it he describes very honestly his experience with acupuncture by describing the beneficial effects as well as the difficulties he encountered.

However, one of the most definitive statements on acupuncture was made by Sir William Osler (1849-1919), then Professor of Medicine at John Hopkins University, in his classical textbook of medicine: *The Principles and Practice of Medicine* [30] (designed for the Use of Practitioners and Students of Medicine). The First edition was published in Edinburgh and London by the Young J. Pentland Publishing Co. in 1892.

Osler describes the following on p. 282 of his book: "For lumbago, acupuncture is, in acute cases, the most efficient treatment. Needles of from three to four inches in length (ordinary bonnet-needles, sterilized, will do) are thrust into the lumbar muscles at the seat of pain, and withdrawn after five or ten minutes. In many instances the relief is immediate, and I can corroborate fully the statements of Ringer, who taught me this practice as to its extraordinary and prompt efficacy in many instances. The constant current is sometimes very beneficial. In many forms of myalgia the thermocautery gives great relief and in obstinate cases blisters may be tried."

In the section on the treatment of sciatica, on p. 820 of the book, he not only describes the use of acupuncture but also other treatments, such as an injection of distilled water, chloroform injection, or nerve-stretching, as well as electrical stimulation for the relief of sciatic neuralgia, as is seen in the following quotation from his book:

> ". . . It is remarkable how promptly, in some cases, the injection of distilled water into the nerve will relieve the pain. Acupuncture may also be tried; the needles should be thrust deeply into the most painful spot for a distance of about two inches and left for from fifteen to twenty minutes. The injection of chloroform into the nerve has also been recommended.
>
> Electricity is an uncertain remedy. Sometimes it gives prompt relief; It is most serviceable in the chronic cases in which there is wasting of the legs, and should be combined with massage. The galvanic current should be used; a flat electrode should be placed over the sciatic notch, and a smaller one used along the course of the nerve and its branches. In very obstinate cases nerve-stretching may be employed. It is sometimes successful; but in other instances the condition recurs and is as bad as ever."

In 1896 the same book was re-published as a second edition by D. Appleton and Company, New York (which is now Appleton-Century Croft). This book became one of the most important, classical texts of the time. In the first and second editions, at the end of the book on page 1111, on the first page of the index, the term acupuncture was indexed. Although the same description of the use of acupuncture were maintained in the different pages of the revised sixth edition, for unknown reasons acupuncture was not indexed on the first page of the index page 1115. Judging from the number of the books printed, which was 105,000 copies, many English

speaking physicians must have read about the use of acupuncture, although the description is not clear and the suggestion that an ordinary bonnet-needle three to four inches in length be used would frighten a physician if no practical technique of its use (why and how such a long needle would be used), was given. He simply describes the effectiveness of the local acupuncture method without involving any oriental theories or any scientific explanation.

Wherever Acupuncture originated, it was highly developed in China since the time of the 2nd or 3rd centuries B.C. and spread to the Far Eastern countries such as Korea and Japan. After the 6th century A.D. particularly, it quickly permeated throughout Japanese daily life and was refined. Much of the scientific research before 1948 on Acupuncture was carried out in Japan. For a variety of reasons, much of the recent research published in the United States as well as in mainland China and Hong Kong does not acknowledge the well known original work done in Japan previously, although such information is used.

One of the reasons for this is language barriers. There is a tendency to conveniently ignore the previous published works that were not quoted in the Index Medicus, regardless of whether they were written in English or not. Typical examples are previous original research work written or introduced in well-known Japanese acupuncture books, such as those by Y. Manama, [3, 4] K. Serizawa [5], and many others or written in journals or institutional organizational reports which are well-known but not yet indexed. If some authors cannot find these in the Index Medicus they may publish the work in plagiarized form in current articles and present it as original scientific research. Some of the editors of the indexed journals who are strongly nationally biased, knowingly or inadvertently have been accepting and publishing these papers in some current journals. In doing so, they help perpetuate the tendency to plagiarize or distort the facts.

So, the usual problem is that many editors and doctors are deceived into believing that some so-called original articles published in current American and Chinese journals are genuine, whereas they are in some cases merely repetitions of the actual original works published much earlier in Japan, France or other countries. Even though the Index Medicus may not include a particular work due to language or other barriers, this doesn't mean that the work doesn't exist.

On the other hand, actual original work may sometimes be attributed to traditional sources. For example, some people publicly state that "Auricular diagnosis and therapy is a part of the traditional Chinese medicine," without giving any credit to the true main originator, Dr. Paul Nogier, of Lyon, France. (Some of these investigators are even supported by NIH). The auricular method was developed by Dr. Nogier in the 1950's. He was the first to use the concept that the whole body was represented in ear, although some acupuncture points on the ear were used in classical oriental medicine.

Even though the roots of modern medicine go back to the Greeks, no one calls Western Medicine *Greek* Medicine. Modern medicine came into its highly developed form in the U.S.A. after World War II. Yet few called it American Medicine because researchers and doctors from all over the world directly or indirectly contributed to it. Similarly, acupuncture came to its present status through centuries of efforts of many people in far eastern countries before it became well-known in Western countries. In this Journal, Acupuncture will be known as a "branch of Oriental Medicine or Far Eastern Oriental Medicine." We will eliminate extreme nationalism as well as politics from this journal to avoid distorting history and the facts. At the same time, we will consider for publication any new development made known to us by any nation in the world.

DESCRIPTION OF ACUPUNCTURE METHOD AND TECHNIQUE

Some people believe that "Acupuncture is a form of hypnosis" or that "Acupuncture is a ceremonial procedure to the induction of hypnosis" or that "acupuncture and hypnosis

are completely different, and the effects of acupuncture on pain is less than hypnosis."

But if we compare these claims critically we find many discrepancies as well as poor experimental design. These reports often say where Acupuncture was given without telling how it was carried out and for how long, and whether the needle was twirled or not, and if it was twirled, how many twirls per second. Even when Acupuncture was given in the area known by a certain Acupuncture point name, the results of acupuncture cannot be compared with other modalities of medicine simply by telling the areas where acupuncture was given, because the result is considerably different depending on the technique of administration as well as its duration both in its local as well as its generalized effects. If any scientific paper does not describe how it was given it cannot be considered an acceptable scientific paper since the location only gives partial information on the several important parameters which control acupuncture effects. Therefore, to compare the results of acupuncture effects on the same acupuncture point, we would like to encourage scientists doing research on acupuncture to develop a custom of describing procedures in addition to describing the location of the acupuncture point itself, and not only the number of twirls but also the total surface area of the needle as well as the insertion angle of the needle and the diameter of the needle as these variables also may contribute to the acupuncture effects. For instance, the author's own research indicated that the degree of vasodilation which is closely related to the beneficial effects of Acupuncture as well as characteristic blood chemistry changes associated with the effectiveness of acupuncture are often enhanced by the increase in the surface area of the same needle when the length of the needle in contact with body tissue is increased.

METHOD OF DESCRIPTION OF ACUPUNCTURE POINTS (ACUPUNCTURE LOCI)

On the other hand many of the effective acupuncture points often correspond to the trigger points of pain and some of the known pathways of the meridians will correspond to the referred pain or radiation of the pain along certain parts of the body for certain abnormal conditions of the body. A typical example is the heart meridian in which the meridian's pathway often corresponds to some of the radiation of the anginal pain or pain associated with various cardiac diseases. In describing the effective Acupuncture point (regardless of whether the concept of meridians makes sense or not) it is convenient to use certain simple names to replace an anatomically lengthy description. We name stations on a railroad line by certain names and we do not describe them in terms of geographical locations. Therefore, we encourage the utilization of both Chinese or Japanese acupuncture point names in the original language (the Japanese also use the same Chinese characters) and the original pronounciation, or its direct translation into English, since classical Acupuncture point names are often related to either its anatomical location or characteristic of the disease or condition for which acupuncture given to that point is effective, or related to the concept of flow of Yin or Yang energy through their respective meridians. Therefore we cannot ignore such an historical heritage in Acupuncture. When comparing the work of more than two individuals in Acupuncture Research, it is essential to describe not only the location where acupuncture was given as carefully as possible, but also the presence or absence of twirling and the type, frequency, and total duration of twirling, the diameter of the needle used and the length of the needle inserted into the body, as well as the material of the needle, whether it is steel, silver, gold, copper, or an alloy.

It is also essential to describe whether or not the patient experienced the "Echo of Acupuncture" (*Hari no hibiki*, in Japanese or so-called *Te Ch'i* in chinese, which means obtaining *Qi*) characterized by the propagation of a tingling or an electrical shocklike sensation or a sensation of heaviness from the area of the Acupunctured point or area to the distal part of the body. Although the experiencing of the "Echo of Acupuncture" by the patient immediately after the insertion of the needle is often associated with the significant appearance of the beneficial

effects of Acupuncture these can also be obtained without the sensation of the "Echo of Acupuncture", but the degree of these effects is often less significant. Therefore, the presence or absence of the sensation of the "Echo of Acupuncture" as well as what type of sensation and where it is propogated should be included if one really seriously tries to analyze Acupuncture effects.

Placebo effects

Strictly speaking, there is no location for insertion of the needle that may be called the "placebo acupuncture point" on the human body. Insertion of the needle into any part of the body will produce a series of reactions. Some degree of response to external needle stimulation results from the mechanical stimulus as well as from the consequential inflammatory reaction. However, the degree of the response may be quite insignificant on a non-Acupuncture point compared with well known effective Acupuncture points, particularly when the patient has a previous exposure to Acupuncture treatment and knows that when the "echo of acupuncture" is obtained he will get better results. If the person is highly susceptible to hypnosis and doesn't experience the "echo of acupuncture" which he was expecting, regardless of whether acupuncture was given on a known point or a non-acupuncture point, the patient's immediate psychological response will most likely be negative. Such a psychological response might in turn influence the patient's evaluation of the acupuncture effects.

Hypnotic effects

Some people believe that Acupuncture is one type of ceremonial procedure for the induction of hypnosis. To evaluate such a factor it is desirable to evaluate each patient's degree of susceptibility for hypnosis. At the same time any procedure for evaluating the hypnotic susceptibility of the patient should not bring the patient into deep hypnotic trance induction. If one is hypnotized then one must devise a means to separate the hypnotic effects from the acupuncture effects. For instance, this author is using the simplest means of evaluating hypnotizability, i.e. the eye-roll test, which was originally reported by Herbert Spiegel of Columbia University (see article by this author in this issue). Just as any other method, this method has certain ambiguities and limitations. But one must start from such a simple standard procedure rather than not evaluate the effects at all. If any other simple and reliable method is available, then one should not limit oneself to any particular method that is familiar. According to the author's experience, in more than 300 patients examined, those who had a high hypnotizability score of above 3 seem to have slightly better response in obtaining beneficial effects of Acupuncture. On the other hand, those who had a low hypnotizability score of less than 2 still obtain similar degrees of beneficial effects from acupuncture. It is thus difficult to say that hypnosis plays an important role in obtaining beneficial effects of acupuncture. If anyone still believes that hypnosis plays an important role in acupuncture, one must explain why more than 50% of these people with hypnotizability scores of 0 by eye-roll test showed beneficial effects of Acupuncture. Ideally, hypnotic effects and acupuncture effects should be studied separately on the same patient at separate times by measuring multi-parameters, including blood chemistry. However, it would be very time consuming and may not be practical or ethical from the patient's point of view.

The claim that acupuncture is almost entirely hypnosis may not reasonably explain some of the findings on acupuncture-induced analgesia, (e.g., Acupuncture given on the *hoku* point of one hand often results in various degrees of oral analgesia on the opposite point).

