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A TRIP REPORT OF THE AMERICAN
ACUPUNCTURE ANESTHESIA STUDY GROUP

Acupuncture Anesthesia in the People's Republic of China

Submitted to the
Committee on Scholarly Communication with the
People's Republic of China

NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C. 1976

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the Committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

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PREFACE

This report summarizes observations made by a study group* sponsored by the Committee on Scholarly Communication with the People's Republic of China of the American Council of Learned Societies, the National Academy of Sciences and the Social Science Research Council during a 3-week visit to the People's Republic of China in May of 1974. During this visit, the study group visited 16 hospitals and witnessed 48 operations performed under acupuncture analgesia.

The group was picked to include anesthesiologists and neuroscientists with special expertise in control of pain and with special competence in the field of pain mechanisms; our objectives were to try to determine how effective this technique is for the prevention or alleviation of pain during surgical procedures. In making our observations, we considered the possible mechanisms responsible for the analgesic effects of acupuncture. Some brief observations on the organization of medical care and medical education and the use of acupuncture for purposes other than surgical analgesia were also made. The present report will be concerned only with the application of acupuncture to the control of pain during surgical procedures on human patients.

The study group wishes to express its deep indebtedness to the Chinese Medical Association and to their colleagues in the People's Republic of China for their courteous and unfailing assistance; whatever success our efforts may have met with is due to a major degree to their generous cooperation.

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*This report is based on the work and individual reports of each of the members of the study group. The report attempts to reflect the opinions of the study group and does not represent the official view of the Committee or its sponsoring organizations.

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Acupuncture in Surgical Procedures

INTRODUCTION

Since the initial reports on the efficacy of acupuncture for the production of analgesia in surgical procedures[4], delegations from Australia[1], England[10], Scandinavia[7], and the United States[2,5], as well as a number of independent observers, have visited medical centers in the People's Republic of China to obtain first-hand impressions and attempt to reach conclusions about this novel and potentially important new application of an ancient form of therapy.

It should be recognized that the use of acupuncture for control of pain during operations is a relatively new application of this traditional Chinese therapeutic modality. Its use for this purpose dates back only to 1958 and was a response to Chairman Mao Tse-Tung's directive to explore traditional Chinese medicine and integrate it with Western-style modern medical practice. The initial rationale in attempting to use it for surgery was that it had been used for many centuries for the control of pain in certain conditions, such as arthritis. Historical reviews are available in the literature,[3,6,8] and this aspect of the subject will not be discussed further, since it is only indirectly relevant to the present report.

DEFINITION AND SEMANTICS

It must be clearly understood that acupuncture does not produce conventional surgical anesthesia. In no instance is sensation totally abolished or consciousness disturbed; thus, acupuncture anesthesia is a misnomer. There is considerable evidence, however, that acupuncture affects the pain experience, although our observations suggest that complete analgesia may not occur. Therefore, the term

acupuncture analgesia is similarly inappropriate. In view of these limitations, it seems more reasonable to refer to the phenomenon as acupuncture hypalgesia (AH), which may then be graded according to the effectiveness of pain relief.

METHOD OF EVALUATION AND GRADING

Before the study group visited the People's Republic of China, a detailed data sheet (Figure 1) was developed so that we could gather as much information as possible concerning the use of acupuncture for surgical procedures. These sheets were faithfully completed in every instance, and the results were graded with the unanimous concurrence of the observers. Since in most instances several operations were under way simultaneously, the group was divided into three or four teams, each of which in turn assigned specific tasks--such as history taking, photography, tape recordings, and notes on details such as stimulus parameters and autonomic responses--to individual members. We developed a grading system of our own that was similar to that published by the Shanghai Acupuncture Anesthesia Coordinating Group.[9]

Grade I included patients who showed no signs of pain either on direct observation or as manifested by autonomic changes (increase in pulse rate, blood pressure, pupillary dilatation, sweating) whenever autonomic observations could be made. They received no local anesthetics for pain either prophylactically or otherwise. When procaine was injected into the pericardial sac to control cardiac arrhythmia, however, this use of local anesthetic agents did not change the patient's grade.

Grade II included those patients who showed mild and transient signs of discomfort such as brief wincing or grimacing, clenching of fists, twisting of feet or an occasional low moan. Slight increases in pulse rate or a rise of blood pressure might also occur. Infiltration of 1 to 4 cc of 0.25-0.5 percent procaine or lidocaine into the muscle or preperitoneal area or the viscera was performed in several of these patients. However, the quantities of drug used were judged to be too small to account for the analgesic effect that was seen subsequently.

Grades I and II were regarded as potentially satisfactory for pain control in the United States. Clearly, this assessment is a value judgment that is subject to a number of criticisms, but it was arrived at after prolonged

City: Hospital: Director:

Date: Patient: Age: Sex:

Diagnosis: Physical Condition:

Acupuncture Chart used.

Basis for Selection	A.	Type of Procedure
	B.	Behavioral Predisposition
	C.	Educational Level
	D.	Testing of 'take' and/or G.S.R.
	E.	Cultural Bias
	F.	Other
Psychological Prep.	A.	Number of Visits
	B.	Duration of Visits
	C.	Prior Surgical Acupuncture
	D.	Other
Physiological Prep.	A.	Respiratory
	B.	Other
Pre-op. Medication	A.	Night before: drugs used, quantity
	B.	Morning of Sx. " " "
	C.	Reassurance - Suggestion hypnosis
Team Coordination	A.	Meetings between M.D.'s and Acupuncturists
	B.	Other
Acupuncture Analgesia	A.	Point Selection in relation to operation
	B.	Number and Type of needles or Electrodes
	C.	Who decides A and B
	D.	Mechanical or Electrical Stimulation
	E.	Parameters: Vo. Pulse m sec. Frequency
	F.	Length of Induction
	G.	G.S.R. testing
	H.	Tests for analgesia of operative site
	I.	Local phenomena (flare, pallor, etc.)
	J.	Obtain Acupuncture chart
	K.	Other
Supplementation	A.	Additional Points
	B.	Changes in Parameters (voltage, etc.)
	C.	Drugs - indications, types, dose
	D.	Local anesthetic, types, %, volume, site
	E.	Psychological
Observations they make	A.	Do they keep anesthesia charts?
	B.	Record of B.P., pulse, resp. depth of resp. rhythm sweating, pupil size
	C.	Comment
	D.	pCO_2, pO_2, E.K.G., central venous pressure, etc.
	E.	Other
Observations made by Us in O.R.	A.	Physiological, Facial Expression, Vocalization, Restlessness, Sweating, Pallor, Cyanosis, Shock, Hemmorrhage
	B.	
	C.	Treatment for above - Replacement (blood fluids, etc.)
	D.	Psychological

When are needles removed:
Duration of Operation:
Degree of Success of Analgesia on 1 to 4 scale (1 being optimum)

Immediate Post Op. Period	A.	When does pain begin to appear? Does patient complain or is it observed?
	B.	Management of same p.r.n. or other
	C.	Respiratory, cardiovascular, neurological, urinary retention, nausea, vomiting, abdominal distension
	D.	Fluids, drainage, oral fluids
	E.	Mobilization
Delayed Post Op.	A.	Length of hospitalization
	B.	Mobilization
	C.	Complications (pain?)
	D.	Wound healing, infection, hematomas
	E.	Where do they go subsequently?

Subsequent evaluation by our Group

Overall Impression Names of Observers

FIGURE 1 Acupuncture checklist.

discussion by critical observers accustomed to dealing with pain problems.

Grades III and IV were applied to those patients who, because of a combination of behavioral and autonomic signs, evidenced failure of acupuncture to control pain. Grade III showed frequent signs of pain, but most of the operation was completed without use of local anesthetic. Grade IV showed pain throughout the procedure, and extensive use of local anesthesia was necessary. No case was observed in which a shift to general anesthesia was used to complete a procedure.

In addition to individual grading by the groups assigned to each patient, several sessions were held during the visit in which all members of the visiting group discussed, reviewed, and updated the observations and methods of obtaining data. A final summary session revealed differences of opinion and of emphasis regarding various aspects of acupuncture hypalgesia. The basis for divergence of opinion resides, at least in part, in the nature of the phenomenon that was under scrutiny.

Pain is a subjective experience. Judging whether an individual is in a state of pain depends on observations of the subject's behavior, including verbal reports to the observer. Autonomic responses such as changes in pulse, blood pressure, and respiration also provide useful supporting information. When there is no evidence of pain, the observer can adopt one of three positions:

- A judgment about pain cannot be made because of lack of evidence. The corollary of this position is that only the presence--not the absence--of pain can be recognized.
- Pain is present in spite of the lack of evidence. This position accepts the notion that pain-associated behavior and autonomic responses can be withheld by the subject, but that the presence of pain can be inferred from other factors, such as the presence of extensive tissue damage. This position also implies that the observational measures currently available are too crude to form the sole basis for judgment.
- Since there is no evidence for pain, there is no pain. Although this is the position most often adopted by clinicians and pain researchers, it relies heavily upon the observer's skill and accepts the notion that a judgment about the presence or absence of pain can be made on the basis of behavioral observations.

The major area of disagreement among members of the group derived from the above issue. We were faced with the problem of making judgments about a patient's subjective experience when there was often no evidence for pain in spite of extensive tissue damage sustained while the patient was fully conscious, alert, and attentive to his or her environment. The grading system employed indicates acceptance of the last position by most members of the delegation for the purpose of completing our mission. Although our use of a grading system implies faith in the significance of our observations, some members of the delegation expressed reservations along the lines of the first two positions described above.

It was not possible for the group to reach complete accord regarding the degree of hypalgesia under acupuncture, since it could always be argued that, for whatever reason, our observations were inadequate to judge the extent of private pain experience. The realities of life and patient management, however, continually force us to make judgments about pain on the basis of the best evidence available. To the extent that this is possible, then, the group could conclude that the majority of patients were not in pain during surgery.

