

## The Physiological Basis of Acupuncture Therapy

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**A**CUPUNCTURE is a traditional therapy used in the Orient to treat disorders of internal organs through stimulation of the body surfaces by needles. It is described in the *Yellow Emperor's Classic of Internal Medicine* written in China about 500 B.C.<sup>1</sup>

The therapeutic value of acupuncture has been recognized beyond question in the Orient for more than 3000 years, but has not been well known in the Western hemisphere until recently. During the past 30 years, a number of textbooks on acupuncture have been translated into major European languages.<sup>2-8</sup> The results of its clinical trials have been documented, and further research is in progress in many hospitals and medical centers in France, Germany, Great Britain, Italy, Switzerland, Poland, Czechoslovakia, and the U.S.S.R.<sup>9-17, 71-74</sup> In France, acupuncture is now being taught in the teaching hospitals.<sup>11</sup> In the Soviet Union, after the completion of basic research, acupuncture is going to be a part of their medical practice.<sup>11</sup> In America, recent reports by Veith and Dimond on acupuncture generated widespread interest among physicians.<sup>11, 38</sup>

### INDICATIONS AND CONTRAINDICATIONS

During the past 3000 years, countless cases of various diseases have been treated by acupuncture in China, Japan, Korea, and many other countries in Asia. Some of these cases are on record and available for review. More recently documented cases and data from laboratory investigation have also been published in many medical journals in Europe.<sup>13-74</sup>

In summary, various medical diseases, often considered to be diseases of neuro-vegetative and endocrine disorders, such as essential hypertension, Cushing's syndrome (bilateral adrenal hyperplasia), dysfunctional uterine bleeding, diabetes mellitus, rheumatism, idiopathic neuralgia (trigeminal neuralgia, intercostal neuralgia, lumbosacral root syndrome), vasomotor rhinitis, glaucoma, peptic ulcer, spastic colon, asthma, and various dermatoses are treated with good to excellent results.<sup>16-33</sup> Acupuncture, as anesthesia, is also reported with favorable results.<sup>24-38, 74</sup>

Acute infectious diseases, such as tonsillitis, otitis media, malaria, upper respiratory infection, gastro-enteritis, appendicitis, food poisoning, peritonitis, nephritis, and hepatitis are also treated with good results.<sup>39-50</sup>

Chronic organic diseases are more resistant to treatment, usually requiring longer periods of time ranging from several months to several years, depending upon the degree of chronicity and pre-existing structural damage, and often cure is incomplete.<sup>42, 51</sup> Malignant neoplasms are resistant to acupuncture therapy, although relief of pain or enhancement of general well being is often obtainable.<sup>34-36</sup> Acute surgical diseases, such as perforated viscus, are, needless to say, contraindications for acupuncture therapy.

### MECHANISM OF ACTION

The acupuncture points correspond well with Head's areas of referred pain. According to Head's postulate, the cutaneous pain felt in visceral disease is located in the areas where sensory nerves enter the spinal cord at the same segmental levels

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which supply nerves to the viscera concerned. It appears that various cutaneous stimulations by needles are, at least in part, transmitted to the internal viscera through the somato-visceral neuronal synapses in the spinal cord.<sup>52, 53</sup> And, during the process of such synapses, one of the components of the visceral nerves, either the sympathetic or the parasympathetic, seems to be selectively stimulated, and adjusts the function of the autonomic nervous system. Evidence to support this view is submitted by Grashchenkov and his associates. They demonstrated that the blood content of adrenalin, noradrenalin, diamine oxidase, acetylcholine, acetylcholine esterase, and histamine in their patients with asthma and peptic ulcer returned to normal after acupuncture.<sup>54</sup> It is, however, quite possible that the effect of acupuncture on the adjustment of function of autonomic nervous system may be mediated at the level of the thalamus rather than in the spinal cord.