Pre- and post-acupuncture evaluation

Before giving acupuncture, the general conditions of every patient or animal must be evaluated by complete physical examination, in order to find whether or not acupuncture is indicated. Such examination should be supplemented by X-ray and blood chemistry studies, or any additional appropriate tests, whenever feasible. In evaluating the acupuncture effects, the most important procedure is to repeat the initial physical examination and all of the supplemental tests. This is to be done repeatedly after the acupuncture treatment at various time intervals in order to observe delayed (time-dependent) effects.

Pulse diagnosis

The pulse diagnosis has been one of the most important diagnostic means used as a part of the examination of the patient by palpation in oriental medicine. It has been practiced for at least 2200 years. Pien Chiao is one of the earliest physicians known to be an expert on pulse diagnosis, before the oldest book specifically on pulse diagnosis, the *Mia Ching* was published by Wang Shu Ho (265-317 A.D.). From our Western Scientific view point there is no scientific basis in making a diagnosis of different internal organs by palpating superficial and deep pulses at 3 finger positions on the radial artery of each wrist. On the other hand examination and classification of the different types of the pulses has a significant diagnostic value in evaluating cardio-vascular systems as indicated in the author's previous work [44, 45, 48, 55]. Dr. Kazu Mori, at the Department of Rehabilitation Medicine of Tokyo University under the supervision of Prof. Y. Oshima, made an interesting study of the reliability of the oriental medicine diagnostic system, compared independent results of the evaluation of the same 200 patients with various diseases made by leading experts in oriental medicine and Western medicine. A diagnosis of oriental medicine was done utilizing the 5 Element Theory and concepts of meridians and oriental pulse diagnosis. However they claimed that the diagnosis reached by oriental medical diagnostic system coincides very poorly with the diagnosis derived by Western medicine [75]. It is desirable to have repeated, similar comparative works from different institutes in different countries. If such findings are repeatedly confirmed without being biased by any personal feelings or nationalism, it is reasonable to convince everybody involved in acupuncture of its advantages as well as limitations of the classical 5 Element Theory, as well as classical oriental pulse diagnosis, since one set of studies by particular investigators in one city cannot be generalized as a basis for strong discussion.

CBC and blood chemistry

According to the author's previous study (a summary of which is published in this issue), most of the blood chemistry changes such as increase in serum glucose, decrease in Triglyceride and phospolipid and a slight decrease in cholesterol, as well as changes in CBC and white cell differentials are often insignificant during the first four hours after acupuncture. However, these changes often become more significant from four to twenty four hours after acupuncture. Most of the effects on blood chemistry gradually return within 1 or 2 weeks after acupuncture, with the exception of γ-globulin which often shows significant delayed increase in 1 or 2 weeks.

In some of the patients who had no beneficial effects produced by acupuncture, it was also found that there was often no change or even changes opposite to those described before. The above changes were most significantly observed following the acupuncture given on St. 36 or GB.22 with prolonged manipulation of more than two minutes. Usually Auricular Acupuncture did not produce significant changes compared with the above described body acupuncture points. Some researchers measured blood chemistry changes only within a few

hours after acupuncture and have confirmed findings of the author: Namely, that these changes are insignificant. They did not study the blood chemistry 4-24 hr later when most of the changes actually occur. Some investigators erroneously made the generalization that acupuncture did not produce any significant CBC or blood chemistry changes. They did not study them following the few hours after acupuncture (particularly more than 10 hours after acupuncture). In studying the blood chemistry, a condition of fasting of patient or animal as well as change of diet will greatly influence the blood chemistry result.

Our study indicated that in those who developed acupuncture-induced generalized vasodilation of the arterioles, capillaries and veinules (vasodilation of the veinules was minimal), appearance of the above described CBC and blood chemistry changes often occurred. In those persons who also had high blood pressure, systolic blood pressure dropped significantly. The above described CBC and blood chemistry changes were often observed between four and twenty four hours after acupuncture. When these effects lasted more than one or two weeks, the beneficial effects also lasted for prolonged periods of time. However, blood chemistry changes and CBC changes were insignificant in the first four hours after acupuncture, but beneficial effects of acupuncture (such as relief from pain or spastic muscles or high blood pressure or migraine headache etc.), began to appear within ten seconds to a few minutes. Therefore, in the studying of blood chemistry, we are probably missing changes in minute concentration of certain chemicals such as hormones, prostaglandines and neurotransmitters which occur immediately after acupuncture but much of which we have not yet noticed or measured.

Skin electrical impedance for given frequency and d.c. electrical resistance

Since this subject is discussed in other papers in this journal by this author, it will be omitted here. [4, 44, 45, 50, 55, 56].

Measurement of skin temperature

Measurement of temperature under the tongue and at the rectum will give us a general indication of the body temperature. On the other hand, skin temperature at various parts of the body will often reflect not only the circulatory condition at that particular area but an abnormal temperature will indicate various pathological conditions as well as some of the low skin impedance areas or effective acupuncture points. In measuring the skin temperature before, during and after acupuncture, if the measurement of the temperature is to be used for clinical research,an electronic skin thermometer with a small sensor probe should be used. An ideal skin temperature sensor should have a minimum heat capacity and a very short response time. Using such a sensor, with a diameter of less than 0.5mm and a response time of less than 80 msec, the author found that, in more than 300 individuals 5-85 years old, when temperature is measured at both the left and right sides of the forehead where the supraorbital artery supplies blood, if there is more than 0.3 to 0.5°C difference between the left and right side of the forehead, with corresponding increase in brain microcirculation, in more than 90% of the patients tested, the grasping force of the hand opposite the side of the high temperature is significantly greater than the side opposite the low temperature. In other words, right handed people usually have higher temperature at the right left forehead.

Even in the same individual, the author also discovered that once in a while, the temperature between right and left becomes reversed, with corresponding reversed change in the grasping force at the side of the body which is innervated by the opposite side of the brain. In such a situation, if the heat capacity of the temperature sensor is large, it is usually difficult to detect significant differences between the sides of the head. But if the response time of the temperature

sensor is less than 100 msec, the measured skin temperature becomes reliable and useful information. The electronic thermometer the author uses (made by Bailey Instruments Co. of New Jersey) has a needle-shaped sensor with a tip diameter of about 0.24mm, a length of 13mm, and a response time measured through an oscilloscope of less than 80 msec. In spite of a short response time, because of the large inertia of the moving coil of the thermometer's meter, the movement of the needle is relatively slow. In some individuals the author found that exercise of the hand on one side increased the temperature of the corresponding opposite side of the forehead, with corresponding improved microcirculation due to vaso-dilation of capillaries and arterioles. Therefore, general exercise of the total body may improve brain microcirculation as well as brain function if it's not overdone. Another interesting phenomenon we encountered occasionally was that when the subject was asked to concentrate on certain effective acupuncture points or areas until they felt a tingling or warm sensation developing in that area, vaso-dilation developed, accompanied by some beneficial effects of acupuncture. This was not always easy to produce and it was necessary for the subject to develop intense concentration. One might call such a phenomenon "psycho-acupuncture", or it might be called "self hypnosis" or "bio-feedback". In evaluating patients with migraine headaches, insomnia, or irritability, some of the patients are found to have a significant decrease in temperature on one side of the forehead at the supraorbital area. For instance the temperature in the forehead among normal individuals ranges between 33 and 35°C, depending on the individual, and often the temperature is below 33°C in patients who have migraine headaches or in some of the hyper-active emotionally unstable children, particularly at their hyper-active state. Such a temperature change can also almost instantaneously be measured by infra-red thermographic methods, such as by the wave lengths emitted from the human body surface as a heat source.

For given skin temperature t°C, the wave length of the peak energy emission can be estimated by the Wien Displacement Law:

$$\lambda_{max}\,(\mu) \doteqdot \frac{2897.9\ (\mu.^{\circ}\mathrm{K})}{T(^{\circ}\mathrm{K})} \quad \text{or} \quad \lambda_{max}\,(\mu) \cdot T(^{\circ}\mathrm{K}) = 2897.9\ (\mu.^{\circ}\mathrm{K}) = 0.28979\ (\mathrm{cm}.^{\circ}\mathrm{K})$$

where λ is the peak of the blackbody radiation curve for the given temperature and T is the absolute temperature in °K. T = 273°K + t (t is temperature in °C). Therefore, if the temperature at the forehead is 33-35°C:

$$\text{For } 33^{\circ}\mathrm{C} \text{ Skin temperature: } \lambda_{max}\,(\mu) \doteqdot \frac{2897.9\ (\mu.^{\circ}\mathrm{K})}{T(^{\circ}\mathrm{K})} \doteqdot \frac{2898\mu}{273+33} = \frac{2898\mu}{306} \doteqdot 9.47\mu$$

$$\text{For } 35^{\circ}\mathrm{C} \text{ Skin temperature: } \lambda_{max}\,(\mu) \doteqdot \frac{2897.9\ (\mu.^{\circ}\mathrm{K})}{T(^{\circ}\mathrm{K})} \doteqdot \frac{2898\mu}{273+35} = \frac{2898\mu}{308} \doteqdot 9.40\mu$$

According to the empirically found Stefan-Boltzmann Law of Radiation, the rate of energy emission (from a unit area of 1 cm^2), E (W in joules per second or watt = 10^7 erg/sec.), from a hot body with absolute temperature, T, is proportional to the fourth power of the body's absolute temperature: $E = \sigma \cdot T^4$, where σ = the black body constant = 5.670 x 10^{-5} · erg/sec. · cm^2 · deg^4. Since everything at above absolute zero temperature radiates or absorbs energy, radiation from the body surface will be influenced by the surrounding temperature. For two different hot bodies, the rates of energy radiation are: $E_1 = e_1 \cdot \sigma \cdot T_1^4$ and $E_2 = e_2 \cdot \sigma \cdot T_2^4$ Although emissivity, e, of the human body surface is about 0.9 for the wave length larger than 1μ (for the ideal black body, e = 1), it is important to record and consider the influence of heat loss or gain by conduction, convection and evaporation from various environmental heat sources, including the room temperature and the effect of uneven movement of air, where infra-red thermography or skin temperature measurement is carried out.

Thus, any infra-red detector which is sensitive to wave lengths between 9 and 10μm and has a short response time can detect a change in the infra-red radiation most effectively, particularly in the abnormally decreased radiation due to vaso-constriction in the micro-circulatory network or to permanent disturbance in circulation. Infra-red thermography is a useful tool in evaluating the effect of acupuncture on the circulatory system, if a proper temperature range is selected for measurement. The high temperature point or area of the body surface relatively often has a low electrical impedance, but a low electrical impedance point or area is not necessary to have increased temperature.

Environmental effects

Just as in any physics experiment, in the evaluation of acupuncture effects, attention must be paid to the routine recording of environmental temperature, humidity and atmospheric pressure. Some of the symptoms are either improved or made worse by change of weather, as well as by the presence or absence of certain types of air pollution. Typical examples of the diseases that are known to be influenced by the weather and the type of the pollutions in the air are rheumatoid arthritis and asthma. In addition to the weather condition, knowing the presence or absence of air pollution as well as the degree of the air pollution may be helpful in evaluating therapeutic effects of any modality of treatment, including acupuncture.

Bio-rhythm and time factors

According to the classical acupuncture theory, each organ has specific times of the day where its function is maximum or minimum; although the time described by the classical theory may not be accurate, it may still have some physiological basis. In the treatment of certain diseases or symptoms (regardless of whether the treatment is acupuncture or not), it may be advantageous to use the knowledge of bio-rhythm of certain organs to obtain maximum beneficial effects. Practically speaking, acupuncture can be given anytime, although the degree of the beneficial effects may be different. In modern Western medicine customary medications are given in the same amount with the same intervals or same time of day. However, when functions of certain internal organs are at their maximum activity, the amount of the drug required to produce certain beneficial effects may be much less than the amount of the drug required to produce the same beneficial effect at minimum activity of the same organ.