OBSERVATIONS

The 48 operations observed are summarized in Tables 1-6; they comprised 13 abdominal, 14 head and neck, 6 thoracic, 3 orthopedic, 3 ophthalmologic, and 9 dental procedures. In addition, one veterinary surgical procedure was seen and is discussed separately.

ABDOMINAL SURGERY

More variation was observed in the effectiveness of acupuncture for abdominal operations than for any other kind (Table 1). Six, or just under half of the procedures, were considered acceptable from an analgesic standpoint; two of these were graded I (an ovarian cyst and a hysterectomy for myoma) and four were graded II (two appendectomies, a cholecystectomy, and a gastrectomy). Analgesia for gastrectomies in general did not appear to be satisfactory: in only one of four cases was it graded acceptable (II); interestingly, acupuncture was administered manually in this instance. It was evident that the other three patients experienced considerable pain.

Other abdominal operations in which pain was not adequately controlled by acupuncture were a suprapubic prostatectomy, a pyelolithotomy, an ovarian cystectomy and an inguinal hernia, all of which were graded IV.

HEAD AND NECK SURGERY

There were 14 operations in this group (Table 2). Acupuncture was uniformly successful in controlling pain in

the 5 cases of excision of thyroid adenomas; even when the electrocautery was being used for hemostasis of vessels in the dermis, the patients showed little sign of discomfort. No local anesthesia was used in any of these patients.

Craniotomies

Five craniotomies were seen (a right frontal glioma, left acoustic neurinoma, pituitary chromophobe adenoma, a sphenoid wing meningioma, and a frontotemporal glioma). The frontotemporal glioma is not included in the series since the patient's neurologic condition rendered evaluation of pain or discomfort impossible. In three cases the analgesic effects were graded as acceptable (grade I and II), and in one case the grade was IV. In the evaluation of these cases, however, it should be remembered that the main pain-sensitive structures in a craniotomy are the scalp and pericranium and that within the skull only limited areas of the dura and the proximal portions of the major cerebral arteries are pain-sensitive; consequently, many neurosurgical procedures can be carried out satisfactorily with local anesthesia. In all the craniotomies we observed, the scalp was liberally infiltrated with saline containing epinephrine to improve hemostasis. However, it has been known since the time of Halstead that infiltration of the skin with saline alone may produce sufficient analgesia to permit painless or nearly painless incisions. Therefore, while it is of interest to note that craniotomies can be performed during acupuncture analgesia, the degree of analgesia required is considerably less than generally assumed.

Ear, Nose, and Throat

The two tonsillectomies observed were done with a Sluder guillotine; one patient showed mild discomfort (grade II), while the other had severe pain and was graded as IV. The gag reflex was present in both patients and at times was very active and troublesome. A submucosal resection of the nasal septum was carried out with no detectable signs of discomfort and was graded as I. No local anesthesia was given or required; topical epinephrine was applied to the mucosa at the operative site.

TABLE 1 Abdominal Operations Performed with Acupuncture Hypalgesia[a]

Diagnosis and Procedure	Age	Sex	Premedication (mg.)[b]	Local Anesthetic	Needle Locations[c]	Stimulus	Grade of Analgesia
Peptic ulcer; subtotal gastrectomy	40	M	None	Lidocaine in incision	2H, 2T, 4E, 2I	Manual Electrical	IV
Carcinoma of lesser curvature of stomach; subtotal gastrectomy	54	M	Mep. 100; barb. 100	3 cc procaine to lesser curvature	4H, 2I	Electrical	III
Duodenal ulcer; subtotal gastrectomy	37	M	Mep. 50; barb. 100	Procaine: 3 cc preperitoneal; 5 cc vagus	2T, 4E, 2I	Electrical	IV
Peptic ulcer; subtotal gastrectomy	24	F	Barb. 100	Procaine 0.5%: 4 cc preperitoneal; 2 cc lesser curvature	5E	Manual	II
Chronic appendicitis; appendectomy	38	M	Mep. 50	Procaine: 4 cc preperitoneal	2T, 2I	Electrical	II
Appendectomy	19	M	Barb. 100	None	2E	Manual	II

Chronic cholecystitis; cholecystectomy	49	M	Mep. 50; barb. 100; scop. 0.3	Procaine 5%: 4 cc preperitoneal; 1 cc bile ducts	2T, 2E, 4T	Electrical	II
Inguinal hernia	73	M	Mep. 50	Procaine 5%: incision	2T, 2I	Electrical	IV
Ovarian cyst	22	F	Mep. 100; barb. 500	None	2T, 4E, 2I	Electrical	IV
Ovarian cyst	30	F	Mep. 50	None	2T, 4E, 2I	Electrical	I
Myoma of uterus; hysterectomy	43	F	Mep. 30; barb. 100; scop. 0.3	None	2T, 4E, 2I	Electrical	I
Renal calculus; pyelolithotomy	37	M	Mep. 50; barb. 100	None	4H, 2E	Electrical	IV
Benign prostatic hypertrophy; suprapubic prostatectomy	68	M	Mep. 30; barb. 300	None	2E, 4I	Electrical	IV

[a] In 13 operations, 2 patients were judged to be Grade I, 4 Grade II, 1 Grade III, and 6 Grade IV.
[b] Mep. = meperidine, barb. = barbiturate, scop. = scopalamine.
[c] H = head, T = trunk, E = extremities, I = paraincisional.

TABLE 2 Head and Neck Operations Performed with Acupuncture Hypalgesia[a]

Diagnosis and Procedure	Age	Sex	Premedication (mg.)[b]	Local Anesthetic	Needle Locations[e]	Stimulus	Grade of Analgesia
Thyroid adenoma	39	F	Mep. 50; barb. 100	None	2E	Electrical	II
Thyroid adenoma	24	F	Mep. 50	None	2H	Electrical	I
Thyroid adenoma	30	F	Mep. 50	None	2H	Electrical	I
Thyroid adenoma	20	F	Barb. 200; scop. 0.3	None	4H	Electrical	II
Thyroid adenoma	35	F	Barb. 100	None	4H	Electrical	I
Sphenoid wing meningioma; craniotomy	42	M	None	None[c]	2H?	Electrical	I
Pituitary adenoma; craniotomy	42	M	None	None[c]	4H, 2E	Manual and electrical	I

Frontal glioma; craniotomy	38	F	Mep. 50; barb. 100	None[c]	IE	Electrical	IV
Acoustic neurinoma; craniotomy	53	M	Mep. 50; barb. 100	None[c]	4E	Electrical	II
Cervical ridge; anterior decompression and fusion	50	M	None	Procaine, 10-20 cc (slightly more)	IH, 2E	Electrical	IV
Carcinoma; lip excision and neck dissection	46	M	Mep. 50	Procaine 0.25%, 30 cc	8E	Electrical	IV
Tonsillectomy	24	M	Phenergan 4	None	4H	Electrical	II
Tonsillectomy	23	M	None	None	4H	Electrical	IV
Nasal septum; submucosal resection	26	M	Barb. 100	None[d]	1H, 2E	Electrical	I

[a] Of 14 operations, hypalgesia was judged to be Grade 1 in 6 cases; Grade II in 4; Grade III in none; and Grade IV in 4.
[b] Mep. = meperidine; barb. = barbiturates; scop. = scopalamine.
[c] Infiltration with epinephrine.
[d] Topical application.
[e] H = head; E = extremities.

Miscellaneous

An anterior cervical decompression for an osteoarthritic ridge at the C5-C6 level was associated with much discomfort, requiring repeated injections of local anesthetic for completion of the procedure. It was graded as IV.

A carcinoma of the lip with radical dissection of the neck was also graded as IV and could be completed only after infiltration of liberal quantities of procaine. We were told that the patient had undergone an excisional biopsy under acupuncture without discomfort.

THORACIC SURGERY

Six thoracic operations were observed (Table 3). Two pulmonary lobectomies for small tuberculous cavities of the upper lobe of the lung were observed. One of these was particularly striking in that, from the initial skin incision to the conclusion of the procedure, there was no detectable sign of pain. Following surgery, the patient sat up, spontaneously raised his arms above his shoulders to assist in the application of the binder, put on and buttoned his pajama jacket unassisted, smiled, and with a powerful grip shook hands with the visitors and remarked that he felt fine and had no pain. In contrast, the other lobectomy was unsuccessful from the standpoint of pain control and was graded as IV.

At this point it is appropriate to comment on the problem of pulmonary ventilation with a collapsed lung. In China, preoperative preparation is indispensable to the procedure. The patient is trained to breathe abdominally deeply and slowly for at least 1 week before operation. To further enhance abdominal respiratory function, sandbags of progressively increasing weight up to 15 lb are placed on the abdomen during these exercises. During the operation the patients appeared at times to have a mild degree of cyanosis. Oxygen was administered by means of a nasal catheter at a rate of 2.5 liters/min in some patients, while in others it was administered by means of a well-fitting facemask.