It was demonstrated by Rasmussen and Penfield that each area of the skin surface of the body and extremities has a representative area in the cerebral cortex.<sup>55</sup> Dermal stimulation of various kinds on the body and extremities is known to be transmitted into the specific areas of the cerebral cortex through specific pathways and influences its function. This observation is further corroborated by Kassil and associates from the Reflex Therapy Laboratory of Moscow. They demonstrated specific changes in the pattern of electroencephalograms after acupuncture.<sup>56, 57</sup> These findings are extremely interesting when reviewed in conjunction with the reports by Mandell and others who demonstrated that stimulation of one of the limbic structures, the amygdala, produced 17-hydroxycorticoid release, while stimulation of another limbic structure, the hippocampus, reversed the effects of previous stimulation of the amygdala.<sup>58, 59</sup> We now know that the cerebral cortex can exert influences on ACTH production through the reticular activating system.<sup>60, 62</sup> We also know that the anterior pituitary stimulating action of the hypothalamus can further be influenced by impulses generated in the limbic system.<sup>58, 59</sup> For that reason, specific stimulation of the skin by acupuncture could influence functions of the cerebral cortex and subsequently the hypothalamus and its subordinated endocrine glands in some specific manner. Boeva and his associates demonstrated that stimulation acupuncture produced an increase in endogenous

production of ACTH, and subsequently an increase in adrenocortical hormones.<sup>40</sup> Their investigation revealed that stimulation acupuncture produced an effect similar to that seen following the injection of 25 international units of ACTH.<sup>40</sup> (The stimulation acupuncture is a form of acupuncture to be administered in such a manner that the summation of all needle stimuli applied to the body surface will induce an effect similar to the activation of the sympathetic nervous system and/or the amygdala nucleus. On the other hand, the sedative acupuncture is administered in such a manner to produce activation of the parasympathetic nervous system and/or the hippocampus.)

In Oriental medicine, one of the important causes of functional disturbances of internal organs is considered to be excessive emotional stress. For example, a symptom complex known in Western medicine as essential hypertension is considered, at least in part, to be caused by some functional disturbances of internal organs due to excessive emotional stress. Evidence to support this view has been submitted by many western investigators. Barajas, using the electron microscope, demonstrated nerve endings, which appear to be sympathetic, in association with juxtaglomerular cells as well as arteriolar smooth muscle cells of the kidney.<sup>63</sup> Tobian and his associates demonstrated a marked increase of renin in the renal veins if epinephrine and norepinephrine are infused into the renal arteries of dogs.<sup>64</sup> Rapid degradation of juxtaglomerular cells was also demonstrated under similar conditions of epinephrine infusion in rats by Kamura and Niwa.<sup>65</sup> These findings support the view that the production of renin and subsequently angiotensin is, at least in part, under nervous control. As demonstrated by Kassil and his associates, sedative acupuncture can lower the blood pressure by reducing the content of adrenalin and adrenalin-like substances.<sup>56, 57</sup> On the other hand, stimulation acupuncture can elevate the blood content of adrenalin and adrenalin-like substances as demonstrated by Boeva and his associates.<sup>40</sup>

Chronic pyelonephritis, often present in patients with hypertension, is worthy of comment. In Oriental medicine, chronic pyelonephritis is considered to be the manifestation of imbalanced physiological homeostasis in the kidney, with a view that a bacterial infection is only secondary. The current concepts of chronic pyelonephritis in

Western medicine also support this view. Recently, evidence has been offered that high local concentration of ammonia, as may be present when the body is dealing with an excessive acid load in cases of various metabolic acidosis, is sufficient to inactivate complement, thus rendering ineffective a major defense mechanism against bacterial infection.<sup>66</sup> According to recent reviews on hypertension and pyelonephritis by Katz and Courdo, significant numbers of patients with hypertension show varying degrees of pyelonephritis.<sup>68</sup> Furthermore, as indicated by Miall and his associates, treatment of pyelonephritis by bacteriocidal agents does not affect the overall pattern of blood pressure.<sup>69</sup> It is therefore considered that chronic pyelonephritis in patients with hypertension is probably the manifestation of imbalanced physiological homeostasis. This line of thinking is further substantiated by data submitted by Selye who demonstrated experimental nephritis by injecting large doses of adrenal DOCA in rats.<sup>78</sup>