When the classical Chinese concept of the bio-rhythm of each organ was formalized, most people went to bed after sunset and woke up after sunrise. Therefore, their bio-rhythm is different from present day bio-rhythm in terms of the time course of these activities. Today it is important to recognize that each individual has his own bio-rhythm according to his particular life style. The majority of people who have similar life styles have similar bio-rhythms. In present Western medicine, without considering the effect of human bio-rhythm, the results of clinical blood chemical examination cannot be properly evaluated. As is well-known, in the the case of the serum cortisol concentration, which is dependent on sleeping and waking time, the sleeping, waking and eating time and pattern should be included in the parameters to be considered.

In documenting the data on acupuncture research, the approximate time of the administration of acupuncture and the time when the blood chemistry analysis was taken should be recorded for each patient in reference to the time the meal was taken.

Electro-acupuncture and electro-therapeutics

Since the invention of effective static electricity generators and Leyden Jars (primitive)

condenser), static electricity has been used in different parts of the world as one of the earliest forms of Electro-Acupuncture. One of the first persons to use static electricity stimulation with the aim of treating diseases (particularly spastic or paralytic muscle problems) was was Gennai Hiraga of Japan in 1764 in Edo (presently Tokyo). Hiraga was trained in Oriental medicine and was also exposed to Western medicine and science through Dutch physicians who were stationed at Nagasaki. He constructed his own static electric generator and Leyden Jar to charge the generator's electricity.

After the news that Luigi Galvani, of Bologna University, discovered that the fresh muscles of dead frogs can contract by various types of electrical stimulation including bio-electricity or electricity from bi-metal junction or electricity, the interest in static electricity revived and spread all over Europe. Some of the scientists soon began to apply static electricity stimulation for the contraction of paralyzed muscles in an attempt to treat the paralyzed muscles. However, stimulation (as well as the desired frequency of stimulation) with static electric generators and Leyden Jars was limited and difficult to apply for clinical use since important parameters such as intensity of frequency of the stimulation were difficult to control and reproduce. Following the invention of the primitive battery (which is a relatively constant d.c. power source) by Volta of Padua University, Italy in A.D. 1800, d.c. became one source of electrical stimulators.

Following the discovery by Michael Faraday of England in 1831 of the phenomenon of the generation of electro-magnetic induction potential from the secondary coil by switching on and off of the d.c. power source connected in series with the primary coil, it became possible to produce electrical stimulation with relatively short pulse duration with any desired amplitude of voltage. This was done by simply switching on and off the d.c. power source in series with the primary coil (as well as changing the distance between the primary and secondary coil), thus obtaining a very narrow high voltage electrical pulse from the secondary coil. Such an induction coil type electrical stimulator became one of the fundamental means of stimulating the nerve and muscle fibers. The technique was further improved by replacing manual switching by automatic electro-magnetic vibrator type switching. Such a device has been used for neuro-muscular rehabilitation, as well as for neuro-muscular experiments until the 1940's. Since the time of the invention of vacuum tubes, induction coil type stimulators were gradually replaced by the vacuum tube type stimulators. Since the introduction of transistors and other solid state electronic devices, most of the recent electrical stimulators are made of the solid state semi-conductor devices with dry battery or a.c. power sources.

Within the past few years, use of electro-acupuncture has become widespread among the practitioners of Acupuncture due to the following advantages over manual acupuncture:

Advantages of electro-acupuncture

(1) With electro-acupuncture many patients can be treated at the same time by the same physician. With manual acupuncture, it is difficult to treat more than one or two patients at the same time.

(2) Many parts of the body can be treated at the same time, while one acupuncturist can twirl no more than one or two *needles* at a time by hand.

(3) Even if the needles are not placed in the exact acupuncture point, as long as the area to be stimulated is located between two electrodes; one can deliver acupuncture effects.

(4) It is easy to control and adjust the amount of stimulation and treatment is reproducible provided the electrical characteristics of the stimulating current are defined.

Classification of electro-acupuncture

In the broader sense electro-acupuncture can be classified into the following 4 major categories [56]:

(1) Type I . . . Application of electrical stimulation through a pair of metal electrodes (acupuncture needles) inserted into the body tissue.

(2) Type II . . . Electrical stimulation is applied through a pair of surface electrodes (such as electro-conductive rubber electrodes or cotton electrodes soaked with electrolyte solution or metal electrodes placed on the body surface) without penetration of the skin.

(3) Type III . . . Stimulation is applied without direct contact with the body surface. A rapidly changing electro-magnetic field, a large-capacity current, or static electricity can be used.

(4) Type IV . . . Various combinations of the above three basic forms of electro-acupuncture can also be used. Each type has its own advantages and disadvantages, and types can be combined in such a way to make the most of the best qualities of each, with the minimum of side effects.

In Type I, the main advantage is that stimulation can be applied directly in the desired area, and a relatively high electrical impedance of the superficial layers of the epidermis is electrically shunted by deep penetration of the needle into the tissue. There is therefore less dissipation of electrical energy on the superficial skin layers. The disadvantage is that if an excessive current of uni-polar electrical stimulation is applied for long periods, there is a possibility of tissue necrosis around the electrodes as well as breakage of the positive electrode. In this method there is also the possibility of infection or minor tissue damage, and such parameters as wave form and pulse duration may become important variables, limiting safety.

In Type II, the advantage is that no penetration of the skin with a needle is required. As a result, risk of necrosis of deep tissue, infection or the breakage of positive electrodes does not exist. The disadvantage is that stimulation is indirect through the skin, and since electrical impedance of the skin is highest at the superficial layer of the epidermis (particularly in the following order: statum, corneum, stratum lucidum, stratum granulosum, stratum germinativum), most of the potential applied to the body will be delivered to the epidermis rather than to the dermis and subcutaneous tissue. Therefore, most of the acupuncture effects don't last very long after discontinuation of stimulation since the stimulation is mostly concentrated on the papillary layer of the dermis. (This is because the epidermis has very few nerve endings and practically no blood vessels, so the maximum effect is in the outer, or papillary layer of the dermis, where there is a concentration of nerve endings and a microcirculatory network). So, to produce effective muscle contractions below the subcutaneous tissue, the epidermis and dermis are stimulated so much that it often gives the sensation of burning, vibrations or tingling, or a mixture of these.

The advantage of Type III is that since the body tissue is not touched at all with the stimulator, there is no breakage of electrodes nor creation of severe necrosis under normal circumstances (unless an extraordinary amount of stimulation is applied), nor danger of infection. The disadvantage is that to apply a sufficient capacitive current or rapidly-changing electromagnetic field, the thickness of the body tissue to be placed between two electrodes or electromagnetic poles is often limited by the limitations of the instruments used. Although static electricity or a permanent magnet is relatively easy to use, not much in the way of intensive or reliable scientific studies are available, other than empirical findings, and these methods require much further study.

Important parameters in electro-acupuncture

Due to the increasing demand for the electro-stimulator required for electro-Acupuncture, many manufacturers have begun to mass produce a variety of stimulators. However, limitations and side-effects of electro-Acupuncture have never been seriously studied. One of the functions of this journal is not only to find out the beneficial aspects of different modalities of treatments and the underlying mechanisms, but also to find out the limitations and side-effects. If one reviews all the published articles in existing acupuncture journals in the United States, one can immediately notice the lack of the following important information which is essential to any scientific paper:

(1) Output wave form of the electrical stimulator (Preferably shown exactly by a photograph taken from an oscilloscope screen).

(2) Maximum amplitude of the voltage of both the positive and negative wave form before, during and after the Acupuncture procedures. (When there is a significant discrepancy in the voltage measured immediately after the initation of electro-Acupuncture and at the end of the treatment of experimental procedure, it is an indication of the existence of undesirable electrolysis phenomena which produces polarization and results in increased impedance between both electrodes and the immediate surrounding area of the body tissue. This in turn necessitates increasing the voltage to maintain the same effect of Acupuncture. Sustained electrolysis is a major cause of tissue damage.

(3) Pulse duration of each pulse component of the stimulating pulse complex.

(4) Presence or absence of superimposed d.c. voltage level. If it exists, the polarity and magnitude should be specified.

(5) Output impedance of the electrical stimulator. Strictly speaking, output impedance for the complex pulse wave patterns with different frequency components are different for each frequency component of the same pulse complex and, therefore, output impedance can be expressed in the approximate range of minimum and maximum value.

(The higher the output impedance of the electrical stimulator, the higher the required output voltage of the electrical stimulator since the voltage that the tissue is actually receiving will be divided between the output impedance of the stimulator and the electrode-impedance and body impedance between the two electrodes. Therefore, the higher the output impedance of the stimulator the smaller the fraction of the output voltage will be delivered to the body).

(6) Average current density through the electrode surface. Ideally, it is desirable to have the current density distribution in the tissue but it is not practical. For example, if the average current through the body tissue is 200 μA, this will not give any information about the current density in the body tissue unless the length of the needle inside the body is known; provided that the diameter of the needle is the same. Let us use, for example, the two cases where total current measured externally through the body tissue is the same. If the lengths of the pair of the needles inserted inside the body is 1 cm in one case and 2 cm in the other, the current density expressed in $\mu A/cm^2$ between the pair of needles placed 1 cm into the tissue is twice that of the needles with a 2 cm depth. Unless the electrode surface areas are given, reporting externally measured current through a pair of electrodes in the body tissue alone will not describe the actual phenomenon.

(7) The effective surface area of the pair of electrodes (regardless of whether the acupuncture needle is inserted inside the body or a surface electrode is placed on the body surface for the purpose of so-called trans-cutaneous electro-acupuncture (electrical stimulation without insertion of needles).

(8) The angle of the insertion of the needles (this is supplementary information which is necessary to evaluate the effective surface area of the stimulating electrode), as well as the total

length of the needle inside of the body. All of this information is considered to be essential in the preparation of a reproducable scientific report. However, it is not always practical to obtain all of this information in clinical practice when many patients are treated in rapid succession, or by investigators of limited scientific background.

It is regrettable that major existing journals in Acupuncture including indexed journals publish papers with only a fraction of such information.

This in turn encourages the improper approach to scientific research and in the long run it hinders the progress of reproducible scientific research. Even if one cannot supply all of this information in so-called scientific research, at least an effort should be made to obtain most of the basic information.

Factors involved in the effects of the externally applied electrical field F and magnetic field B on the excitable cell membrane

Effects of the external electric and magnetic field and excitable cell membrane can be analyzed quantitatively by the use of Maxwell's four basic equations, following (expressed in MKS unit system):

I. $\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$ (Maxwell's expression of Gauss' law for isolated electric charges; i.e. charge density ρ is a source or sink of electric flux lines)

II. $\nabla X \mathbf{E} = \frac{\partial \mathbf{B}}{\partial t}$ (Maxwell's expression of Faraday's law of electromagnetic induction)

III. $\nabla \cdot \mathbf{B} = 0$ (If one presumes that there are no isolated single magnetic poles found)

IV. $c^2 \nabla X \mathbf{B} = \frac{\mathbf{j}}{\epsilon_0} + \frac{\partial \mathbf{E}}{\partial t}$ (Maxwell's expression for Ampere's law, j is the conduction current density, $\epsilon_0 \cdot \partial \mathbf{E}/\partial t$ is the displacement current density)

where $c^2 = 1/\epsilon_0\mu_0$, c = velocity of light in free space, ϵ_0 = dielectric constant or "permittivity" of free space, μ_0 = permeability of free space.