At our request, our Chinese colleagues obtained blood gas determinations on a patient before, during, and after a right thoracotomy for removal of a thymoma. We do not know if the results are typical for thoracotomy patients, since blood gas analysis usually is not performed clinically. The blood was obtained from the earlobe rather

TABLE 3 Thoracic Operations Performed with Acupuncture Hypalgesia[a]

Diagnosis and Procedure	Age	Sex	Premedication (mg.)[b]	Local Anesthetic	Needle Locations[c]	Stimulus	Grade of Analgesia
Tubercular cavity; upper lobectomy	41	M	None	None	2T, 1E	Manual and Electrical	I
Tubercular cavity; upper lobectomy	22	M	Mep. 50, Demerol 50	Morphine 5 mg.; procaine 0.5%: intercostal, peribronchial	2T, 1E	Manual and Electrical	IV
Thymoma; excision by thoracotomy	20	F	Mep. 50, barb. 100	Lidocaine 0.5%, 100 cc--incision	2E	Electrical	II
Mitral stenosis; commissurotomy	25		Barb. 100	Lidocaine 0.5%, 4 cc--incision	1E	Manual	II
Mitral stenosis; commissurotomy	20	F	Mep. 50, barb. 100, scop. 0.3	Lidocaine 0.5%, 2.5 cc--intercostal; 3 cc--drainage incision	2T, 2E	Electrical	II
Ventricular septal defect repair (bypass)	22	F	Mep. 50, barb. 100	None	8E	Electrical	I

[a] Of 6 operations, hypalgesia was judged to be grade I in 2 cases; grade II in 3; grade III in none; and grade IV in 1.
[b] Mep. = meperidine; barb. = barbiturates; scop. = scopalamine.
[c] T = trunk; E = extremities.

than from an artery. We do not know the exact timing of the preoperative and postoperative samples.

	pH	Base Excess	pCO_2	pO_2	$\%O_2$ Saturation
Before	7.34	-1.4	40	82	96.2
During	7.34	-2.2	45	58	90
After	7.35	-2.7	41.3	91	95.4

During the procedure the collapsed lung could be readily seen against the posteromedial aspect of the chest cavity; of particular interest is the fact that mediastinal shift and flutter appeared to be minimal.

Two mitral commissurotomies and the removal of a thymoma via a right thoracotomy were observed, and all were graded as acceptable with evidence of mild pain being detected in only one patient. The repair of a ventricular septal defect under extracorporeal circulation with a disk oxygenator was particularly striking since the patient, a young woman, showed no evidence of discomfort at any time in a procedure that requires splitting of the sternum with an electric saw, insertion and wide spreading of retractors, and suture of the chest wall with heavy wire. The duration of the operation was slightly over 2½ hours, and pain control was graded I. Of the six thoracic procedures only one was graded unacceptable (IV).

ORTHOPEDIC SURGERY

There were three operations in this category (Table 4). Two operations for ruptured meniscus of the knee were carried out with no evidence of pain. One of these patients was seen sitting up in bed some 40 minutes after the operation; he appeared to be comfortable and stated that he had no pain. During a triple arthrodesis of the foot the patient exhibited only mild operative discomfort, manifested by occasional grimacing while the periosteum was being elevated and tendons manipulated; the duration of discomfort was, however, brief, so the result was graded as II.

OPHTHALMOLOGIC SURGERY

The three procedures observed were a muscle shortening for strabismus, a scleral buckling for retinal detachment,

TABLE 4 Orthopedic Operations Performed with Acupuncture Hypalgesia

Diagnosis and Procedure	Age	Sex	Premedication (mg.)[a]	Local Anesthetic	Needle Location[b]	Stimulus	Grade of Analgesia
Talipes equinovarus; arthrodesis	18	F	Mep. 30, barb. 150	None	8E	Electrical	II
Ruptured meniscus; knee--excision of meniscus	16	F	Mep. 50, barb. 100	None	4E	Electrical	I
Ruptured meniscus; knee--excision of meniscus	20	M	Mep. 50	None	2T, 2I	Electrical	I

[a] Mep. = meperidine; barb. = barbiturate.
[b] E = extremities; T = trunk; I = paraincisional.

and an iridectomy for glaucoma. (Table 5) In all three procedures, electrical stimulation was delivered by needles inserted into points above and below the eye; in two of them, additional stimulation was applied to two points in the upper extremity. No local anesthetic was instilled into the eye and the corneal reflex was retained in at least one patient (retinal detachment). The only signs of discomfort observed during these operations consisted of occasional clenching of fists. All were graded as I.

TABLE 5 Opthalmologic Operations Performed with Acupuncture Hypalgesia

Diagnosis and Procedure	Age	Sex	Premedication (mg.)[a]	Local Anesthetic	Needle Location[c]	Stimulus	Grade of Analgesia
Strabismus; muscular shortening	16	M	Barb. 100	None	2H, 2E	Electrical	I
Retinal detachment; scleral buckling	48	M	Barb. 100	None	2H, 2E	Electrical	I
Glaucoma; iridectomy	54	M	None	None[b]	2H	Electrical	I

[a] Barb. = barbiturate.
[b] Infiltration with epinephrine.
[c] H = head; E = extremities.

DENTAL PROCEDURES

Nine extractions of teeth were observed (Table 6). Of these, only one was graded unacceptable (grade IV). It should be noted that three procedures were done with manual activation of the needles; two of these were graded I and the third was IV. The degree of surgical manipulation required varied considerably, but even quite difficult extractions appeared to be associated with little or no pain. Induction times ranged from less than 5 minutes to 20 minutes in one instance. The longer inductions appeared to correlate with anticipation by the operator of a more complicated procedure. In all instances the acupuncture was delivered by needles inserted into the proximity of the cheek or jaw and no extremity needles were used.

VETERINARY MEDICINE

A healthy aging horse was observed during demonstration of an exploratory laparotomy performed with the aid of acupuncture hypalgesia. It seemed less than a dramatically successful performance, as the horse appeared glassy-eyed and frequently struggled.

TABLE 6 Dental Operations Performed with Acupuncture Hypalgesia[a]

Extraction	Age	Sex	Number of Needles and Location[b]	Stimulus	Grade of Analgesia
Upper third molar	20	F	1H	Manual	I
Lower cuspid	70	M	1H	Manual	I
Upper bicuspid	11	F	1H	Manual	IV
Upper third molar	26	M	2H	Electrical	II
Upper cuspid	70	M	2H	Electrical	I
Lower third molar	20	M	2H	Electrical	I
Upper incisor	20	F	2H	Electrical	II
Upper bicuspid	50	M	2H	Electrical	I
Upper bicuspid and lower first molar	26	F	2H	Electrical	II

[a] Of 9 operations, hypalgesia was judged to be grade I in 5 cases; grade II in 3; grade III in none; and grade IV in 1.
[b] H = head.

FACTORS IN SUCCESS OF ACUPUNCTURE HYPALGESIA

Many factors enter into the evaluation of acupuncture hypalgesia. The following discussion summarizes those that appear to be significant in the success of AH and its possible application in the United States.

SELECTION OF PATIENTS

According to our Chinese colleagues, only good-risk patients, who are not apprehensive and express their willingness to accept AH are selected after a visit by the acupuncturist or the surgeon. The entire acupuncture procedure, including the possibility of pain during operation, is explained to the patients. The patient is encouraged to talk with other patients who have had operations under AH. To the best of the study group's knowledge, coercion is not employed. The relative merits and disadvantages of AH and conventional anesthesia are discussed with the patient.

A preoperative acupuncture test is administered to some, but not all, patients. This consists of needling, either manually or electrically, a point that will be used during the actual operation to try to predict whether satisfactory AH will be obtained. This prediction is based on the patient's experiencing a sensation called *te ch'i*, which is described as a feeling of localized soreness, numbness, heaviness, and swelling during the stimulation; the acupuncturist is said to detect a sensation as if the needle had been grasped by the muscle when this *te ch'i* is produced.

Selection of patients is also determined to a major degree by the type of pathology anticipated. A precise diagnosis is necessary since extensive exploration produces

pain during AH. The procedure should offer no untoward problems such as adhesions, infiltrative tumors, or hemorrhagic complications, and in general operating time should be less than 2½ hours.

Certain other patients are also considered inappropriate candidates for AH. Children under the age of 15 are rarely included because, as we were told, they cannot be relied upon to remain quiet during the procedure. We were informed, however, that some 12 to 15 splenectomies had been carried our satisfactorily under AH at the Peking Children's Hospital on patients ranging from 2 to 13 years of age. Advanced age is also regarded as a frequent but not absolute contraindication. These comments are generalizations since the actual criteria for selection vary from hospital to hospital. There appeared to be no central directive or indications for AH as the analgesic of choice for surgical operations.

PREOPERATIVE MEASURES

General

With two exceptions, we were not able to see the patients the day before operation, but did see a number of them immediately before the operation in the operating room and occasionally on the ward. No effort to condition the patient or to induce hypnosis or posthypnotic suggestion was made, insofar as we could determine, and we have no reason to believe otherwise. Except for training the patients who were to undergo open chest procedures to breathe abdominally as described earlier, no special measures were taken. The role of peer acceptance and national pride on the part of patients were believed to be important factors by some of our colleagues, but there was no objective evidence for or against these opinions.

Medication

The majority of patients received 100 mg of phenobarbital and/or 50 mg to 100 mg of meperidine from 20 to 60 minutes prior to the operation. With the exception of a case of near or actual coma due to a brain tumor, all patients entered the operating room awake and alert.

TECHNIQUE

Needle Placement

The selection of points for insertion of needles was clearly not standardized. An operation might be performed with needles inserted into the extremities or the lumbar area in one hospital and the same operation performed in another hospital with needles inserted in totally different sites, such as the pinna of the ear. Our Chinese hosts, in response to our questions on this point, indicated that the variation in needle placement was indicative of the experimental nature of the method and that acupuncturists were still trying to find the most effective sites. The relationship of the sites selected to the traditional acupuncture points, and of both to the area being operated on, is obscure, and, in view of the preceding comments, no attempt is made here to find a correlation.

In general, the needles were inserted into the underlying muscle mass; the exceptions were the paraincisional needles in the skin (abdominal, knee, eyelid) and ear, where they penetrated approximately 0.5 to 1 cm under the skin. The needles were made of uninsulated stainless steel wires with copper hubs and ranged from approximately 1 in. to 7 or 8 in. in length.

Stimulation

Mechanical or electrical stimulation was used, sometimes in combination. Results appeared to be similar with either method. Mechanical stimulation consisted of rotation of the shaft of the needle about a half or three-quarter circle while it was being thrust back and forth for a distance of 3 or 4 mm 2 to 3 times per second.