According to Selye's concept of the general adaptation syndrome,<sup>70</sup> a "stressor" acting on the organism or any particular target tissue initiates "alarm reaction" through excitation of the sympathetic nervous system and the adrenal medulla. Following the alarm reaction the initial phase of the body defense mechanism begins as the "stage of resistance." The "stage of resistance" is caused by a rise in adrenocorticotropin leading to adrenal secretion of glucocorticoids, and for a brief time mineralcorticoids as well. The mineralcorticoids tend to localize this stressor agent by enhancing inflammatory reaction and eventually building up fibroblastic barriers. When the stress is prolonged, the action of the mineralcorticoid tends to establish pathologic changes characteristic of the "diseases of adaptation" in which Selye has included all the mesenchymal and degenerative vascular diseases. Whether or not an acute "alarm reaction" will eventually be followed by the diseases of adaptation depends, among other things, on the magnitude of the glucocorticoid secretion. Glucocorticoids, represented mostly by cortisol, replenish depleted carbohydrate stores and protects cells against many of the injurious effects of the reaction to the stressors. Therefore, the injection of cortisol minimizes inflammatory responses and subsequent tissue degeneration. The injection of artificial hormones is, however, unnatural, and it has

been clinically demonstrated that in most cases such drugs, while temporarily counteracting effects from stressors, do not produce physiological harmony. On the other hand, acupuncture can allow the reestablishment of a physiological equilibrium without drugs.<sup>40, 56, 57</sup> Therefore, the beneficial effect of acupuncture for the treatment of chronic degenerative diseases can be explained on the basis of its effect on the adjustment of function of the autonomic nervous system and the endocrine system as well. In fact, it seems to act to restore the body's natural defenses against stressors.

In China, acupuncture anesthesia is used extensively for major surgery. Dimond recently reported his observation of acupuncture anesthesia administered on patients undergoing thyroidectomy, thoracotomy, craniotomy and laparotomy.<sup>5</sup> His reports, as well as ones from Europe, indicate that the success rate of this type of anesthesia is quite high, ranging somewhere in the neighborhood of 90-95%.<sup>5, 34-38, 74</sup> However, the physiological basis of acupuncture anesthesia is not clearly understood at the present time. Recently, Dimond provided several references from his library research.<sup>75-85</sup>

The electronic theory of inhibition of the cortical sensory neurons is indeed attractive. However, it is to be noted that acupuncture is capable of producing anesthesia even without the application of electronic current. For that reason, the hormonal theory of inhibition is equally attractive. It is well known that sympathin released at the sympathetic nerve endings inhibits some of the effector structures innervated by sympathetic fibers, and that acetylcholine liberated by some of the para-sympathetic endings can cause similar inhibition. It is demonstrated by Grashchenkov that the blood content of sympathin and acetylcholine can be regulated by adjusting the amount of acupuncture stimuli as well as the sites of its application.<sup>54</sup> Therefore, it is not unreasonable to postulate that the excitability of sensory neurons of the central nervous system could also be regulated by adjusting the amount of hormone capable of inhibiting ganglion cell excitability. The amount of such hormone could be regulated by adjusting the amount of acupuncture stimuli as well as the sites of its application. Although the presence of such a hormone needs to be proven, careful review of the ancient Chinese literatures strongly suggest this possibility.<sup>1, 87</sup>

## SUMMARY

Acupuncture is an ancient Chinese therapy to treat disorders of internal organs through stimulation of the body surfaces by needles.

It appears that acupuncture is most effective for the treatment of functional disorders of internal organs. The beneficial effect of acupuncture appears to be due to its effect on the adjustment of function of the autonomic nervous system and the endocrine system as well. In effect, it seems to act to restore body's natural defenses against stressors.

Widespread use of acupuncture anesthesia in major surgery in China is a relatively recent development. The physiological basis for acupuncture anesthesia is not clearly understood at the present time. However, electronic inhibition and/or hormonal inhibition theories are proposed.

Significant contributions made by western investigators to the understanding of the physiological basis of acupuncture are reviewed.