The symbol V (called "del" or "nabla") is the vector differential operator which is usually represented in cartesian coordinates by

$$\nabla = \mathbf{i}\frac{\partial}{\partial x} + \mathbf{j}\frac{\partial}{\partial y} + \mathbf{k}\frac{\partial}{\partial z} = \text{gradient} = \text{grad}$$

$\nabla \cdot \mathbf{E}$ is a scalar quantity, also known as the divergence of $\mathbf{E}$ or div $\mathbf{E}$. That is, for $\mathbf{E} = \mathbf{E}(x,y,z) = \mathbf{i}E_x + \mathbf{j}E_y + \mathbf{k}E_z$,

$$\nabla \cdot \mathbf{E} = \text{div } \mathbf{E} = \left(\mathbf{i}\frac{\partial}{\partial x} + \mathbf{j}\frac{\partial}{\partial y} + \mathbf{k}\frac{\partial}{\partial z}\right) \cdot (\mathbf{i}E_x + \mathbf{j}E_y + \mathbf{k}E_z) = \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$$

$\nabla X \mathbf{E}$ is a vector quantity also known as the curl of $\mathbf{E}$ or curl $\mathbf{E}$, and the rotation of $\mathbf{E}$ or rot $\mathbf{E}$. That is,

$$\nabla X \mathbf{E} = \text{curl } \mathbf{E} = \text{rot } \mathbf{E} = \left(\mathbf{i}\frac{\partial}{\partial x} + \mathbf{j}\frac{\partial}{\partial y} + \mathbf{k}\frac{\partial}{\partial z}\right) X (\mathbf{i}E_x + \mathbf{j}E_y + \mathbf{k}E_z)$$

$$= \mathbf{i}\left(\frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z}\right) + \mathbf{j}\left(\frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x}\right) + \mathbf{k}\left(\frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}\right)$$

Some of the methods of analysis using these equations are described in *Electro-Acupuncture, its Electro-Physiological Basis and Criteria for Effectiveness and Safety*, by the author in this issue, and further detailed analysis will be published in this journal in the subsequent issue.

Minute electro-magnetic field produced by current flow of excitable cell membranes, and excitation of nerve and muscle fibers by electro-magnetic field or capacitive current

Any flow of electrical current will be accompanied by an electromagnetic field surrounding it. The heart is likewise producing a change in electromagnetic field (e.m.f.) during each cycle of *P*-wave, QRS-complex, ST segment (usually isoelectric), and T-wave (and also during the *U*-wave, if it exists). Although the magnetic field produced by the heart is usually somewhere between the order of 10^{-7} and 10^{-8} gauss, which is even smaller than one millionth of the magnitude of the steady magnetic field of the earth (usually between 0.25 and 0.5 gauss, depending on the geographical location where the measurement is obtained), a change in such a cardiac magnetic field can be detected by a coil (whose number of turns is n and whose area covered by the coil is S) placed outside the chest wall, if the environmental background fluctuation of magnetic field (on the order of 10^{-4} gauss) can be eliminated. The magnitude of the potential, **E**, induced in such an external coil can be expressed by the equation $\mathbf{E} = -1/C \cdot n \cdot d\phi/dt$. Since $\phi = B \cdot S$ and $B = \mu_0 H$, therefore $\mathbf{E} = -1/C \cdot \mu_0 \cdot S \cdot n \cdot dH/dt$.

Therefore, even if the magnitude of the magnetic field is small, if the change for the given time is great, a large potential will be induced in the external coil. On the other hand, even if **H** is very large, if the change dH/dt is very small, the measured e.m.f. **E** will be very small. To measure such a small magnetic field produced by the electrical activity of the heart, G. Baule and R. McFee, of New York State College of Medicine, Syracuse, and the Soviet scientists Y. Safonov and colleagues used magnetic field condensing material (e.g. flux-gathering material, such as supermalloy) by inserting a substance that has extremely high initial magnetic permeability μ_0 into the core of the coil with large n and relatively large S. These investigators used a pair of identical coils, terminals of which were connected in series in mutually opposite directions to cancel out the major fluctuations of the large environmental background magnetic field. The coils had a considerably large S and a very large number of turns, n, (for instance, 0.55-2.0 million turns of 0.05-mm diameter wire), and the cores were constructed of high-initial-magnetic-permeability (μ_0) substances (for instance, initial permeability μ_0 = 70,000 and $\mu_{effective}$ = 2000) to increase induction e.m.f. E. One of the pair of coils was used as an MCG pickup coil.

However, this method introduced deformities as a result of the nonuniformity of the magnetic field produced by the use of high-initial-magnetic-permeability material as the cores of these pairs of supposedly identical coils with extremely large number of turns, n, in spite of the considerable improvement made in 1965-67 by Baule.

On the other hand, David Cohen and his associates at the Francis Bitter National Magnet Laboratory of M.I.T. have obtained reasonably clear magnetocardiograms (MCG) without introducing nonlinearity not by using materials with high magnetic permeability μ (such as ferrite or supermalloy cores) but, rather, by using unusually good magnetic shielding to eliminate change in a large external (environmental background) magnetic field and good high-gain amplifier. Another possibility of increasing the magnitude of measured potential E is to make dH/dt large by artificial movements of the human body or by the use of coils. A possible application of Zimmerman's recent work with a superconducting quantum-interference device, which is one of a class of point-contact devices utilizing the principle of the Josephson Effect, may revolutionize the MCG measurement in the near future for its clean, low noise and its stability at low-frequency-range signal measurement.

On the other hand, the reverse situation is also possible. Externally introduced strong and suddenly changing electromagnetic fields can be utilized as a means of stimulating nerve and muscle fibers in the form of capacitive stimulation, or inductive (magnetic) stimulation, or a combination of both forms, with no contact between electrodes and living tissue. Therefore, stimulation of the nerves or pacing or delibrillation of the heart can be accomplished not only *in vitro* but also *in vivo* with no electrodes connected to the body surface. Over the past 8 years we have obtained encouraging and successful results *in vitro* and, in small animals, by the use of *in vivo* preparations. We have made some theoretical analysis of the phenomena by using Maxwell's equations, particularly in reference to displacement current density in capacitive stimulation and in connection with molecular structure of excitable cell membranes of nerve and muscle tissue. For instance, in the simplest case of capacitive stimulation, our theoretical prediction indicated that it is possible to stimulate nerve or muscle fibers with a voltage as low as or even lower than the magnitude of the known threshold stimulation obtained by directly connecting a pair of metalic electrodes, but only if we could make dv/dt of the rising or falling part of the stimulating pulse voltage extremely large in order to make the capacitive current ($I_c = C \cdot dv/dt$) extremely large. The minimum successfully used voltage with large dv/dt required for the capacitive stimulation of the sciatic nerve of the bullfrog in our experiments was as low as 3-5 V, which could be improved by better instrumentation. The details of our study of capacitive and inductive stimulation will be published elsewhere.

Some electrical characteristics of ions (found in tissue or externally introduced) in biological systems

In considering threshold potentials of excitable cell membranes, the following simple Nernst equation for the given intracellular and extracellular potassium ion concentrations can give a relatively accurate expression for the transmembrane resting potential. The same simple Nernst equation for the sodium ion alone cannot provide the magnitude of an accurate overshoot potential, since the existence of other major ionic current due to the potassium ion is not included.

$$E_{\text{rest}} \doteqdot -RT/F \log_e [K^+]_{in}/[K^+]_{out} \text{ or}$$

$$E_{\text{rest}} \doteqdot -61.5 \log_{10} \frac{[K^+]_{in}}{[K^+]_{out}} \text{ (mV)}^*$$
(at 37°C)

However, considering the intracellular and extracellular concentrations of the major ions as well as their permeability constants, the following more generalized Goldman's equation can be used to express the magnitude of the transmembrane action potential in relatively stationary states as well as the transmembrane resting potential.

* More generalized Goldman's equation:

$$E \doteqdot RT/F \cdot \log_e [(P_{Na}[Na^+]_{out} + P_K[K^+]_{out} + P_{Cl}[Cl^-]_{in})/(P_{Na}[Na^+]_{in} + P_K[K^+]_{in} + P_{Cl}[Cl^-]_{out})]$$

$$\text{or } E \doteqdot 61.5 \log_{10} \frac{P_{Na}[Na^+]_{out} + P_K[K^+]_{out} + P_{Cl}[Cl^-]_{in}}{P_{Na}[Na^+]_{in} + P_K[K^+]_{in} + P_{Cl}[Cl^-]_{out}} \cdot \text{(mV)}$$
(at 37°C).

where P_K, P_{Na} and P_{Cl} are permeability constants for K^+, Na^+, and Cl^- ions. This generalized equation can be used only during the phases where $I_c = C_m \cdot dV/dt$ is negligibly small and the electrical field in a membrane is presumed to be a constant field and contributions from other monovalent ions and divalent ions are considered to be very small and are ignored, as in the one used by Hodgkin and Katz.

In the role and behaviour of the ions in excitability as well as electro-conductivity and ionic activation of enzymes in a biological system the following factors should be taken into consideration:

In excitable cell membranes a sudden influx of Na^+ ions (Na: $1s(2)2s(2)2p(6)3s(1)$) has been shown to create NRC in V-I curves. The Na^+ ion may be playing an important role, equivalent to heavy doping, at the *p-n* junction with impurity atoms. However, contrary to the case of the tunnel diode, the same Na^+ ions do not remain for long periods of time within the boundary of an excitable cell membrane. But the process of the Na^+ ions entering from outside the cell membrane and passing through the cell membrane in the presence of K^+ ions contributes to the formation of the NRC. It is interesting that all of the biologically important cations involved directly or indirectly in the excitability of cell membranes have conveniently relatively low first-ionization potentials, $V_{I\text{-}ion}$. Particularly, K ($1s(2)2s(2)2p(6)3s(2)3p(6)4s(1)$) with 4.318 eV, Na with 5.14 eV, Ca ($1s(2)2s(2)2p(6)3s(2)3p(6)4s(2)$) with 6.09 eV, and Mg ($1s(2)2s(2)2p(6)3s(2)$) with 7.61 eV. In general, the larger the atomic radius for atoms with the same valence, the smaller the 1st ionization potential. Among these ions, Na^+ has the highest second-ionization potential, V_{IIion}, of 47.29 eV with a uniquely high ratio of $V_{IIion}/V_{Iion} \doteqdot 47.29/5.14 \doteqdot 9$ [in the periodical table, Li($1s(2)2s(1)$), Na, K, and Cs ($1s(2)2s(2)2p(6)3s(2)3p(6)3d(10)4s(2)4p(6)4d(10)5s(2)5p(6)6s(1)$) have low V_{Iion} and unusually high ratio of V_{IIion}/V_{Iion}. Li, V_{IIion} (75.62 eV)/V_{Iion} (5.39 eV) $\doteqdot$ 14; Na, $V_{Iion}/V_{Iion} \doteqdot 9$; K, V_{IIion} (31.81 eV)/V_{Iion} (4.34 eV) $\doteqdot$ 7; Cs, V_{IIion} (23.4 eV)/V_{Iion} (3.89 eV) $\doteqdot$ 6]. However, replacement of Na^+ by either Li^+ or Cs^+ can not maintain normal firing of "Phase 0" of cardiac cells and results in the loss of amplitude and shortening of TAP duration, presumably because of the inability to activate $Na^+ - K^+ -$ activated Mg^{2+} dependent ATPase of cell membrane, and Li^+ and Cs^+ are considered to be toxic. But Cl (Cl: $1s(2)2s(2)2p(6)3s(2)3p(5)$), O_2, O ($1s(2)2s(2)2p(4)$), H_2O and CO_2 all have relatively large first-ionization potentials of 12.95, 12.5, 13.5, 12.56, and 14.4 eV respectively. The large ratio of V_{IIion}/V_{Iion} for Na^+ ions makes it convenient for the transfer of electrons from the atoms. Concerning the apparent radii of the atoms, the Mg^{2+} ion with an atomic radius of 0.66 Å is the smallest among the biologically important ions and the Na^+ ion is the second smallest, with radius of 0.97 Å. Following Na^+ is Ca^{2+}, with a radius of 0.99 Å then K^+, which has a radius of 1.33 Å and Cl^- is relatively large, at 1.81 Å, However, in water, because of the attraction of the water molecules, the effective diameter of an ion is larger than the ionic radius in the crystal. Thus, Na^+ and Mg^{2+} have small ion mobilities of 5.20×10^{-4} and 5.49×10^{-4} (cm/sec)/(V/cm), respectively, when compared to H^+ (H: 1s(1)), and OH^-, which have the highest mobilities of 36.2×10^{-4} (cm/sec)/(V/cm) and 20.5×10^{-4} (cm/sec)/(V/cm), while K+, Ca^{2+}, and Cl^- have ion mobilities of 7.61×10^{-4}, 6.16×10^{-4}, and 7.92×10^{-4} (cm/sec)/(V/cm) at 25°C, respectively. Notice that the K^+ ion and Cl^- ion have the closest ion mobilities. The rough values of each ion mobility (usually correct within $1 \sim 10\mu$ (cm/sec)/(V/cm)) were estimated by the widely used method of dividing the equivalent conductance of the cation (λ_+) or anion (λ_-), expressed in coul·g-equiv^{-1} ·(cm/sec)/(V/cm) = g-equiv^{-1} ·Ω^{-1} ·cm^2 by Faraday constant, F $\doteqdot$ 96,500 Coulomb ·g –equiv^{-1}. ($F = e \cdot N \doteqdot 1.60 \times 10^{-19}$ Coulmb $\times 6.02 \times 10^{23}$ atoms/mole $\doteqdot$ 96,500 Coulmb .g-equiv^{-1}, where N = Avogadro's number, e = the charge of an electron). For the ideal simplest case, the velocity u of a charged (Ze) particle (radius, r) moving through a medium of viscosity η, under electrical potential E, is equal to the force acting on the particle (eZE) divided by the resistive Stokes Factor ($6\pi\eta r$), $u \doteqdot eZE/6\pi\eta r$.