Electrical stimulation was provided by a battery-powered stimulator made in the People's Republic of China. Determination of the stimulus parameters used was often difficult or uncertain, and the following comment is only a broad generalization. Stimulation was commonly begun at a rate of 3 Hz. The voltage and pulse durations were usually not established. Voltages from 0.25 V to as much as 48 V were said to be employed, and pulse durations appeared to be in the range of tenths of a millisecond. Direct measurements of current were not available. The

stimuli were not painful, but were sufficiently strong to produce synchronous contractions of the muscles into which the needles were inserted. The acupuncturists stated not only that it was unnecessary to reach pain thresholds with the stimulus but that it was undesirable.

After an initial period of stimulation of 3 Hz, the frequency was usually increased to about 50 Hz and this was almost invariably done just before the skin incision was to be made, or when a potentially painful maneuver was to be executed. Some acupuncturists reported using frequencies of up to 200/sec. The number of needles varied considerably, ranging from a single one in some lesser dental operations, to as many as 10 in more extensive operations.

Induction Time

This period was quite variable, but for most procedures 20 minutes of stimulation appeared necessary before the skin incision was made. Dental extractions required from a minimum of 3 minutes to a maximum of 20 minutes for a difficult extraction of a malpositioned lower third molar (graded I). A maximum induction time of 31 minutes was recorded for one operation. It was not clear, in general, how the acupuncturist decided when the operative incision could be made. Usually, it seemed that the decision was related to the duration of stimulation and that after 20 minutes it was all right to proceed. In a number of instances, testing of the operative site was done by pinching the skin lightly with a toothed forceps or with a hemostat or by pricking the skin with the point of a scalpel, but more often the surgeon proceeded on a signal from the acupuncturist. Stimulation was maintained throughout the operation, with some variation in stimulus parameters at times. In one procedure at least (a gastrectomy done with manual acupuncture), the stimulation was interrupted for periods of 2 or 3 minutes during the course of the operation without any evidence of discomfort to the patient.

One or two needles were sometimes removed after the skin and underlying tissues had been incised and hemostasis obtained; stimulation was maintained by other needles. All needles were removed after the skin incision was sutured.

SENSORY LOSS INDUCED BY ACUPUNCTURE

When it was possible to do so, members of the study group attempted to determine whether sensory loss could be demonstrated during acupuncture stimulation. The results obtained were variable and difficult to interpret. In an operation on the knee (ruptured meniscus), analgesia of the knee to pinprick was confirmed by us and the subsequent operation was completed without signs of pain. In this instance paraincisional needles as well as a needle near the femoral nerve were stimulated. In a tooth extraction, localized analgesia to pinprick over most of the face and mouth, both ipsilaterally and contralaterally, was demonstrated. Needles had been introduced at the glabella and into the skin of the lateral aspect of the upper lip. No sensory loss could be demonstrated in another patient (malpositioned upper wisdom tooth), in whom two needles had been inserted below the zygomatic arch, midway between the tragus and the ear, after five minutes of stimulation, and the subsequent operative AH was graded as II. In an abdominal procedure (graded II) in which AH had been produced by distant electrically stimulated needles, no analgesia to pinprick could be detected at the operative site.

From these scattered, and admittedly uncertain, observations, it is difficult to draw any conclusion other than that studies of this type should be carried out under optimal conditions to determine whether hypalgesia can be induced in this manner, what its extent is, and whether it is a nonspecific and generalized phenomenon, or local and related to specific acupuncture points.

EMOTIONAL AND MOTIVATIONAL FACTORS

An issue of central importance in evaluation of AH is the site at which the pain experience is affected. This subject will be dealt with at length in Part II of this volume, our report on research on acupuncture in the People's Republic of China. However, it is necessary to comment on psychological issues that constitute one of the major determinants of pain and the response to pain.

The great majority of the operations we witnessed produced extensive tissue damage, which is normally associated with obvious somatic and autonomic manifestations of pain. Yet the majority of the wide cross-section of pa-

tients we observed gave little or no indication of experiencing pain. Although the desire of some patients to withold evidence of pain cannot be entirely discounted, it is highly improbable that such factors alone account for the frequently observed and often dramatic dissociation of tissue damage and expression of pain. Cultural and racial differences in laboratory measurements of pain *threshold* exist, but they are hardly of the magnitude to permit thoracotomy under acupuncture in one group and require general anesthesia in another. One Chinese physician with extensive experience with European patients was also of the opinion that pain threshold difference is not a significant factor. As noted earlier, there was nothing to suggest that the patients we observed were in a hypnotic or posthypnotic state.

It is well known, however, that considerable pain *tolerance* can be exhibited by certain groups, tribes, or individuals, usually in emotionally charged circumstances such as combat, games, or religious rites. The psychophysiological mechanisms underlying these phenomena are not known; they may relate to any of a number of brain mechanisms for modulating sensory input to higher centers, so that the affective dimension of normally painful input is blunted. Surgery under AH may not appear to have the necessary emotional content, but, on the basis of our observations, we cannot discount the possibility that AH is a phenomenon of this class, attributable to the same or similar psychophysiological processes.

EFFECTIVENESS OF ACUPUNCTURE HYPALGESIA IN CONTROLLING OPERATIVE PAIN

GENERAL CONSIDERATIONS

Although we observed 48 operations, this is admittedly a modest number of procedures on which to base more than some tentative and cautious conclusions. This cautious attitude is particularly important in view of the considerable variation in effectiveness from one region of the body to another. Since only a few procedures were witnessed for each specific anatomical area, our data may be distorted at times by coincidental successes or failures.

In most operations, incision of the skin produced no signs of discomfort or changes in blood pressure, pulse, respiration, or pupils (when the pupils could be observed). With regard to specific operative procedures, some generalizations seem possible, provided the earlier caveat regarding the limited extent of our experience is remembered.

For example, in operations on the thyroid, on the eye, and on the extremities, as well as in extraction of teeth, acupuncture, with rare exceptions, was strikingly successful. In major operations in the thoracic cavity (6 cases), with one exception, pain also appeared to be satisfactorily controlled during acupuncture stimulation.

Abdominal operations, on the other hand, were, in general, much less satisfactorily managed with acupuncture, as the Chinese physicians themselves have indicated.[10] Pain was usually not satisfactorily controlled in gastrectomies, despite very skillful and gentle surgery combined with infiltration of a small amount of local anesthetic in the preperitoneal tissues and either into the celiac plexus or the area of the left gastric artery. Appendectomy and some gynecologic procedures, such as a total abdominal hysterectomy and excision of an ovarian cyst, could be performed with good control of pain without supplementation

with local anesthetic; in one ovarian cystectomy, however, AH was clearly unsuccessful. The reasons for these variable results are unknown; this uncertainty is one of the reasons why the Chinese themselves stated that acupuncture hypalgesia for surgical operations is an experimental procedure in the early stages of evolution. During the operation, if the patient became restless or complained of pain or discomfort, much reassurance and gentle massaging of the forehead and temples took place; this, of course, is no different from what occurs in our own environment under similar circumstances.

The main problems encountered in AH as described by our Chinese colleagues were lack of complete pain relief, absence of muscle relaxation in operations in the abdomen, and pain on traction of the viscera.

Regardless of these shortcomings of AH, the success rate that was quoted to us by virtually all persons of whom this question was asked in the People's Republic of China was 90 percent. Our criteria were, as noted, slightly different from those adopted by the Chinese physicians, and an overall summary of results is presented in Table 7. It is recognized that there are shortcomings in attempting statistical comparison using small numbers and a varied assortment of procedures ranging from uncomplicated tooth extractions to major thoracic and abdominal surgery.

POSTOPERATIVE COURSE

It was generally stated by our hosts that patients operated on under AH had less postoperative pain than those

TABLE 7 Summary of Results of 48 Surgical Procedures Performed under Acupuncture Hypalgesia

Grade	Number of Cases	Percent	
I	22	45%	73% satisfactory
II	13	27%	
III	1	2%	27% unsatisfactory
IV	12	25%	

who had received general anesthesia and that they had little or no distension after abdominal operations. They consequently required miminal or no analgesic medication. The basis for these results could be that acupuncture effects persist for a number of hours into the postoperative period. On the other hand, it seemed equally likely that the smooth postoperative courses reported were due to the fact that Chinese surgeons were extremely gentle in their handling of incisions and viscera, since they were well aware that the patient was under hypalgesia and not analgesia and had to modify their operative techniques accordingly. Parenthetically, it may be noted at this point that, because of the absence of complete analgesia and of muscle relaxation, surgeons in China do not explore the abdominal cavity at the time of operation to check for adventitious pathology. Another reason for easier recovery is the absence of even the minimal effects of "chemical" general anesthesia.

IMPLICATIONS FOR WESTERN SURGERY

At this time it is not possible to extrapolate from observations made in the People's Republic of China to our own patient population since social, psychological, and cultural factors--to name but a few--are entirely different in each setting. However, some conclusions can reasonably be based upon our observations.

First, it must be recognized that, even in China, AH has relatively limited application, since only some 15 percent of all patients are selected for this type of pain control. Of this 15 percent it was our estimate that approximately two-thirds obtained acceptable pain relief, thus diminishing the number of individuals who would do well to some 10 percent of the surgical patient population.

The disadvantages of an induction time of 20 minutes and the uncertainty that satisfactory analgesia will be obtained must also be considered when comparing AH to conventional drug anesthesia. In the latter category, the use of local anesthesia for dental extractions, and of regional anesthesia for more extensive procedures, would permit most of the operations which were observed under AH to be done with much less stress to both the patient and the surgeon.

Among advantages that can be envisioned from the use of AH are more physiological methods of control of pain without the need for significant amounts of drugs, a smoother postoperative course, and possible use when conventional anesthesia is not readily available.

If AH could be perfected to the point where a larger proportion of patients could be included, and if the predictability and degree of hypalgesia could be improved, clearly, much more widespread use could be anticipated.

A number of these issues could be resolved by a limited number of well-controlled clinical trials of AH for

surgery in this country. These trials should be performed only by investigators familiar with conventional anesthesia as well as acupuncture techniques. The surgery should be limited to procedures not requiring marked muscle relaxation and to those in which transition to local, regional, or general anesthesia is easy.