## LITERATURE CITED

1. VEITH, I. Huang Ti Nei Ching Su Wen: The Yellow Emperor's Classic of Internal Medicine. Williams and Wilkins Co., Baltimore, 1949.
2. VOISIN, H. L'acupuncture du praticien. Librairie Maloine, Paris, 1950.
3. KALMAR, J. M. La pratique de l'acupuncture. G. Doin, Paris, 1952.
4. NIBOET, J. E. H. Essai sur l'acupuncture chinoise and complements d'acupuncture. Wapler, Paris, 1951, 1955.
5. CHOAIN, J. La "voie rationelle" (Tao) de la médecine chinoise. Lille: Editions s.l.e.l., 1957.
6. STIEFVATER, E. Die Organuhr; tagesperiodisches Al. tivitatsdiagra biologischer Rhythmen des Menschen oder. Karl F. Haug, Verlag, 1958.
7. BACHMAN, G. Leitfaden der Akupunktur; die Akupunktur, eine altchinesische Heilweise und ihre Klinischexperimentelle bestatigung. Karl F. Haug, Verlag, 1960.
8. BOURGEOIS, G. La lutte contre le cancer par la physique nucleaire et l'acupuncture chinoise. Librairie Vega, Paris, 1950.
9. GRALL, Y., et al. Acupuncture From the Ancestral Treatment to Present Research. Maroc. Med., 43: 979-82, 1964.
10. HUARD, P. and M. WONG. Present-Day Trends in Acupuncture. World Med. J., 9:335-6, 1962.
11. VEITH, I. Acupuncture Therapy—Past and Present, Verity or Delusion. J.A.M.A., 180:478-84, 1962.
12. FERRARI-SACCO, A. and T. OLIARO. On the Centenary of the Death of Alessandro Riberi (1861-1961). Experiences and Thoughts of Alessandro Riberi on Chinese Acupuncture. Minerva Med., 52: 4582-90, 1961. (It.)
13. UMLAUF, R., et al. Acupuncture and its Therapeutic Importance. Voj. Zdrav Listy, 34:70-4, 1965. (Cz.)
14. RUSETSKH, H. Integument of the Body and Viscera. Klin. Med. (Mosk.), 37:25-31, 1959. (Rus.)
15. KIBLER, M. The Treatment of Internal Organs Through the Skin. Deutsch Med. Wschr., 86:1929-30, 1961. (Ger.)
16. TUHACEK, M. and J. VYMAZEL and K. OBRDA. Experiences in the Treatment of Peripheral Facial Nerve Paralysis with Acupuncture. Cesk. Neurol., 26:120-5, 1963. (Cz.)
17. STARY, O. and S. FIGAR, M. TUHACEK, D. KREJCI, V. HLADKA and J. VYMAZAL. Value of Acupuncture in Diskogenic Radicular Pains and its Effect on the Polyreographic Reaction in the Affected Segments. Cesk. Neurol., 26:104-11, 1963. (Cz.)
18. GRISCHENKO, V. V., et al. The Cheng-chiu Therapy of Children with Bronchial Asthma and Remote Therapeutic Results. Pediat. Akush. Ginek., 3:20-4, 1964. (UK.)
19. VYAMAZAL, J. and M. TUHACEK. Treatment of Trigeminal Neuralgia with Acupuncture. Cesk. Neurol., 26:112-9, 1963. (Cz.)
20. MUKHAMEDHAROV, G. Z. Chen-chiu Therapy of Some Skin Diseases. Kazan Med. Zh., 1:54-6, 1962. (Rus.)
21. FIGAR, S., et al. Vasomotor Reactions Following Acupuncture in Lumbrosacral Syndromes. Cesk. Nerol., 27:251-5, 1964.
22. BERENBBIN, B. A. Results in Acupuncture Therapy of Certain Dermatoses. Vestn. Derm. Vener., 34: 56-60, 1960. (Rus.)
23. GROMOVA, V. N. Use of Acupuncture in Bronchial Asthma in Children. Pediatria, 38:64-8, 1960. (Rus.)
24. WANG, S. H. Acupuncture and Functions of the Gastrointestinal Tract. Zhong. Fang. Z., 7:376-9. 1959. (Ch.)
25. AKIMOCKKINA, V. A. Use of Acupuncture in Glaucoma. Vestn. Oftal., 74:50-5, 1961. (Rus.)
26. HORYD, W. Preliminary Experimental Treatment of Facial Neuralgia with Acupuncture. Neurol. Neurochir. Psychiat. Pol., 12:715-9, 1962. (Pol.)
27. DEMIDENKO, T. D. and A. D. MIKHAILOVA. Effect of Acupuncture on the Course of Severe Recurrent Radiculitis. Vop. Psikiat. Nevropat., 7:261-7, 1961. (Rus.)
28. IVANOVA, E. M. Experience with Acupuncture in Ophthalmology. Vestn. Oftal., 74:45-50, 1961. (Rus.)
29. KASHMEL 'LA, K. Treatment by Acupuncture of Peripheral Paralysis of the Facial Nerve. Zdravookhr Beloruss, 8:57-8, 1962. (Rus.)
30. VACEK, J. Electro-physiological Study of the Early Effect of Acupuncture on Peripheral Paralysis of the Facial Nerve. Cesk. Neurol., 28:381-8, 1965. (Slovk.)