However, this classic equation can not be accurate unless r is much larger than the radius of the molecules of the medium (in this case, water molecules). Furthermore, interaction of more than two charged particles, which is concentration-dependent and reduces the magnitude of u, is not accounted for in this equation. Since the equivalent conductance of an electrolyte Λ is equal to the sum of the equivalent conductances of the cations λ_+ and anions λ_-, Λ can be expressed by (subtracting the interaction effect between charged particles from Λ_0) semiclassical Onsanger's limiting law: $\Lambda = \lambda_+ + \lambda_- \doteqdot \Lambda_0 - A\ (\Gamma/2)^{1/2}$, where Λ_0 is the equivalent conductance of an infinite dilution and $\Gamma/2 = \frac{1}{2}\sum_{i=1}^{i=n} C_i \cdot Z_i^2$ is the ionic strength, and where $A = \frac{0.9945 \times 10^4}{(DT)^{3/2}} + \frac{1}{\eta(DT)^{1/2}}$, D = dielectric constant, T = absolute temperature, and η = coefficient of viscosity = $\frac{h}{d^3} \cdot \frac{Z}{Z^*} \cdot e^{\frac{\Delta E}{RT}}$, d = lattice distance, $\Lambda_0 \eta \doteqdot$ const. Thus the charged particle in an ideal system has the mobility $l = u/E \doteqdot \frac{Z\,e(\text{statcoul})}{6\pi\eta(\text{dyne-sec/cm}^2)r(\text{cm})} = \frac{(\text{cm/sec})}{6\pi\eta r(\text{dyne/statcoul})} = \frac{Z\,e\,(\text{cm/sec})}{6\pi\eta r(\text{ergs/statcoul-cm})} =$

$$\frac{Z\,e}{6\pi\eta r}\,\frac{(\text{cm/sec})}{(\text{statvolts/cm})} = \frac{Z\,e}{6\pi\eta r}\,\frac{1}{300}\,\frac{(\text{cm/sec})}{(\text{Volt/cm})}$$

since 1 statvolt = 300 Volts, and statvolt = ergs/statcoul. Thus the equivalent conductivity of a diluted electrolyte solution is $\Lambda_0 = \lambda_+ + \lambda_- = F\,(l_+ + l_-) =$

$$\frac{Fe}{6\pi\eta}\left(\frac{Z_+}{r_+} + \frac{Z_-}{r_-}\right)\frac{1}{300}(\text{coul-g-equiv}^{-1}) \cdot \frac{(\text{cm/sec})}{(\text{Volt/cm})}$$

As far as the magnetic properties of excitable cell membranes are concerned, from the magnetic permeability μ in Gaussian Unit System, most of the atoms or molecules can be separated into paramagnetism ($\mu > 1$) or diamagnetism ($\mu < 1$). From the intensity of the magnetic field H and the magnetic induction B, where $B = \mu H$, and the intensity M of the induced magnetic field in the medium, by the external magnetic field, $B = H + 4\pi M$ and $\mu = 1 + 4\pi \frac{M}{H}$. The proportional constant χ in the equation $M = \chi H$ is called the magnetic susceptibility and $\mu = 1 + 4\pi\chi$. Thus in paramagnetic substances, $\chi > 0$ and in diamagnetic substances, $\chi < 0$, and for ferromagnetic substances, $\chi \gg 0$. For instance, the magnetic susceptibilities of one-gram ion solutions of various ions, expressed in units of 10^{-6} (e.m.(c.g.s.)), are: F^- (−10.8), Cl^- (−23.2), Br^- (−34.6), I^- (−51.9), Na^+ (−6.9), K^+ (−14.1), Rb^+ (−22.0), Cs^+ (−35.1), Ca^{2+} (−5.5), Sr^{2+} (−14.8), Ba^{2+} (−27.8). Paramagnetism of an atom or molecule is due to both the orbital momentum of the unpaired electrons and the number of unpaired electron spins. However, the magnetic susceptibility of paramagnetic substances is usually much larger than that of diamagnetic substances. For instance, O_2 has a magnetic susceptibility of $+ 106.2 \times 10^{-6}$ (cgs). The paramagnetic moments μ_S due to the unpaired electron spin increases with the number n of unpaired electrons as shown as following: V^{2+} ($n = 3$, $\mu_S = 3.87$), Cr^{2+} ($n = 4$, $\mu_S = 4.90$), Mn^{2+} ($n = 5$, $\mu_S = 5.92$), Fe^{2+} ($n = 4$, $\mu_S = 4.90$), Co^{2+} ($n = 3$, $\mu_S = 3.87$), Ni^{2+} ($n = 2$, $\mu_S = 2.84$), Cu^{2+} ($n = 1$, $\mu_S = 1.73$), and

(Taken from Y. Omura, *Transactions of the New York Academy of Sciences,* Series II, Vol. 33, No. 5, pp. 467-518, May, 1971.)

The side effects of electro-acupuncture

In any medical treatment the ideal treatment should not only be effective in treating the disease or symptoms, but it must also be absolutely safe. Particularly in electro-acupuncture,

prevention of side-effects is the responsibility of both physicians and the manufacturers of electric-stimulators and indirectly the responsibility of the State and Federal Governmental regulatory bodies. Unfortunately, there is no established rule or regulation specifically designed for the protection of the patient from the side-effects of Electro-Acupuncture. Theoretically speaking, the possibility of having the following side-effects can be predicted; depending upon what type of electrical stimulation is used and how it is applied and how long it is applied:

(1) Strong acid formation in the tissue surrounding the positive electrode and its consequent damage and necrosis of the tissue.

(2) Strong alkaline formation around the negative electrode and its consequent damage and necrosis of the tissue around the electrode.

(3) Dissolving of the metal from the positive electrode in the form of ions and movement of these ions towards the negative electrode.

This dissolution of the needle may eventually result in breakage of the positive metal electrode (needle) within the tissue as well as the side-effect resulting from the deposit of the dissolved metal ion by prolonged electrolysis phenomena.

Such a side-effect due to electrolysis phenomena of ionic currents is most rapidly produced by prolonged d.c. current stimulation.

Even with application of the pulsed electric-stimulation, if the pulse wave is monophasic and of long duration (pulse width) similar electrolysis phenomena will occur, when it is applied for long time intervals. Even when the electrical stimulation has an ideal form of electrical impulse, and the pulse duration is unnecessarily long (such as more than 0.5 msec and used for prolonged periods of time) the first two of the above phenomena can easily occur with or without breakage of the metal of the positive electrode (needle). Therefore, it is essential for the physician to know the major parameters already discussed, before using any electrical stimulator. For example, if one inserts a pair of acupuncture needles into the human or an animal body or into a Ringer's solution or even into any normal saline solution in a glass container by keeping the inter-electrode distance anywhere between 3 and 30 cm and a d.c. voltage of 3 V is directly applied, the electrode will break within 3-20 min, depending upon the diameter of the needles, the length of the needles, depth of the insertion into the body tissue or solution and their electrical characteristics, as well as homogeneity, materials and previous mechanical history of the positive electrode. In the Ringer's or normal saline solution by adding a pH indicator, the pH changes around the positive and negative electrodes can be visualized as a striking change of color. Other side-effects which can theoretically happen, but may rarely occur are the following:

(1) Cardiac Fibrillation has been reported in the Orient but has not yet been reported in the U.S.

(2) Burning of the skin and tissue

If a sudden electrical stimulation was given during the certain part of the rising part of the T wave of the electro-cardiogram, there is a theoretical possibility of inducing cardiac fibrillation. Although such a period, known as the "vulnerable period", will not last more than 50 msec and a particularly effective vulnerable period will not last more than 10 msec, simple probability will tell us that if one gives electrical stimulation of sufficient intensity (that is strong enough for any random stimulation to induce cardiac fibrillation) the probability of producing the fibrillation will be less than 1/100. Although this is a simple calculation it indicates that there is one possibility of producing a fibrillation if very strong electrical stimulation is given randomly 100 times through ventricles. In reality, it has never been reported through the use of electro-Acupuncture since most of the time, the intensity of the stimulation going through the heart is not sufficient to produce the fibrillation. Still one must be aware of such a possibility and that under certain conditions such a possibility may exist. One of the possibilities is when suddenly a switch is turned on while the output stimulation set up is in a regular required voltage, rather than gradually increasing the stimulation voltage after turning on the switch.

Likewise, suddenly turning off the power switch can also create a sudden transient strong pulse and may theoretically contribute to the possibility of fibrillation. Before the power switch of the electro-stimulator is turned on or off, the intensity of the stimulator should be turned down (reduced to zero).

KIRLIAN PHOTOGRAPHY AND ACUPUNCTURE

Recently some investigators have begun to claim that the Kirlian high voltage high frequency electrical discharge pattern from the human body surface is an invisible aura of energy emitted by living things. The author has evaluated the subject on and off since 1972 and finds no reason as yet to support this concept of a special mysterious discharge pattern due to emission of human energy, to be identified as aura. The discharge pattern is based on a rather simple, known electrical discharge pattern from the body surface (influenced by complex factors) only appearing when part of the body is placed under a high frequency high voltage electrical field. Therefore, such an electrical discharge pattern from the body surface will be influenced by many factors such as electrical conductivity of each part of the skin, temperature, humidity on the skin's surface, gas or ions on the surface of the skin, as well as these factors in the air in the direct vicinity of the skin surface. Such factors will be influenced by the change of circulatory states as well as the pressure exerted on the body surface. Acupuncture, as the author's previous work indicates, has an initial response (1st phase) of vaso-constriction, accompanied by decrease in temperature and delayed increase in electrical impedance, and a corresponding decrease in discharge intensity in Kirlian photography.