The experimental nature of AH should be emphasized.

CONCLUSIONS*

1. Acupuncture stimulation can be effectively used for the control of pain in approximately 10 percent of surgical patients in the People's Republic of China. It is important to recognize that this is an experimental technique at present.

2. Acupuncture appears to modify the pain experience at times to a remarkable degree. However, it is doubtful that complete analgesia is ever obtained; rather, it appears that varying degrees of hypalgesia occur in favorable instances.

3. AH is a significant human biological phenomenon of unknown mechanisms. The induction of a hypnotic trance is not necessary. Social factors may be important in some instances but are not, of themselves, sufficient to account for the effects observed. Some psychophysiological process appears to be important in modifying the experience of pain.

4. The effectiveness of acupuncture hypalgesia varies in different procedures, between different patients, and even within the same patient at different times. It appeared particularly satisfactory for surgery of thyroid adenomas, for ophthalmic, thoracic, and some orthopedic procedures, and for most dental extractions. It appears considerably less effective for abdominal operations, particularly for gastrectomies, though other procedures in this area are often completed satisfactorily.

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*One member of the study group, Arthur Taub, dissents from the conclusions expressed in this report. His views on acupuncture hypalgesia have been published in various scientific journals (see, for example, *Yale Medicine* 9:4-6, 1974).

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II

Acupuncture Hypalgesia Experimental Studies

INTRODUCTION

Most of what is reported in this section is based solely on personal communication with Chinese scientists. The absence of a literature citation indicates that the material is derived from personal communication alone. The circumstances of our visit precluded a critical scientific evaluation of the experiments described by our hosts.

Most of the experiments being done in China on acupuncture hypalgesia fall into one of three major categories: human psychophysical studies; animal behavioral studies; and animal neurophysiological studies.

Two different stimuli are employed in all experiments on acupuncture hypalgesia: a *test stimulus* to the skin or other tissues that excites receptors whose activity produces pain and a *modulating stimulus* given with acupuncture needles or in some other way designed to modulate (reduce) the pain caused by the test stimulus. Unless otherwise indicated, it will be assumed in the subsequent discussion of the experimental studies observed in China that the modulation was applied with needles that penetrated the skin at approximately right angles to the skin surface and entered the underlying muscle.

HUMAN PSYCHOPHYSICAL EXPERIMENTS

NORMAL SUBJECTS

The Research Group of Acupuncture Anesthesia, Peking Medical College,[8] used a current of K^+ ions passed into the skin iontophoretically as the test stimulus. The modulating stimulus was hand manipulation of a needle in either the *ho-ku* point (region of the first dorsal interosseous muscle) or the *tsu-san-li* point (anterior tibialis muscle) or both on one side. The subject was asked to report when the pain induced by the K^+ ion became distinct, and the K^+ current at this point was called the threshold current. Preliminary studies had shown that morphine elevated the threshold by 80-90 percent and meperidine by 30-50 percent. Needling the *ho-ku* point for 50 minutes raised the threshold in 70 percent of the subjects by approximately 65-95 percent. Thirty percent of the subjects showed little or no change in pain threshold. Comparable needling of the *tsu-san-li* point raised the threshold slightly less in about the same proportions of subjects, but the effect was not significantly different from that obtained with *ho-ku* needling. Simultaneous needling of both points gave an effect significantly greater than needling *tsu-san-li* alone, but not significantly different from needling *ho-ku* alone. In all cases, the increases in threshold occurred generally over the surface of the body. After needling stopped, the effect gradually declined exponentially over a period of 30-40 minutes.

At Shanghai First Medical College the test stimuli that have been used include electrical pulses delivered to the skin and blunt pressure applied with a spring algesimeter. We observed an experiment in which a painful stimulus caused less change in the galvanic skin response of a subject during acupuncture than before or after acupuncture.

The research was aimed at establishing more objective measures of pain than the subject's verbal report.

NORMAL SUBJECTS WITH NERVE BLOCK OR CIRCULATORY ARREST

At the Shanghai Institute of Physiology and Institute of Traumatology in Shanghai,[3] the test stimulus was an electrical pulse of 0.5 sec in duration delivered to the skin, and the modulating stimulus was simultaneous mechanical manipulation of needles in the *ho-ku* and *tsu-san-li* points on one side for 16 minutes. The modulating stimulus significantly raised the threshold over the entire body, although the threshold may have been increased slightly more above the T_2 (thoracic) level. It was reported that arrest of the circulation to the arm did not reduce the effectiveness of the modulating stimulus, nor did local block of the nerve supply to the skin over the *ho-ku* point. Infiltration of the deeper tissues at the *ho-ku* point with local anesthetic, without impairment of cutaneous sensibility, was said to eliminate the effect of the modulating stimulus. The investigators concluded that the modulating effect is mediated by sensory nerve fibers innervating subcutaneous tissues.

SUBJECTS WITH NEUROLOGICAL DEFICITS

The Research Group of Acupuncture Anesthesia at Peking Medical College have reported that needling the afflicted limbs of hemiplegic and paraplegic patients does not cause an increase in pain threshold.[8] A group from the Shanghai First Medical College and Hua Shan Hospital in Shanghai[11] have tested patients with various neurological disorders for the subjective sensation of *te ch'i* and at the same time for the increased electromyographic (EMG) activity that accompanies this sensation at the needled site. *Te ch'i* is described as a feeling of soreness, swelling, heaviness, and numbness that is referred to the point needled and sometimes to remote areas as well. Changes in pain threshold are said not to occur unless this sensation is present. It was found that if a patient had a motor impairment but no appreciable sensory loss, the *te ch'i* sensation could be obtained, but there was no EMG response. If patients had a loss of pain and temperature sensibility, as in cases of syringomyelia, the *te ch'i* sensation could not be obtained, though some EMG response might be present.

ANIMAL BEHAVIORAL EXPERIMENTS

NORMAL ANIMALS

At the Peking Medical College and at the Shanghai Institute of Physiology, rabbits were supported in a sling, and radiant heat was applied to the nose. The escape or withdrawal threshold was measured with a stopwatch as the time from stimulus onset until head withdrawal movement. Needling of the *tsu-san-li* point for 10 minutes, while the animal's forelimbs and hindlimbs were restrained, was said to increase the escape threshold time significantly in about 80 percent of the animals tested. We saw a rabbit tested in this fashion during our visit to Peking. The animal withdrew cleanly and sharply when tested both before and just after needling. In the former case, the withdrawal came after about 9 seconds, in the latter after almost 13 seconds. We were told that holding the animal for 10 minutes and just squeezing the skin over the acupuncture point did not produce the effect. However, squeezing the Achilles tendon was said to give effects similar to needling. At the Shanghai Institute of Physiology, it was remarked that about half the rabbits tested did not withdraw from the radiant heat stimulus and could not be used in the experiments. No explanation was offered for this phenomenon.

Rabbits were used in a similar type of experiment at the Shanghai First Medical College. The test stimulus was iontophoretic injection of K^+ ions into the skin of the ear. Electrical stimulation of the *ho-ku* point was reported to increase the withdrawal threshold.

At the Chung Shan University in Kwangchow, the tail-flick response was measured in rats exposed to 55°C water applied to the tail. Electrical stimuli applied between needles inserted bilaterally into the buttocks constituted the modulating stimulus. The average latency of the tail

flick showed a statistically significant increase (50 percent) after 10-20 minutes of stimulation.

EFFECT OF CENTRAL NERVOUS SYSTEM SURGICAL LESIONS OR ELECTRICAL STIMULATION

Experiments at the Shanghai Institute of Physiology[4] are reported to show that bilateral transection of the dorsal and dorsolateral columns of the spinal cord of rabbits did not alter the effect of needling. However, section of the contralateral anterolateral columns abolished the effect completely. The investigators concluded that a crossed anterolateral spinal pathway is necessary to the acupuncture effect.

Experiments described at both the Shanghai Institute of Physiology and the Shanghai First Medical College have implicated the caudate nucleus in the central elaboration of the acupuncture effect. It was reported that bilateral destruction of the head of the caudate nucleus abolished the acupuncture effect in rabbits. Experiments at the Shanghai First Medical College are reported to show that electrical stimulation of the head of the caudate in rabbits increases the escape threshold to a potassium ion stimulus and potentiates the effect of *ho-ku* stimulation.

HUMORAL FACTORS

The hypothesis that a chemical substance is involved in acupuncture anesthesia has been tested at the Peking Medical College by transferring intraventricular cerebrospinal fluid from a donor rabbit needled at the *tsu-san-li* point to a non-needled recipient. The recipients showed a transient increase in their threshold of escape from radiant heat. These results suggest to the Chinese investigators that nerve impulses from the acupuncture point reach the brain and cause the release of some substance(s) that modulates the discharge of central neurons involved in pain. Depending on how these neurons are modified, some or all portions of the body might be rendered hypalgesic. The nature of the effective substance is not known. Animals treated with reserpine showed prolonged elevations in withdrawal threshold after needling. Adding serotonin, dopamine, or noradrenaline to the ventricular cerebrospinal fluid of reserpinized animals shortened the duration of the needling effect.

Whatever the effective substance or substances may be they apparently enter the general vascular system. Cross-circulation experiments on rabbits have been carried out at the Shanghai First Tuberculosis Hospital, and similar experiments have been done on rats at the Shanghai Institute of Traditional Chinese Medicine.[9] The recipient animals exhibited elevated withdrawal thresholds when tested with potassium iontophoresis or heat.

At the Chung Shan University in Kwangchow, it was reported that implantation of hydrocortisone pellets in the ventromedial nucleus of the rat hypothalamus reduced the effect of an electrical modulating stimulus on the tail-flick response to 55°C water. Control implantation of sucrose into the hypothalamus did not alter the acupuncture effect. The results are interpreted as implicating the hypothalamic pituitary adrenal-cortical axis in the acupuncture effect.