31. NISHIZAWA, M. *Yoga to Doin no Kenkoho* (The Yoga Therapy and Hygiene), Tokyo. Kubo Shoten, 1963. (Jap.)
32. NISHIZAWA, M. *Karada o Kaizo suru Shokumotsu* (The Dietary Therapy and Acupuncture), Tokyo. Kubo Shoten, 1962. (Jap.)
33. NISHIZAWA, M. *Ido no Shokuyoho* (The Dietary Therapy in Oriental Medicine), China. Ikkokan Ido Kenkyujo, 1958. (Jap.)
34. GORLINA, A. A. Use of Acupuncture for Post-Tonsillectomy Analgesia. *Vestn. Otorinolaring*, 25:38-40, 1963. (Rus.)
35. CHANG, H. K. Chest Pain After Pneumonectomy Treated by Acupuncture. *Zhong Watke Z.*, 9:389-90, 1961. (Ch.)
36. TUNG, L. Acupuncture in Place of Narcotics in Bronchography. *Zhong Fang Z.*, 8:94-5, Apr. 1960. (Ch.)
37. HAN, F. Y. and J. H. LEN, K. C. CH'EN and J. K. SUN. Electroacupuncture for Dental Anesthesia in Exodontia; Preliminary Report of 100 Cases. *Chin. Med. J.*, 80:100-2, 1960.
38. FENG, Y. K. The Immediate Effect of Acupuncture on the Electroencephalograms of Epileptic Patients. *Chin. J. Neurol. Psychiat.*, 5:339-45, 1959. (Ch.)
39. BISCHKO, J. The Possibility of Acupuncture in the Ear, Nose and Throat Area. *Mschr. Ohrenhkiik*, 97:464-6, 1963.
40. BOEVA, E. M. and V. S. MALTSINA, M. L. RATT, V. A. FABRICHAIA and T. P. SHEBALKINA. Experience in the Use of Acupuncture in Vasomotor Rhinitis. *Vestn. Otorinolaring*. 25:23-7, 1963. (Rus.)
41. FEDER, E. E. and M. L. ABRAMOV. On Treatment of Inflammatory Diseases of the Superior Maxillary Sinuses with the Use of Chen-chiu. *Zdravookhr. Beloruss.*, 8:62, 1962. (Rus.)
42. KASHMEL'LA, K. Treatment of Trophic Varicose Ulcers of the Leg by the Method of Chen-chiu Therapy. *Zdravookhr. Beloruss.*, 8:78-9, 1962. (Rus.)
43. PAN, H. Eight Cases of Epidemic Inflammatory Salivary Glands Diseases Treated by Acupuncture. *Shandong Yikan*, 24:36, 1959. (Ch.)
44. CHENG, B. C. and B. H. WANG. Preliminary Conclusions on 2044 Trial Cases of Infantile Paralysis Prevented by Acupuncture and Cauterization. *Shandong Yikan*, 17:19-20, 1959. (Ch.)
45. CHU, H. K. Observations on Laryngitis with Measles Treated by Acupuncture and Beef Knee. *Zhong Waik Z.*, 11:20, 1960. (Ch.)
46. CHU, A. L. The Results of Electroacupuncture Therapy for Soft Tissue Infection. *Zhong Waik Z.*, 8:190-1, 1960. (Ch.)
47. TUNG, S. T. and T. Y. CHOU. Acupuncture Combined with Traditional Drug Wu Mel T'ang in Treatment of Biliary Ascariasis, Preliminary Analysis of 48 Cases. *Chin. Med. J.*, 78:542-2, 1959.
48. TSAI, C. Malaria Treated by Acupuncture: A Report of 102 Cases *Zhong Waik Z.*, 7:966-7, 1959. (Ch.)
49. YU, T. F. Acupuncture and Traditional Drugs in the Treatment of Acute Appendicitis: Analysis of 151 Cases. *Zhong Waik Z.*, 8:277-9, 1960. (Ch.)