However, once the 1st phase is over and the 2nd phase is reached, the Kirlian photograph returns to original intensity with various time delays. When acupuncture successfully can produce significant vaso-dilation (3rd phase), which in turn can increase skin temperature as well as a delayed increase in electrical conductivity of the skin surface above it, the Kirlian photographic pattern increases its intensity, with various degrees of time delay (2-50 min.). Therefore, change of the high frequency discharge pattern is to be expected by acupuncture or hypnosis or bio-rhythm since all of these procedures can modify circulatory states. Furthermore, change of the discharge pattern as well as appearance of change in different colors, is dependent upon the frequency components and voltages of the externally applied electrical field, as well as gas molecules of different ionized atoms or molecules in the applied field. Unless the following parameters and safety precautions are specified, one cannot reproduce or compare with the results of Kirlian photographic research among different investigators:

1. Major frequency components of the applied electrical potential.
2. Its wave form (photographed from an oscilloscope) with indication of sweep and vertical sensitivity, as well as zero voltage line.
3. The maximum magnitude of applied electrical potentials and their polarities.
4. Output impedance of high frequency high voltage sources.
5. Skin temperature or surface temperature of the subject.
6. Skin electrical impedance (or surface electrical impedance of the subject).
7. Parameters of high voltage electrode plate (including size, surface conditions and the kind of metal or alloy used).
8. Area of body surface in contact with film and exerted pressure on the surface of the subject to be photographed, as well as the current actually passing through the subject.
9. General condition of the skin surface (whether skin has been washed with water, water and soap, alcohol sponge, or not washed).
10. Room temperature.
11. Humidity of the air.
12. Atmospheric pressure.
13. Degree of air pollution, if any.

} Environmental conditions

14. Subject's vital signs (such as pulse rate, respiratory rate, body temperature and blood pressure) and circulatory condition of the area of the body to be photographed before and after Kirlian photography.
15. Mental state of subject.
16. Exposure time for the electrical field.
17. Parameters of the recording film (including distance between back of film and high voltage electrode plate and distance between the subject, emulsion surface of the film and electrode plate surface, as well as the arrangement of each of the color sensitive emulsion layers).
18. Names, composition or nature of materials and thickness and other parameters of dielectric substances between high voltage electric plate and subject to be photographed.
19. Experimental set-up shown in photographs or schematic diagrams.
20. Safety precautions for both subject and examiner for exposure time to high voltage discharge, electric shock, burning of skin, and possible side effects from ozone* gas, ultraviolet, and the remote possibility of X-ray generation, particularly when the voltage is very high and applied for a long time.
21. Grounding conditions of subject (where and how the subject stands or sits, what the subject wears or contacts and weight and height and other pertinent sizes of the subject).
22. Current-voltage curve measured while Kirlian photograph is being taken.
23. Blood chemistry including concentrations of various ions, and CBC of human subject or animal.
24. Other parameters. For instance, a widely used inexpensive Kirlian photography unit sold by the Edmund Scientific Company of New Jersey has a frequency component of around 10 kcycles/sec. compared with the frequency component of around 50 kcycles/sec, or even higher frequencies (up to 2 m/cs) reported by Dr. Kirlian of Russia, as well as some other scientists.

The results obtained with 10 kcycles/sec. and the results obtained with 50 kcycles/sec cannot necessarily be compared directly, although they may resemble each other. When frequency is beyond 50 kcycles/sec due to decreased impedance of the skin, changes in the discharge pattern due to physiological conditions as well as mental state become less significant. In addition, the color patterns are also influenced by the quality and condition of the color film as well as by interference from any external unrecognized light.

In interpreting color changes in Kirlian photography, the following two important factors must be taken into consideration: (1) Different gas molecules exist between the skin and the electrode. The main cause of the color emission of the light during the discharge under high frequency high voltage electrical field depends upon what kind of gas molecules exist between the skin's surface and the electrode. In a high voltage high frequency electrical field, most of the gas molecules can easily become ionized by emitting electrons. Such electrons further ionize the surrounding gas molecules and create a cascading shower of ionization, which in turn creates a series of pairs of electrons and ion molecules. When the ions and the electrons recombine, a stable molecule state is produced and light is emitted. The color of the light is specific for each molecule. The most abundant gas molecule in the air, nitrogen, gives a bluish light when the ionized nitrogen molecule and electron recombine. On the other hand, if hydrocarbon molecules ionize, and if they recombine with electrons, a reddish color is emitted. Therefore, if a color other than bluish appears, there is a possibility that hydrocarbon or some other gas

* Ozone, 0_3, has characteristic odor and strong oxidative action and it turns Starch-Iodide paper blue, and Tetramethyldiamine-diphenyl methane paper violet (hydrogen peroxide, halogens or nitrous fumes give similar change) as non-specific reaction. When it passes through KI solution, iodine I_2 will be released:

$$2KI + H_2O + O_3 => 2KOH + I_2 + O_2$$

molecule exists. For instance, a commercially available small neon gas tube (neon lamp) requires a minimum of 65 V and a maximum of 125 V to produce a cascade ionization phenomenon and recombination of the ions of the neon molecule and the electrons, which emits that distinctive pink color only around negative electrode*. During such a discharge pattern, if the voltage current curve is measured, the voltage current curve will show current-controlled negative resistance characteristics. Therefore, if we know the current voltage curve during such a discharge, we can predict the most efficient way of emitting light by adjusting the load line on the negative resistance region to make the entire electrical circuit an a-stable oscillator.

(2) Each layer of the film emulsion produces a specific color, depending on whether the light is entering from the top of the film or the bottom. Since the top layer usually produces a blue color, if the light is coming from the top and the entering light has a bluish or ultra-violet color with a very short wave length, the picture will show a predominantly bluish color. If the entering bluish or ultra-violet light comes from the direction of the bottom layer, which generally produces a red color, the picture will be predominantly red. Therefore, unless the composition of each layer of the emulsion that produces a specific color is known for the film used for the experiment, as well as from which direction the light is entering, the results may lead to an erroneous conclusion based on artificially created color; as previously described by Prof. W.A. Tiller of Stanford University.

In carrying out experiments with Kirlian photography, two factors often limit usefulness in its clinical application: (1) Such photography occasionally results in an uncomfortable electric shock to the subject (or even burning), which may be hazardous if a relatively large current flows through the body, particularly through the heart.* (2) The size and location of the human body to be used is often limited by the size of the commonly available Polaroid color film. †

Kirlian photography can demonstrate a variety of patho-physiological states of the human body before signs or symptoms become obvious, provided that it produces significant changes

* Among the different small neon lamps, although excitation voltage vary between 65V and 125V depending upon the pressure of gas molecules and geometrical arrangement of the pair of electrodes, extinction voltage is almost constant (54V) for the same gas molecules.

† This electric shock is encountered relatively often during recording of the Kirlian photograph in the darkroom with Polaroid film. One of the reasons is that some of the protective black paper is made deliberately electroconductive to prevent an undesirable discharge pattern exposure by friction during transportation of the film. Another reason is that the outside holding frame is metal with a black insulating coating which can become easily conductive when the protective painting is damaged by friction or scratching. However, in spite of the existence of such electroconductive material, unless a current is leaking between the electrode plate and the container of Polaroid film through the surface of the glasssor lucite insulating plate on which the filmpack is placed, the shock will not occur. The major cause of such leakage causing the shock is contamination of the insulating plate by the electrolytes in sweat during handling. Therefore, meticulous cleaning of the insulator and careful handling can eliminate this problem of electrical shock. The simplest way of reducing undesirable electric shock is to completely encapsulate the high voltage plate inside of the insulating material.

If one uses a transparent insulating plate with one side acting as a transparent electrode, and part of the body is placed directly on the other side of the insulating glass surface without inserting film between the transparent electrodes and the human body, it will be much easier to take either still photographs or movies from the outside of the transparent electrode as well as reducing the problem of electric shock. With the transparent electrode method, any size of film can be used and a wide area of the body surface can be studied regardless of the film size used, provided that the electrode surface is smooth and flat or curved and not irregular and that the electroconductive material is distributed homogeneously.

On the other hand, when the photograph is taken from outside of the electrical field from a distance, because of the overall intensified discharge pattern, much of the detailed structure cannot be seen. As a result, sensitivity of the detection of minute changes will be drastically reduced. Ideally, to obtain a fine structure in the Kirlian photography pattern, the recording film should be placed between the electrode and the biological specimen, and to take a movie such a film should be moved with constant speed, in order to record continuously the changes in the discharge pattern.

in the hemodynamics of the microcirculatory system. If the area of the living body has a low electrical impedance and increased temperature, the high frequency discharge becomes more significant and can be seen as a dense discharge pattern in the photography. Some of the acupuncture points have such low impendance high temperature characteristics compared with surrounding tissue that discharge patterns become more distinctive. On the other hand if there is an abnormal vaso-constriction and decrease in temperature, metabolism and electrolyte concentration, that part will show a decreased discharge pattern. If the above described two limiting factors can be improved or eliminated, Kirlian photography can be utilized safely for a much wider area of the body and may become a very useful clinical tool for the study of circulatory conditions in various diseases (including cardio-vascular, mental, and infectious diseases) as well as the effects of acupuncture or various drugs. The author has been developing high voltage micro-electro photography in order to study the electrical characteristics of cell membrane and intracellular fine structures. The details will be published in the near future.

Another possible side effect is the formation of a large quantity of ozone around the high voltage generator, which creates a distinctive odor. Excessive amounts of ozone formation not only have bacterio-cidal effects, but may also have some toxic effect. As long as the leakage current is kept minimum through the body, there seems to be no obvious recognizable side effect, although one cannot be sure what is happening in the body tissues where the current flows. (The possibility of inducing cardiac fibrillation cannot be excluded). As a Kirlian photography technique, the single pulse technique can be used as a high voltage source. The author found that the simplest high voltage source for Kirlian photography was the Piezo electric high voltage generator (commonly used for small lighters or electrical spark generators for gas burners), with an output wave form of dumping sinusoidal oscillation. A Piezo electric spark generator for gas burner was obtained in Bologna, Italy, in 1973 (brand name: "Killer"), which had an average frequency component of around 10 kcycles/sec. in the experimental set-up.

Historically speaking, the principle of Kirlian photography was already reported by two M.I.T. researchers in the city of Boston in 1939 as a single pulse technique (F. H. Merrill and A. Von Hippel, The Atomphysical Interpretation of Lichtensberg Figures and Their Application to the Study of Gas Discharge Phenomena, [31] in the *J. appl. Phys,* **10**, 873-887, 1939). In the same year, S. Prat and J. Schlemmer published the article, Electrophotography, [32] in the *J. biol. Photographic Ass.*, 7, 145-148, 1939). This was long before the renowned Professor David Semyon Kirlian and his wife, Valentina (Kirlian photography was named after them), described their studies in 1958 at Kazakh State University, Alma-Ata, Kazakh, U.S.S.R. Also, it is said that Nikola Tesla (1856-1943) successfully recorded high voltage high frequency photography from the electric sparks between electrodes and his body some 40 years before Kirlian's discovery.