ANATOMICAL EXISTENCE OF ACUPUNCTURE POINTS AND THEIR RELATIONSHIP TO THE VISCERA

At the Peking Medical College, investigations are under way to determine whether distinctive anatomical and physiological characteristics exist at acupuncture points and whether they are related to body functions. Skin impedance measurements were made on the external ear of the rabbit, and regions of relatively low impedance were located on the inner surface near the base of the ear. Experimentally induced peritonitis or peptic ulcer increased the number of lowered skin impedance points on the ear. The locations of these points appeared to be correlated with the distribution of vagal sensory fibers to the ear. Histological examination of these lowered skin impedance points revealed no special neural innervation, nor could they be systematically related to nerves or blood vessels. Inconsistent results were found after vagal denervation; many of the low-impedance points disappeared, but others did not.

ANIMAL NEUROPHYSIOLOGICAL EXPERIMENTS

RECEPTORS ACTIVATED BY MODULATING STIMULI

In discussing which receptors are activated by modulating stimuli, it is necessary to distinguish between remote and segmental types of modulation. Needles placed for paraincisional and segmental modulation are likely to exert their effects primarily through cutaneous nerves. There is no deep soreness associated with either the placement or electrical stimulation of such needles, but cutaneous paresthesias are prominent and often there is no muscle contraction. Both hypalgesia and reduced touch sensations are produced by paraincisional needles, and the effects are most prominent in the region to which the paresthesias are referred. One possible explanation for the segmental type of modulation is fatigue of peripheral nerve axons or terminals. According to this mechanism, the modulating stimulus excites, among others, those peripheral nerve fibers whose activity gives rise to pain with the consequence that they become fatigued and so do not respond to damaging stimuli. If this mechanism applies, the modulating stimuli should be of sufficient intensity to cause pain, at least until the fibers fatigue. The Chinese physicians and scientists with whom we discussed this matter said that paraincisional modulation was not painful; this was consonant with our observations of patients. In the cases that we observed, at least, a peripheral fatigue mechanism does not seem likely, and some central action of the stimulus must then be responsible for the modulating action. It is possible that, with stronger stimuli, fatigue of peripheral nerve fibers might contribute to hypalgesia.

In contrast to segmental modulation, a soreness that is referred to deep tissues is part of the *te ch'i* sensation

produced by hand needling and electrical stimulation at remote sites. Although this suggests that deep receptors are involved, data on whether excitation of cutaneous afferent fibers makes any contribution to remote modulation are not entirely clear. With remote modulation produced by hand needling, Chiang et al.[3] found that local block of the cutaneous supply to the skin over the *ho-ku* point did not diminish the action of the modulating stimulus. On the other hand, Andersson and coworkers[1] obtained equally good modulation with electrodes on the skin surface and with needles that penetrated the underlying muscle. In their study, combined remote and segmental modulation was employed using electrical stimuli. It may be that cutaneous modulation was effective in the experiments of Andersson *et al.* because one of the sites stimulated was segmental, but the matter requires further study. If cutaneous receptors have little modulating effect from remote sites but are effective if the inflow is segmental, this would suggest that different central mechanisms are involved in segmental and remote modulation.

Of the receptors below the skin, both mechanoreceptors and nociceptors would be expected to respond to remote modulating stimuli. At the Shanghai Institute of Physiology[12] studies were being conducted on muscle receptors at the cat *tsu-san-li* point that could be activated by hand needling. A type of receptor had been identified that responded to firm pressure applied by a fine rod or the manipulation of an acupuncture needle but only weakly or not at all to stretch of the muscle. These "pressure receptors" had small, spotlike receptive fields located on the surface of the muscle, and there was a tendency for the fields to concentrate at the *tsu-san-li* point. The receptors were associated with fibers conducting mainly at group II and III velocities and thus were not Golgi tendon organs. The possibility that such pressure receptors might be of importance in remote modulation was suggested, and studies to test this hypothesis were planned. Firm pressure on acupuncture points is said to have a modulating action, which is consistent with a role for these receptors in acupuncture anesthesia. Firm pressure, as well as needling, is likely to excite receptors with C fibers, and they might also produce modulation. Little is known about subcutaneous receptors with C fibers or about subcutaneous nociceptors in general.

SPINAL CORD

At the Shanghai Institute of Physiology, studies were being conducted on the responses of neurons in the spinocervical tract (SCT) to modulating stimuli delivered to acupuncture points or peripheral nerves.[9] The SCT neurons were activated by test sural nerve volleys that included C fibers. Modulating stimuli consisted of manual or electrical stimulation of forelimb or hindlimb acupuncture points or electrical stimulation of cutaneous or muscle nerves; similar results were obtained in intact animals and animals with severed spinal cords. In general, the most powerful inhibitory effects occurred when modulating stimuli were delivered near the test stimulus and when the intervals between the modulating and test stimuli were shortest, although inhibition might last up to 1 or 2 minutes after the end of a modulating stimulus that had been delivered to the sural nerve for several seconds. The conditioning effect was said to be more marked when delta fibers were activated. It was not clear to what extent the SCT neurons were activated by the modulating stimulus alone.

The role of the SCT in the relay of nociceptive input is not clear, and the available evidence suggests that SCT neurons do not respond specifically to noxious stimuli. Nevertheless, the studies have indicated that neurons in this ascending spinal pathway are most powerfully inhibited by modulating stimuli that are delivered near the test stimulus. Insofar as the modulating stimuli have been delivered to both cutaneous and muscle nerves, the results may pertain to both segmental and remote types of modulation as it occurs in the clinic.

BRAINSTEM

Experiments reported by the Shanghai College of Traditional Chinese Medicine, Shanghai Normal College, and Shu Kuang Hospital in Shanghai[10] indicate that there are neurons in the midbrain reticular formation of the guinea pig that respond to natural stimuli of noxious intensity after a long latency and with a prolonged after-discharge. Responses of this type were readily abolished by morphine. These neurons also responded to tactile stimuli, but the discharge was brief. It is not clear from the report whether repeated tactile stimuli could excite these neurons to frequencies of discharge that were as great as those evoked by noxious stimuli.

The receptive fields of these midbrain reticular neurons were large, encompassing virtually the whole animal, including the face. Modulating electrical stimuli applied to hindlimb acupuncture points decreased the responsiveness of two-thirds of these neurons to noxious stimuli. The modulating effect came on and subsided gradually. Only classical acupuncture points were tested in this study, and it would be of interest to know whether the modulation could be obtained primarily from such points or if some other rule for placing the needles would provide an effective prediction of the strength of the modulating effect.

THALAMUS

At the Shanghai Institute of Physiology, single-unit recordings have been made from cat thalamic neurons that may be involved in nociception, and the effect of acupuncture modulation on their discharge characteristics has been studied.[2,13] A small number of neurons in nucleus centralis lateralis and parafascicularis are described that responded actively to noxious stimulation after a long latency and with a prolonged after-discharge but showed little or no response to gentle mechanical stimulation. They responded to electrical stimulation of peripheral nerves only when the stimuli were sufficiently strong to activate small myelinated or C fibers, and their responses to noxious stimuli were suppressed by morphine. These are all properties that would be anticipated in neurons activated predominantly or exclusively by nociceptors. Both evoked and spontaneous discharges of these neurons could be inhibited by a variety of somatic stimuli such as moving the hair, touching the skin, electrically stimulating hindlimb acupuncture points, and squeezing deep tissues such as the Achilles tendon. The latter stimulus was the most effective inhibitor. The inhibition developed after a delay and diminished slowly after the stimulus was terminated. Similarly, inhibition took 2 to 5 minutes to develop when produced by electrical stimulation of acupuncture points. Gentle mechanical stimuli, however, apparently exerted their effects quickly, and inhibition was transient.

Inhibition of these thalamic neurons was more marked when the modulating and test stimuli were delivered in the same or adjacent segments, but it is not stated whether the modulating effects were stronger when an acupuncture

point was stimulated. It was shown that transection of the dorsal columns did not reduce modulation, nor did stimulation of the dorsal columns rostral to the transection produce inhibition. This is consistent with results obtained in animal behavioral and human psychophysical experiments, indicating that remote modulation is mediated via anterolateral tracts. Whether these observations provide a physiological basis for acupuncture hypalgesia cannot be fully evaluated until the central representation of pain is better understood.

CAUDATE NUCLEUS

In animal behavioral experiments, stimulation of the caudate nucleus was said to reduce reactivity to noxious stimuli, and destruction of the nucleus abolished the modulating effects of acupuncture on withdrawal threshold. At the Shanghai First Medical College, the activity of caudate neurons is being recorded during electrical stimulation of acupuncture points.[9] Gross potentials are evoked in the dorsal part of the head of the caudate nucleus by electrical stimulation of the *ho-ku* and *tsu-san-li* points. During unit recordings, both excitation and inhibition of caudate neurons have been seen during repetitive electrical stimulation of the *ho-ku* point. These studies are still at an early stage, and the role of the caudate nucleus in acupuncture hypalgesia has yet to be clarified.

CEREBRAL CORTEX

Experiments in both Peking[7] and Shanghai[9] are reported to show that cortical potentials evoked by tooth pulp stimulation are depressed by electrical stimulation of the *ho-ku* point in both cats and rabbits. This depression apparently lasts for approximately 1 minute after the termination of the modulating stimulus and is accompanied by a parallel reduction in the contraction of the submaxillary muscles (recorded electromyographically) evoked by the tooth pulp stimulus. *Ho-ku* stimulation at a frequency of 1 Hz was said to be more effective in depressing the cortical potentials than was a frequency of 33 Hz.

The members of the Study Group were told that, at Chung Shan University in Kwangchow, evidence has been obtained that electrical stimulation of C fibers in a cat cutaneous nerve (the saphenous) produces a positive potential

recordable from the surfaces of the somatosensory cortex after a latency of about 200 msec. This is the first report of a C-fiber-evoked cortical potential. The presence of such a potential does not necessarily mean that the cerebral cortex is reached by nociceptor activity, since the cutaneous C fiber population in the cat includes many mechanoreceptors. Also, it is important to establish that the potential is actually generated in the somatosensory cortex and not at some distant locus. The argument would be further strengthened by showing that the cortical potential is unambiguously linked to the activation of C fibers in the peripheral nerve and not due to the repetitive activation of A fibers that occurs with the strong shocks needed to excite C fibers.