50. CHANG, J. F. and C. F. WU. Preliminary Report on the Treatment of Pertussis with Acupuncture. *Zhong Erke Z.*, 11:144-5, 1960. (Ch.)
51. CHENG, B. C. and B. H. WANG. Experiences in 9 Cases of Liver Cirrhosis Treated by Acupuncture. *Shandong Yikan*, 16:17-8, 1959. (Ch.)
52. KUO, N. M. and J. H. CHEN, J. L. MA and S. P. LIU. A Model Bladder for the Study of Acupuncture. *Zhong Waik Z.*, 9:503-5, 1961. (Ch.)
53. TANG, L. Y. Effect of Acupuncture on Motility of the Stomach as Observed by Multiradiography. *Zhong Fang Z.*, 8:90-4, 1959. (Ch.)
54. GRSHCHENKOV, N. I. and G. N. KASSIL, M. K. USOVA, A. M. BEIN, N. A. IL'NA, B. I. KAMENETSKAIA and E. M. NEL'NIKOVA. Result of the Application of Acupuncture in Certain Diseases (Clinico-physiological Investigation). *Zh Nevropat Psikhiat Korsakov*, 59:1159-66, 1959. (Rus.)
55. RASMUSSEN, F. and W. PENFIELD. Further Studies of the Sensory and Motor Cerebral Cortex of Man. *Federation Proc.*, 6:452-460, 1947.
56. KASSIL, G. N. and J. M. BOJEW, A. H. WEIN, B. I. KAMENEZKAJA, V. S. MALTSINA and M. N. FISHMAN. On the Problem of Mechanisms of Therapeutic Effects During Acupuncture. *Vestn. Akad. Med. Nauk. SSSR* 16 (3), 37-47, 1961. (Rus.)
57. KASSIL, G. N. and E. M. BOEVA, A. M. VEIN, B. I. KAMENETSKAJA, W. S. MALTSINA, J. M. MELNIKOWA and M. N. FISHMAN. On the Therapeutic Effect of Acupuncture. *Sowjetwiss Naturwiss Beitr.* 10:1053-66, 1961. (Ger.)
58. MANDELL, A. J. and L. F. CHAPMAN, R. W. RAND and R. D. WALTER. Plasma Corticosteroids; Changes in Concentration After Stimulation of Hippocampus and Amygdala. *Science*, 139:1212-16, 1963.
59. RUBIN, R. T. and A. J. MANDELL and P. H. CRANDALL. Cortocosteroid Responses to Limbic Stimulation in Man; Localization of Stimulus Sites. *Science*, 153:767-768, 1966.
60. ENDROCZI, E. and K. LISSAK, B. BOHURST and S. KOVACS. The Inhibitory Influence of Archicortical Structures on Pituitary-Adrenal Function. *Acta Physiol. Assoc. Sci. Hung.*, 16:17, 1959.
61. EGDAHL, R. H. Adrenal Cortical Function in Dogs with Central Nervous System Ablations. In L. Martini and E. Pecile (Eds.). *Hormonal Steroids, Biochemistry, Pharmacology, and Therapeutics: Proceedings of the First International Congress on Hormonal Steroids*. Academic Press, New York, 1964.
62. MASON, J. M. The Central Nervous System Regulation of ACTH Function. In H. H. Jasper, L. D. Proctor, R. S. Knighton, W. C. Nashey, R. T. Costello (Eds.). *Reticular Formation of the Brain*. Little, Brown; Boston, 1958.
63. BARAJAS, L. The Innervation of the Juxtglomerular Apparatus. An Electronmicroscopic Study of the