And according to Viktor Adamenkov of Moscow, one of Russia's leading physicists, the Russian electrical engineer Yakov Narkevich-Todko demonstrated "electrographic photos obtained with the help of quiet electrical discharges," at the Fifth Photographic Exhibition, given by the Russian Technical Society in 1898. Narkevich-Todko constructed a Ruhmkoff-induction pole and used it as a lightning rod. A second electrode was connected to a metal plate on which sensitive photographic film was placed, so an electrophotograph could be taken.

However, even before this, according to Zdenek Rejdak (in his article, Bioplasma and Kirlian Photography, in *The Kirlian Aura* [33] ed. by S. Krippner and D. Rubin, Doubleday-Anchor, New York, 1974, pp. 178-180), in 1889 a Czech physicist, Professor O. Navratil, was the first to use what he called "electrophotography." And in 1896, according to Rajdak, the French scientist, H. Baravuc, published electrographic photographs of hands and leaves. And long before any of the above, among sailors a similar phenomenon was known to occur around the masts of ships—"St. Elmo's Fire."

In this editorial the author presented some of the problems and parameters to be considered

in carrying out serious research in order to bring out and illustrate the present status of acupuncture and the possible direction of that research. However, the editorial, in trying to clarify the existence of ambiguity and the limitations in much of the present research, ends up by creating more questions by considering many important parameters and problems. It is easy to discuss parameters, but it is more difficult to carry out documentation and analysis in a routine clinical situation, due to the limitations of time, facilities and motivation. In order to better understand the phenomena associated with Acupuncture and Electro-Therapeutics, one must always be aware of this problem and make a special effort to document the measurable multi-parameters in quantitative methods as thoroughly as possible. (In certain situations, animal research provides better experimental models than human.) In some ways, the author's paper presented in this journal fails to satisfy some of the above considerations. But one must begin with what has been achieved so far. In the first issue of this journal, a summary is presented of typical examples of the effects of acupuncture on both the cardio-vascular and nervous systems, studied by the author from the multiparameter approach, supported by grants from the Heart Disease Research Foundation. So far as I know, this foundation was the first in the U.S. to support this type of acupuncture research as carried out by the author (as early as December, 1971). They gave this author support at a time when no other governmental or private foundation was serious enough to consider such a possibility.

As in any field of medicine, acupuncture and electro-therapeutics requires research and teaching. Since it is generally not taught in medical school as a required course, some proper teaching mechanism—as well as regulation by law regarding safety and maintenance of standards—should be created. A similar situation may develop in Kirlian Photography too.

The author, with the help of Mr. Robert R. Peters and Mrs. Eileen F. Bonelli of the Heart Disease Research Foundation organized one of the first series of teaching programs on "Clinical Applications and Limitations of (Manual and Electro-) Acupuncture and Their Pathological Bases," in Autumn, 1972, in the state of Pennsylvania. The course was given for physicians, dentists, and medical scientists with Ph.D. or equivalent background, and it was also sponsored by the Heart Disease Research Foundation with a modest registration fee of $15-$25 per day, which was used for the continuation of acupuncture research. As is well known, Dr. Frank Z. Warren further expanded this into a nationwide program, and similar programs have mushroomed all over the country (as have their registration fees). Among these seminars, accredited by the New York State Board of Medicine, are those given by the National Acupuncture Research Society, organized by Dr. Warren; the New York Society of Acupuncture for Physicians and Dentists, organized by Dr. Saul I. Heller, elected president, and its founding members, as well as the American Journal of Chinese Medicine, owned by Dr. Frederick Kao.

Since record-keeping is so important in carrying out clinical research, a method of uniform record-keeping developed by Dr. Heller should be helpful in recording, in an orderly way, the treatment of each patient who receives clinical acupuncture and electro-therapeutics. In the practice of any modality of medicine, the patient must be protected from undesirable side effects. For the safety of the public, acupuncture should be administered by a physician who has satisfied at least the minimum required period of study (a 100 hr credit course in New York state). Both justified and unjustified competitions among those groups helped to educate the medical profession on Acupuncture and stimulated interest in doing research on Acupuncture and Electrotherapeutics. Similar competition and coexistence also exists among acupuncture research groups in Europe such as those organized by Dr. Van Nghi of France and his associates in various countries.

It is encouraging to receive a Foreword for the first issue of this journal from people such as Dr. Howard Rusk and Dr. Matthew Lee. Dr. Rusk, Professor and Chairman of the Department of Rehabilitation Medicine of New York University, has contributed so much in the progress of the field of Rehabilitation Medicine in the United States. Dr. Rusk's work has become internation-

ally known through the reputation of his Rehabilitation Institute at New York University. Dr. Matthew Lee, Professor of Clinical Rehabilitation Medicine, is a close associate of Dr. Rusk and has been actively involved with him in acupuncture research at New York University. They have been seriously interested and involved in trying to integrate medically acceptable beneficial effects of acupuncture in the field of rehabilitation medicine. Acupuncture is still considered by some researchers and educators in some departments in medical schools in the United States to be something a respectable researcher should not be involved with. This assumption is often made without attempting to seriously evaluate it through research.

On the other hand, there are many individuals and institutions who are intensively involved in research on acupuncture and electro-therapeutics throughout the world. In Vienna, the Austrian government established the Ludwig Boltzmann Institute for Acupuncture in the University of Vienna some time ago. It is edifying to read the article on the summary of the past ten years of progress in acupuncture research in Austria, written by the Director of the Boltzmann Institute, Dr. Johannes Bischko. Dr. Bischko is generally considered one of the leading authorities in the field in Europe. He has taught many acupuncturists in Europe including the renowned Dr. Felix Mann of London, England.

It is gratifying that the Kitazawa Institute, one of the most prestigious medical institutes in Tokyo, but a relatively conservative one, has established a division of oriental medicine. For this new division the Institute suitably appointed Dr. Yoshio Manaka as its first director (We are pleased to say that Dr. Manaka is now a member of our own editorial board.) Dr. Manaka and his associates have contributed directly and indirectly to the promotion of medically acceptable acupuncture throughout the world through his many classics in the field of acupuncture medicine. Dr. Yoshio Oshima, Professor Emeritus of the University of Tokyo and Dr. Katsusuke Serizawa, Professor at the Tokyo University of Education, as well as many of their associates, have contributed greatly in research on acupuncture, moxibustion and shiatsu.

Dr. Akira Ishihara of the School of Medicine, Yokahama City University, is not only an expert on oriental medicine but also one of the most outstanding historians in that field, known throughout the world by his many now-classic textbooks. His lectures and work have inspired many students of medicine, including this author. In spite of his contributions and his international reputation, the institution has not given him as much recognition and support as he deserves.

Dr. Kentaro Takagi, Professor and Dean of the Medical School of Nagoya City University, has done intensive study on the mechanism of sweating and the effects of pressure on the sweating patterns of the different parts of the body. (In the individual with normal spinal cord function, when one side of the chest wall is pressed with a finger the sweating on the same side of the body is diminished and on the opposite side sweating increases.)

While President of the Japanese Anesthesiological Society in 1974, Dr. Masayoshi Hyodo became a member of our editorial board. Dr. Hyodo is Professor and Chairman of the Department of Anesthesiology of Osaka Medical College, and he was the first academician in medical school in Japan to introduce acupuncture and electro-acupuncture in a medical school pain clinic.

Dr. Hideo Yamamura, Professor and Chairman of the Department of Anesthesiology, University of Tokyo, was initially a skeptic; but he has now become one of the most serious investigators in the field and is a member of our editorial board.

In the ancient city of Kyoto, the Pain Control Institute has actively contributed to acupuncture research for the past several years. The Bulletin of Kyoto Pain Control Institute, edited by Dr. Kunzo Nagayama, is familiar to some westerners. Dr. Yoshio Nakatani is well-known as the originator of the *Ryo-Dou-Raku* treatment, a simplified clinical acupuncture and electro-acupuncture treatment based on the measurement of abnormal body surface impedance or d.c. resistance at representative points of the body surface. His organization,

specializing in the study of *Ryo-Dou-Raku* and the autonomic system, is very active with many physicians participating. Dr. Haruto Kinoshita, President of the Japanese Acupuncture and Moxibustion Association (former president, Dr. Sodo Okabe) has contributed greatly in maintaining standards of acupuncture and moxibustion treatment through both a classical and Western approach in teaching and research. As did his father before him, Mr. Yuichiro Tobe, President of Ido-no-Nippon-Sha, Yokosuka, Japan, has contributed greatly in popularizing acupuncture through his Japanese journals and books, as well as providing any information and supplies relating to acupuncture. To this author's knowledge, Ido-no-Nippon-Sha is the largest and oldest existing organization in the world specializing in acupuncture and moxibustion. Dr. Koubei Akabane's "See-Saw Phenomena," "Heat Sensitivity Methods," and "Intra-Dermal Needle Treatments," known as *Hinai-Shin-Hou* are contributions too well-known to need further mention.

There are many others involved in acupuncture research who cannot be mentioned here due to limitations of space. However, the author hopes to give them the recognition they deserve in subsequent issues of this journal.

The Shanghai Institute of Physiology in the People's Republic of China is well known because of Professor Chang Tsiang-Tun's research on acupuncture from basic neurophysiological aspects. There are of course many other individuals and institutions involved in acupuncture in the People's Republic of China and Taiwan, but these have been well-covered by many other authors.

Outside the U.S. and the Far Eastern countries, there are many individuals working on acupuncture in the clinic and in basic research. Space does not permit mention of everyone who deserves mention, but following is a partial list of those individuals known to the author.

In France, there are many physicians and investigators involved in the field of acupuncture and electro-therapeutics. Dr. Nguyen Van Nghi (of this journal's own board) is among the leading authorities. He is the editor of *Le Mensuel du Medecin Acupuncteur*, and he and his associates have contributed greatly to the promotion of research as well as education in the field. The World Congress initiated by Dr. Van Nghi and his associates in 1973 has become an annual event and has attracted many participants from all over the world. Dr. Paul Nogier of Lyons is the originator of Auricular Therapy. (His concept of representation of the organs of the entire body on the ear not only created great controversy but eventually resulted in stimulating research in the field.) His associate, Dr. R. J. Bourdiol of Paris, contributed in explaining the method of Auricular Therapy from the standpoint of embryological developmental aspects of the ear and its innervations by various nerve fibers. Dr. J. Claude de Tymowski of Paris is President (Past president is Dr. Monnier) of the French International Society of Acupuncture. Drs. Monnier, Darras, Mussat, Kespi and Lasry have contributed to the teaching of clinical acupuncture based mainly on classical Chinese concepts. The Editor-in-Chief of the well-known journal *Meridiens, Revue de l'Association Scientifique des Medecins Acupuncteurs de France,* is Dr. Didier Fourmont.

Among those who are directly or indirectly involved in acupuncture research from more basic approaches: Dr. J. E. H. Niboyet of Marseille; Prof. J. Bossy of the University of Montpellier in Nimes (who contributed to the study of neurophysiology of inhibition of pain); Prof. Aime Limoges, of the University of René Descartes in Paris (who has done extensive work on the application of high frequency electrical stimulation with or without combined use of chemical synthetic agents for oral or major abdominal or genital-urinary surgery); Prof. Denise Albe-Fessard and her associates, of the Laboratoire de Physiologie des Centres Nerveux, College de France, (who have been deeply involved in the study of the mechanisms of the pain sensation from the standpoint of neurophysiology); and Prof. Andre Soulairac (a member of our board as well as this author's research collaborator), and his associates at the Dept. of Psychophysiology, University of Paris, VI.

In Milan, Italy, Prof. Lucciano Roccia has been working on the application of acupuncture analgesia in surgery. Dr. Ulderico Lanza and Dr. M. Martinelli of Torino and their associates contributed greatly to the promotion of acupuncture. Dr. Lanza is the editor of *Rivista Italiana di Agopuntura,* the leading acupuncture journal in Italy.