The cortical potentials evoked by saphenous nerve stimulation were said to have been modulated with needle stimulating electrodes inserted into the muscles on either side of the saphenous nerve at the knee. When these electrodes were stimulated electrically at a rate of 16-20 pulses/sec with a strength sufficient to make the muscles contract, there was depression of the cortical potentials evoked by both A and C fibers. This depression occurred promptly, becoming obvious after 5 sec of stimulation and reaching a maximum after 15 sec of stimulation. After the modulating stimulus was turned off, the cortical waves returned over a period of seconds, with the C wave returning more slowly than the A wave. If a comparable modulating stimulus was delivered to the muscles of the opposite leg, there was little effect on the cortical potentials.

STUDIES AIMED AT REDUCING THE SENSATIONS PRODUCED BY TRACTION ON THE VISCERA

One of the problems with acupuncture anesthesia at present is that patients often experience discomfort during visceral traction. Members of the Study Group were told of animal experiments being undertaken at Chiang Medical College in Kwangtung Province that are aimed at providing a basis for a rational approach to this problem in the clinic. In the initial phase of the study, activity is being recorded from the vagus and splanchnic nerves with gross electrodes during traction on the stomach. This activity is being correlated with changes in blood pressure, pulse, and respiratory rate produced by the same stimuli. The next step in the experiments will be to try to identify points on the body surface that, when stimulated, reduce

the cardiovascular and respiratory changes produced by traction on the stomach. These points could then be tested in the clinic in an effort to reduce the patient's traction responses during surgery.

CONCLUSIONS

PSYCHOPHYSICAL STUDIES

A number of factors may influence the outcome of psychophysical studies and their interpretation. The subjects may have preconceived ideas about the efficacy of acupuncture and so report less pain than they feel. This would not explain, however, the gradual onset and disappearance of the effect nor the reproducibility of its distribution. Furthermore, similar observations have been made in the United States by C. Richard Chapman, whose observations are as yet unpublished, by Lee *et al.* in New York City[6] and by scientists at the University of Goteborg in Sweden.[1]

Motivation might also produce a genuine hypalgesia--i.e., the subjects actually experience less pain in response to a stimulus. Some investigators[5] have argued that this is the mechanism of acupuncture anesthesia, because, although subjects feel less pain, they are still able to discriminate equally well between different intensities of painful stimulation. The extent to which attitude, expectation, and suggestion contribute to acupuncture anesthesia is a subject for future study.

ANIMAL BEHAVIORAL STUDIES

A criticism that might be directed toward the animal experiments is that the observed increases in withdrawal threshold are unrelated to the acupuncture hypalgesia that occurs in man. This could be the case if the animals were being put into a "still reaction" by the stress of the modulating stimulus.

The argument that the same phenomenon was being studied in man and other animals would be strengthened if it could be shown that any differences in the effect of needling on and off classical acupuncture points were the same in both psychophysical and behavioral studies. Knowledge of any nonuniformity in the distribution of receptors effective in producing modulation also would be useful in identifying which receptors are responsible for the effect.

ANIMAL NEUROPHYSIOLOGICAL STUDIES

While a considerable volume of research has been carried out in recent years in the People's Republic of China on mechanisms of acupuncture, these studies are in their early stages and it has not yet been possible to establish what peripheral receptors are involved or what central mechanisms may be responsible for the phenomena observed during acupuncture anesthesia. This should not be a cause for any surprise, since, despite almost a century of research, peripheral pain mechanisms are only partially resolved, central pain mechanisms are still the subject of profound controversy, and no satisfactory explanation of the mechanisms of action of aspirin or of general anesthesia has as yet been provided.

The techniques being employed in the People's Republic of China are generally comparable to those being applied to the problem of pain in research centers in the West, and the Chinese investigators were fully cognizant of the problems and current status of research on the neurophysiology of pain. It should be emphasized that the neurophysiological research being carried out in China is directed largely at finding phenomena that could explain the mechanism of acupuncture anesthesia. The study of pain mechanisms as such is viewed as secondary to this goal. In this respect, the emphasis and direction of research in China differs significantly from the research strategy employed in the West.

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APPENDIX: PERSONS, INSTITUTIONS, AND PLACES VISITED BY THE ACUPUNCTURE ANESTHESIA STUDY GROUP IN THE PEOPLE'S REPUBLIC OF CHINA, MAY 1-22, 1974

May 1, 1974

Arrival in *Shum Chun*. Welcome by:

Chung Chih-chang 钟智昌

Shih Ming-yao 施明耀
Kwangtung Provincial Branch
Chinese Medical Association

Arrival in *Kwangchow*. Welcome and tour of the Trade Fair with:

Chang Wen-pin 张文彬
Responsible Person
Kwangtung Branch, CMA

Lan Wen-hu 蓝文湖
Deputy Secretary-General
Kwangtung Branch, CMA

Ch'en Chi-heng 陈纪恒
Deputy Director
Anesthesia Division
Kwangchow First People's Hospital

Chin Jui 靳瑞
Deputy Chief,
Acupuncture and Moxibustion Section
Kwangtung Traditional Chinese Medical College

Lu Kuang-ch'i
Chief, Physiological Research Section 盧光啓
Chan Chiang Medical College

Overnight in Kwangchow.

May 2, 1974

Arrival in *Peking*. Welcome at airport by:

Fu I-ch'eng 傅一誠
Deputy Secretary-General
Chinese Medical Society

Hsin Fu-lu 辛福录
Responsible Person
Peking Medical Society

Yü Tsü-yuan (F) 余祖元
Department of America and Atlantic
Ministry of Foreign Affairs

Ku Yün-hui (F) 顧緼煇
Deputy Director
Physiology Research Department
Peking Medical College

Ts'ai Lien-fu 柴璉甫
Deputy Director
Chest Surgery
Peking Institute of Tuberculosis Research

Wang Chung-ch'eng 王忠誠
Director
Neurological Surgery
Hsuan-Wu Hospital

Chou Kuan-han 周冠汉
Deputy Director, Surgery
Third Hospital, Peking Medical College

Li Ch'üan-chieh 李傳杰
Deputy Director
Institute of Acupuncture and Moxibustion
Academy of Traditional Chinese Medicine

Our hosts from the Chinese Medical Association who accompanied the Acupuncture Anesthesia Study Group throughout China:

Fu I-ch'eng 傅一誠
Deputy Secretary-General
Chinese Medical Society

Huang Tung-pi 黃東壁
Interpreter

Chang Hung (F) 張虹
Interpreter

May 3, 1974 *Peking*

Morning. Visit to the Institute of Acupuncture and Moxibustion, Academy of Traditional Chinese Medicine.
中医研究院针灸研究所

Liu Wen-ch'üan 刘文泉
Wei Ju-shu 魏如恕
Li Ch'uan-chieh 李傳杰

Afternoon. Visit to the Peking Medical College.
北京医学院

Mi Le 米勤
Deputy Director
Revolutionary Committee

Wang O 王谔
Deputy Director
Revolutionary Committee
Fundamental Medicine Department

Li Chao-tê 李肇特
Professor-in-charge
Department of Histology Research

Wang Chih-jun 王志均
Professor-in-charge
Phyiology Research Department

Ku Yün-hui 顧雲輝
Deputy Director
Physiology Research Department

Evening. Banquet hosted by Chinese Medical Society (Peking Duck Restaurant). 北京宴会名单

Yen Chun 閻均
Responsible Person
Chinese Medical Society

Fu I-ch'eng 傅一誠
Deputy Secretary-General
Chinese Medical Society

Hsin Fu-lu 辛福录
Responsible Person
Peking Medical Society

Ts'ai Lien-fu 蔡、璉甫
Deputy Director
Chest Surgery
Institute of Tuberculosis Research, Peking

Ku Yun-hui (F) 顧雲輝
Peking Medical College

Li Ch'uan-chieh 李傳杰
Academy of Traditional Chinese Medicine

Yu Tsu-yuan 余祖元
Department of America and Atlantic
Ministry of Foreign Affairs

Hsu Shou-jen 徐寿仁
Bureau of Foreign Affairs
Health Ministry

Lin Kang 林刚
Bureau of Foreign Affairs
Peking

Huang Tung-pi 黄东壁
Interpreter

Chang Hung 张虹
Interpreter

Pai Ke-ming 白克明
Hsuan Wu Hospital

T'an Hui-ying 谭惠英
Friendship Hospital

Wang Chia-hsiang 王家祥
Veterinary Hospital

Four other staff

May 4, 1974 Saturday. Visit to No. 3 Hospital affiliated with Peking Medical College.

Chou Kuan-han 周冠汉
Deputy Director, Surgery

This hospital became affiliated with Peking Medical College in 1958. It is engaged in the treatment of the sick, in medical education, and in research. It has departments of internal medicine, obstetrics and gynecology, surgery, plastic surgery, otorhinolaryngology, eye, neurology, psychiatry, dermatology, physical therapy, and radiation therapy. It has 606 beds and 500 staff members.

Afternoon. Visit to the Forbidden City and Palace Museum.

Evening. Revolutionary ballets.

May 5, 1974 Sunday.

Visit to the Great Wall and the Ming Tombs and Tien an Men Square. Cocktails at the United States Liaison Office.

May 6, 1974 *Peking*

Morning. Visit to the Peking Institute of Tuberculosis Research. Welcome by:

Ho Mu 何穆
Deputy Director
Revolutionary Committee

Ts'ai Lien-fu 蔡廉甫
Deputy Director
Chest Surgery

Liu Shao-lan 刘紹兰
Deputy Section Chief
Section of Practice

The Peking Institute of Tuberculosis Research has reported an 80 percent success rate using acupuncture anesthesia in 700 or more procedures. The hospital has 440 beds, 120 of which are for thoracic surgery. It performs 400 operations per year, 200 using acupuncture anesthesia.