- Innervation of the Glomerular Arterioles. Lab. Invest., 13:916-29, 1964.
64. TOBIAN, L. and M. BRADEN and J. MANEY. The Effect of Unilateral Renal Denervation on the Secretion of Renin. Federation Proc., 24:405, 1965.
  65. KAMURA, S. and T. NIWA. The Effects of Angiotension II Infusion and Epinephrine Infusion on Juxta-glomerular Granularity in the Rat Kidney. Federation Proc., pp. 24 and 434, 1965.
  66. BEESON, P. S. and W. MCDERMOTT. Cecil-Loeb Textbook of Medicine, Philadelphia and London: W. B. Saunders Company, p. 841, 1963.
  67. NISHIZAWA, M. Toyo Igaku Gairon (A Textbook of Oriental Medicine), Tokyo: Tokkyu Insatsu Kabushiki Gaisha, 1959. (Jap.)
  68. KATZ, Y. J. and S. R. COURDO. Chronic Pyelonephritis. Ann. Rev. Med., 18:481-496, 1962.
  69. MIALL, M. E. and E. H. KASS, J. LING and K. L. STUART. Factors Influencing Arterial Pressure in the General Population in Jamaica., Brit. Med. J., 5303:497-506, 1962.
  70. SELYE, H. The Physiology and Pathology of Exposure to Stress. Montreal, Acta, Inc., 1950.
  71. CHEN, Y. K., et al. Experimental Studies on Hemostasis by Acupuncture. Zhong Waik Z. 11:375-6, 1963. (Ch.)
  72. KVICALA, V., et al. Effect of Acupuncture on Muscle Clearance of I-131. Cesk. Neurol., 28:51-5, 1965. (Cz.)
  73. LECOMTE, M. Cutaneous Stimulotherapy: Principles, Mode of Action, Results. Scalpel (Brux), 117: 734-41, 1964. (Fr.)
  74. GORBULEV, IUL. On the Problem of the Effectiveness of Acupuncture in the Treatment of Facial Neuritis. Azerbaidzh Med. Zh., 9:29-35, 1961. (Rus.)
  75. SHEALY, C. N. The Physiological Substrate of Pain. Headache, 6:101-108, 1966.
  76. SHEALY, C. N. and N. TASLITZ and J. T. MORTIMER. Electrical Inhibition of Pain: Experimental Evaluation. Anesth. Analg., 46:299-305, 1967.
  77. SHEALY, C. N. and N. TASLITZ and F. HOCHBERG. Physiological Standardization of Analgesics and Anesthetics. J. Lancet, 88:124, 1968.
  78. Electroanalgesia and Electrohypalgesia. International Congress Series No. 212, Amsterdam, Excerpta Medica, p. 322, 1969.
  79. SHEALY, C. N. and J. T. MORTIMER and J. B. RESWICK. Electrical Inhibition of Pain by Stimulation of the Dorsal Columns: Preliminary Clinical Report. Anesth. Analg., 46:489-491, 1967.
  80. SHEALY, C. N. Dorsal Column Electroanalgesia. J. Neurosurg., 32:560, 1970.
  81. SHEALY, C. N. Dorsal Column Electrohypalgesia. Read before the Congress of Neurological Surgeons, Miami, Fla., 1971.
  82. NOTERMANS, S. L. H. Measurement of the Pain Threshold Determined by Electric Stimulation and Its Clinical Application: I. Method and Factors Possible Influencing the Pain Threshold. Neurology, 16:1071, 1966.
  83. NOTERMANS, S. L. H. Measurement of the Pain Threshold Determined by Electric Stimulation and Its Clinical Application: II. Clinical Application in Neurological and Neurosurgical Patients. Neurology, 17:58, 1967.
  84. MELZACK, R. and P. D. WALL. Pain Mechanisms: A New Theory. Science, 150:971, 1965.

#### RELIGIOUS OBJECTION TO TREATMENT—SUMMARY OF PRESENT LAW

The courts will order transfusions for minors, when parents refuse consent on religious grounds.

Again acting to protect the unborn child, we can probably assume that all courts will require pregnant patients to submit to transfusions if there is a threat to life.

The *Kennedy Hospital v. Heston* case will probably be followed by other courts faced with the problem of an adult patient refusing consent, if life is in danger.

The concern for individual rights demonstrated in *Winters v. Miller* demonstrates the desirability of obtaining a court order before proceeding with such transfusions.

If it is absolutely impossible to seek a court order, for lack of time when the risk of death is so imminent, the courts will probably uphold those who proceed with essential transfusions without a court order. As the *Kennedy Hospital* decision notes, "the solution sides with life."

Some courts have waited until the objecting patient becomes comatose, granting approval then on the grounds that the patient is "unable" to grant or withhold consent. This approach is dubious, if the patient has manifested his objection while still conscious. The approach of the New Jersey court, meeting the issue squarely as it did, is much preferred.