Dr. Heribert Schmidt of Stuttgart and Dr. Von Leitner of Berlin are two of the leading educators on acupuncture in West Germany. Dr. Josef A. Richter, Head of the Anesthesiology Dept., Deutsches Herzzentrum, of Munich, has done extensive work with electrical acupuncture analgesia in 125 patients undergoing open heart surgery, along with his associates in the Depts. of Anesthesiology and Cardiovascular Surgery. His work is expected to appear in this journal. Prof. Alfred Doenicke of University of Munich is also involved with Acupuncture research related to G.I. systems.

Dr. Dieter Gross (a member of our board) of Frankfurt has been doing basic clinical research in the mechanics of pain in relation to autonomic functions.

Dr. Felix Mann of London is still very active in acupuncture education through his books and seminars. In Russia, Prof. E. Tykotchinskaja, Director of Acupuncture at the S. M. Kirowa Institute of Leningrad, has been very active in both research and teaching. In Sweden, Dr. Sven Andersson of the Dept.of Physiology, University of Goteborg, is working on the study of effects of electrical stimulation on perception of pain, using the tooth.

In Spain, Dr. Alvarez Simo is active in his Spanish Society of Acupuncture. And in Buenos Aires, Dr. David J. Sussmann was one of the first physicians to introduce acupuncture in South America, and his now-outdated book on acupuncture played an important role in South America among Spanish-speaking people.

In Canada, Dr. Ronald Melzack (of our editorial board), Professor of Psychology at McGill University, has contributed so much in stimulating other investigators to confirm his Gate Control Theory (co-authored by Dr. Patrick Wall, who is now Professor of Anatomy at London University.) Dr. Melzack's book, *The Puzzle of Pain,* published by Basic Books, New York, in 1973, is informative for every student of pain mechanisms, and we are looking forward to his forthcoming book on the mechanism of "aggression."

The author would also like to acknowledge the letter of Dr. Elie Cass, President of the Acupuncture Foundation of Canada, informing us of the activities of their organization of over 500 physician members.

There are so many individuals and institutions who are conducting research in this field in Canada and the United States that it is beyond the scope of this editorial to mention them all.

MEDICO-LEGAL ASPECT OF ACUPUNCTURE TREATMENT; PROTECTION OF BOTH PATIENT AND PHYSICIAN & QUALIFICATIONS OF ACUPUNCTURE SPECIALISTS

Just as in any branch of medicine, the public must be protected from the possible side effects which may stem from the misuse of acupuncture. At the same time qualified physicians must be protected from unreasonably high insurance fees (the major clinical use of acupuncture having nothing to do with acupuncture analgesia used for surgical operations and not to be confused with regular anesthesia used in the operating room), as well as from being unjustifiably sued for malpractice, which would only serve to eventually force an increase in the physician's fee paid by the patient. Until recently malpractice insurance covering acupuncture was generally very reasonable, since most insurance companies recognized that the degree of risk involved is minimal when administered by a qualified physician.

To protect both physician from being sued and patient from possible unexpected side effects from treatment, a paper of informed consent describing both possible beneficial effects and side effects should be signed by the patient, a qualified certified physician and a witness

under mutually acceptable conditions before carrying out any procedure. (see "Consent Form" at the end of this paper.) Once such an informed consent is signed, laws should provide protection for the physician from law suit and unjustified high insurance rates, and protection for the patient from unreasonably high fees. Dr. Felix Mann of London told the author that the annual malpractice insurance premium for his busy practice of Acupuncture is about $85 in 1975.

In order to make acupuncture an acceptable part of the medical practice, acupuncture should ideally be practiced by licensed physicians who have special training in acupuncture from qualified individuals or by acceptable teaching programs. Even licensed physicians should not be permitted to practice acupuncture or supervise its use without special training. On the other hand those who have proper training and experience should be permitted to practice acupuncture under the direct supervision of a licensed physician who is qualified by training to practice acupuncture. At the same time, society should not waste the experience and knowledge of non-physicians. They should be given the opportunity of becoming licensed physicians' assistants as acupuncture therapists. If such people are forced to go underground, it will be more difficult to control safety precautions, and may create more undesirable medical problems.

Dr. Jackson Riddle's article on laws regulating the practice of acupuncture will give the reader much practical and updated information on the subject. In Dr. Riddle's capacity as the executive secretary of the New York State Board of Medicine, he and his associates have made incredible efforts to establish and implement the present law which regulates the practice of acupuncture in New York State, for the first time in history.* It is expected that other states in the United States and Canada will follow the lead of New York State and enact similar laws and regulations controlling the practice of acupuncture.

Despite the protective intentions of the law, some of the accredited courses allot an insignificant amount of time to the teaching of electro-acupuncture and its clinical demonstration. As a result many physicians, upon completion of the course, use electro-acupuncture in their clinical practice with very little knowledge of the basic principles or of the possible side effects and the prevention of side effects. Furthermore, some of the accredited courses were taught superficially to satisfy the requirement for accreditation. Ideally the course should be given by a physician who has training and teaching experience in both electronics and electro-physiology and has considerable experience on electro-acupuncture. The article on record keeping by Dr. Saul Heller will give us a concise and informative introduction to the importance of record keeping in acupuncture evaluation in daily clinical practice. Dr. Heller, past President of the New York State Board of Medicine, is president of the New York Society of Acupuncture for Physicians & Dentists. He has pioneered in the concept of developing a system of uniform record keeping for acupuncture, and has directly and indirectly contributed to the acceptance of acupuncture by the medical profession. The author's major article on the "Patho-Physiology of Acupuncture Treatment; the Effects of Acupuncture on the Cardio-vascular and Nervous Systems" in this issue will provide some ideas on the nature and problems involved in acupuncture research through one particular investigator's research experience.

In order to present a variety of the aspects of both clinical and basic research in acupuncture and electro-therapeutics, we decided to publish many abstracts of the papers presented in the scientific session and workshop of the New York Society of Acupuncture for Physicians and Dentists. This is considered to be one of the few training courses for physicians and dentists officially accredited and endorsed by the New York State Board of Medicine. The seminars offer the physicians and dentists, the latest scientific papers on basic and clinical research as well as teaching clinical applications and limitations within the context of acceptable Western medical standards. These abstracts represent an over-all view of acupuncture research in the United States. Some of the views presented in certain abstracts differ from those of the

* See Appendix II

Editor-in-Chief and many of the Editorial Board members. Such differences, however, should serve to create further questions and help to stimulate more research in the field. In the forthcoming issues many articles on basic and clinical research on electro-therapeutics and particularly electro-acupuncture will appear. In addition many aspects of Acupuncture and related but neglected fields of medicine will be published.

Acknowledgements—The author wishes to acknowledge the help and cooperation of the Editorial Consultant and Co-founder of this journal, Dr. A. L. Copley, and of all the members of the Editorial Board, particularly Dr. Saul I. Heller, President of the New York Society of Acupuncture for Physicians and Dentists, for his endless hours of help and support; Dr. Louis R. Orkin, Professor and Chairman of the Dept. of Anesthesiology, Albert Einstein College of Medicine; Dr. Matthew Lee, Professor of Rehabilitative Medicine, New York University and Director of the Dept. of Rehabilitation Medicine, Goldwater Memorial Hospital; Dr. Simon Freed, Professor of Neurology and Biochemistry, New York Medical College; Dr. Johannes Bischko, Director of the Ludwig Boltzman Institute for Acupuncture, University of Vienna; Dr. Nguyen Van Nghi of Marseilles; France, who is the president of the World Scientific Union of Medical Acupuncturists; and Dr. Yoshio Manaka, Director of Oriental Medicine, Kitazato Institute, Tokyo, Japan.

The author also wishes to thank the following: Dr. Jackson Riddle, Executive Secretary of the New York State Board of Medicine and Chairman of the New York State Commission on Acupuncture, for giving this author invaluable encouragement and assistance in carrying out basic clinical research on acupuncture under very difficult circumstances; Dr. Pascual Sanchez, Chairman of the Acupuncture Committee of the New York State Board of Medicine, for his encouragement; Dr. Deborah Davis of the Sociology Dept. of Queens College, and her graduate assistant, Mr. Howard Rappaport, for supplying many valuable references; Mr. Gary Williams, Miss Joan Landis and Mrs. Nancy Swanson for their editorial assistance; Dr. Salem Kooby and Miss Edith Flanders for their generous help in translating Abstracts into French and German; Brother Michael Losco, Assistant Professor and all the members of the Dept. of Electrical Engineering, Manhattan College, and Mr King Lee, former student at the college, for their help in acupuncture research, and to Mr. Anthony Mercando, presently a student at the college, for his help in Kirlian photography research; Mr. Robert Peters, Chairman of the Board of Trustees, Mr. Barry Peters, Mr. Henry Sasson, Mr. Walton Bader, and other members of the Heart Disease Research Foundation, for their generous support of acupuncture research; and finally I would like to thank the publishers, Mr. I. Robert Maxwell, Mr. Robert Miranda, Mr. Al Henderson, Ms. Heather Barnett, and their associates at Pergamon Press for their interest and help in establishing this journal.

(This work was partially supported by the Research Grants from Heart Disease Research Foundation, New York).

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APPENDIX I

CONSENT FOR EXPERIMENTAL PROCEDURE OF ACUPUNCTURE

Date: _____

This is to state that I _____ hereby authorize the performance of an experimental procedure upon myself by _____ that I understand that this procedure is experimental, and not accepted medical practice but only used by qualified M.D.s on volunteers for medical research in this part of the country although it is used as an accepted medical practice in some other countries. I have been fully informed as to any consequences which may result now or in the future as a result of this experimental procedure and I am free to withdraw from this program at any time.

Acupuncture has been explained to me as a medical treatment performed by the insertion of special needles (with or without the application of small pulses of electric current to the needles) through the skin into the underlying tissues at certain indicated points on the surface of the body, for the purpose of the alleviation or cure of painful bodily diseases and disorders or for the treatment of symptoms, and diseases for which acupuncture is known to be effective. for an undetermined time.

I have been made aware of the possibility of both complications and beneficial effects that may result from this procedure.

> *Potential complications include:* infection, ecchymoses, micro-hemorrhages, hematoma in the tissues, pain and discomfort, numbness, weakness, fainting, nausea, even aggravation of symptoms, breakage of needle and its retention, necrosis of tissue around electrodes, or other unforeseen complications.
>
> *Potential beneficial effects include:* various degrees of relief from various pains including migraine headache and chronic joint pain, spastic muscles, bronchial asthma, insomnia, emotional irritability and mental depression, nerve deafness, constipation, diarrhea, or other gastro-intestinal problems including ulcerative colitis; withdrawal syndromes of drugs, compulsive habits of excessive eating, drinking of alcohol, smoking, menstrual problems, high blood pressure, coma, specific color blindness, and some other diseases or symptoms resulting directly or indirectly from circulatory disturbances.

With this knowledge I will accept responsibility of any consequences resulting from this procedure and I will not blame or sue the people performing it on me or the institutes where they are affiliated or where the experimental procedure was carried out, since I volunteered and authorized that this be done to be studied as a part of medical research, knowing the possible beneficial effects as well as the risk of possible undesirable effects.

I also authorize the taking of photos of myself and of this procedure to be used for purposes of scientific documentation of the data, dissemination of information, publication, or any purpose which shall be deemed necessary.

_____	_____
Witness	Signed Age
	_____
	Address
_____	_____
Witness	Telephone
(Informed consent form used by Yoshiaki Omura, M.D., Sc.D.)	_____
	Profession