Afternoon. Visit to the Peking Veterinary Hospital. Welcome by: 北京兽医院

Hsieh Chih-hao 谢志浩
Director

Wang Chia-hsiang 王家祥
Deputy Director

Chang Ch'en-sheng 张晨生
Veterinarian

This hospital was founded during the latter part of the Cultural Revolution. It cares for animals, trains veterinarians, and conducts experimental work. The hospital uses acupuncture anesthesia routinely. Acupuncture anesthesia has been used on 550 cases since 1970 with a 95 percent success rate. Normally, three needles are used, with an induction period of 5 minutes (5-9 volts, 50-110 cycles/sec).

May 7, 1974 *Peking*

Morning. Visit to Hsuan-Wu Hospital.

Wang Chung-ch'eng 王忠诚
Director, Neurological Surgery

This is a general hospital with departments of internal medicine, surgery, pediatrics, obstetrics and gynecology, and others. Neurosurgery is a specialty. It has 480 beds and 830 staff members, of whom 220 are doctors, 240 are nurses, and 90 are technicians. One hundred and twenty of the beds are in neurosurgery. The hospital does 400 craniotomies per year, many with acupuncture anesthesia.

Afternoon. Visit to Hsun Yi County Hospital.
顺义县医院

May 8, 1974

Morning. Visit to Fu Wai Hospital. Welcome by:
阜外医院

Shang Te-yen 尚德俨
Director
Anesthesia Division

Kuo Chia-ch'iang 郭嘉强
Deputy Director
Surgery Division

Ch'en Shang-kung 陳尚恭
Director
Fundamental Research Laboratory

This hospital was established in 1958 and now has 350 beds. It is a general hospital of medium or small size for those who live in the area, but the emphasis is on cardiovascular disease, to which 60-70 percent of the effort is devoted. In clinical research the areas are heart disease, hypertension, chronic bronchitis, and pulmonary disease. It reports a 90 percent success rate with acupuncture anesthesia in surgery.

May 9, 1974 *Peking*

Morning. Visit to Maternity Hospital. Welcome by:

Wang Ta-wan 王大婉
Deputy Director
Revolutionary Committee

Wang Hsiao-tuan 王孝端
Division Chief

Chin Yu-hui 金育惠
Chief Doctor
Anesthesia Division

While no anesthesia is used for normal deliveries at this hospital, acupuncture anesthesia is used routinely for caesarian sections.

Afternoon. Tour of the Summer Palace.

Evening. Presentation of lectures (Burgess, Casey, Chapman, Dubner, and Kerr) to audience of research workers in acupuncture hypalgesia.

May 10, 1974

Morning. Visit to Ch'ao Yang Hospital. Welcome by:

朝阳医院

Ku Su-chuan 顾素娟
Deputy Director

Li Yün 李云
Deputy Director
Surgery Division

Chang Chien 张健
Surgeon

This is a general hospital with 500 beds. The hospital trains barefoot doctors and sends mobile medical teams of doctors and nurses to the countryside. Fifty percent of all operations are performed with acupuncture anesthesia.

Afternoon. Discussion session (guest list included persons from all hospitals and research facilities visited in Peking).

Evening. Banquet hosted by Acupuncture Anesthesia Study Group (Capitol Restaurant). Guests included:

Yen Chun 闫均
Responsible Person
Chinese Medical Society

Fu I-ch'eng 傅一诚
Deputy Secretary-General
Chinese Medical Society

Hsin Fu-lu 辛福录
Responsible Person
Peking Medical Society

Yu Tsu-yuan (F) 余祖元
Department of America and Atlantic
Ministry of Foreign Affairs

Lin Kang 林冈
Foreign Affairs Bureau
Peking City

Hsin Yu-ling 辛育龄
Deputy Director
Chest Surgery
Institute of Tuberculosis Research of Peking

Ku Yun-hui (F) 顾蕴辉
Deputy Director
Physiology Research Department
Peking Medical College

Chou Kuan-han 周光汉
Deputy Director, Surgery
Third Hospital, Peking Medical College

Shang Te-yen 尚德延
Director, Anesthesia Division
Fu Wai Hospital

Wang Chung-ch'eng 王忠诚
Director, Neurological Surgery
Hsuan-Wu Hospital

Huang Tung-pi 黄东壁
Interpreter

Chang Hung 张虹
Interpreter

May 11, 1974 *Shanghai* Saturday. Welcome at airport by:

Ho Ch'iu ch'eng 何秋澄
Responsible Person
Shanghai Branch, Chinese Medical Society

Liu Chih-yu 刘志玉
Deputy Secretary-General

Ch'en Kung-pai 陈公白
Deputy Director
Cerebrological Surgery Division
Hua Shan Hospital

Sun Ta-chin 孙大金
Deputy Director
Anesthesia Division
Third People's Hospital

T'an Te-hsin 谭德培
Responsible Person
Physiology Laboratory
Institute of Physiology Research

Yao T'ai 姚泰
Deputy Director
Physiology Research Section
First Medical College

Yü Yung-chen (F) 余永真(女)
Doctor of the Five Senses

May 12, 1974 *Shanghai* Sunday.

Morning. Visit to the Shanghai Industrial Exhibition.

Afternoon. Visit to Lou T'ang People's Commune.
娄塘

May 13, 1974 *Shanghai*
嘉定县人民医院
Visit to County People's Hospital, Chia Ting. Welcome by:

T'ang Chi-hao 湯基浩
Director
Revolutionary Committee

Hsü I-chun 徐一鈞
Deputy Director
Revolutionary Committee

Ch'en Lung 陳欣
Deputy Director
Revolutionary Committee and Physician

Ch'eng Ts'ai-chen 程彩珍
Member of the Revolutionary Committee

This hospital performs approximately 1,500 operations per year. Acupuncture anesthesia is used routinely, but not for pediatric cases.

Afternoon. Visit to the Institute of Physiology. Welcome by:

Hsü Ch'ang-tê 徐長德
Responsible Person
Revolutionary Committee

Ts'ai Sui-ang (F) 蔡瞬英 (女)
Responsible Person
Productive Section

Shen Ê 沈鍔
Member

Ts'ao Jui-ying (F) 曹瑞英 (女)
Responsible Person
Second Laboratory

Chiang Chen-yu 江振裕
Member

Shen Kê-fei 沈克飛
Member

Feng Chia-chen (F) 馮佳真 (女)
Member; Interpreter

Wei Jen-yu 魏仁裕
Member

The Institute of Physiology was founded in 1950 under the Chinese Academy of Sciences. The Institute of Biochemistry was originally part of this institute, but is now separate. Research on acupuncture was begun in 1955 and expanded in 1965.

Experiments have been conducted here on rabbits to determine increase in pain threshold during acupuncture needling. Other experiments have been conducted to identify the receptors activated by hand needling at the *tsu-san-li* point in cats and to study the responses of neurons in the spinocervical tract to modulating stimuli to acupuncture points or peripheral nerves. Experiments have also been concerned with the effect of bilateral destruction of the caudate nucleus on an animal's response to a modulating stimulus.

Evening. Performance of the Shanghai Acrobatic Troupe.

May 14, 1974 *Shanghai*

Morning. Visit to Hua Shan Hospital. Welcome by:
华山医院

Chu Hsi-ch'i 朱锡琪
Responsible Person
Revolutionary Committee

Lü Chi'chen 吕炳臻
Physician, Neurological Internist

Huang Jui-chao 黄瑞照
Surgeon

Liang Chu-ch'in (F) 梁竹琴(女)
Surgeon

Chou Chih-fang 周稚芳
Physician
Anesthesia Division

Afternoon. Visit to the First Medical College. Welcome by: 第一医学院

Feng Kuang 冯光(女)
Responsible Person
Revolutionary Committee

Ts'ui Chih-I 崔之义
Professor and Responsible Person
Educational Revolution Section

Hsü Feng-yen 徐丰彦
Professor and Director
Physiology Research Section

The Shanghai First Medical College has been performing experimental work on the mechanisms underlying acupuncture anesthesia for several years. The college has tested about 30 acupuncture points and has tested patients with neurological disorders for sensation of *te ch'i* and increased motor activity. Experiments have been conducted on animals to determine increase in pain threshold during acupuncture needling, activity of caudate neurons during stimulation of acupuncture points, and effects of bilateral destruction of the caudate nucleus on an animal's response to a modulating stimulus.

Evening. Return visit to the Institute of Physiology.

May 15, 1974 *Shanghai*

Morning. Visit to First People's Hospital. Welcome by: 第一人民医院

Ho Chin-I 何静宜
Deputy Director
Revolutionary Committee

Ts'ai Pao-hsien 蔡宝贤
Director, Surgical Division
Leading Member, Revolutionary Committee

P'an Ch'üan 潘铨
Deputy Director
Surgery Division

P'an Kui-fen 潘桂芬
Deputy Director
Ophthalmology

T'ang Hsiu-chün 唐秀钧
Chief, Practice Section

Ch'en Shih-tsung 陈世宗
Deputy Director
Administration Office

T'ang Hsin-liang 唐心良
Chief
Anesthesia Section

This is a general hospital founded in 1864. It has 765 beds.

Afternoon. Visit to Children's Palace.

May 16, 1974 *Shanghai*

Morning. Visit to Lung Hua Hospital of the Traditional Chinese Medical College. Welcome by:
中医学院附属龙华医院

Yao P'ei-fa 姚培发
Deputy Director
Revolutionary Committee

Fang Chih-wen 方志文
Member, Revolutionary Committee

Huang Hsien-ming 黄羡明
Acupuncture Doctor

Lin Wen-ching 林文清
Acupuncture Doctor

Chang Fu-mei 张敷美
Head Nurse

Established in 1960, this is a general hospital of Chinese traditional medicine, with 250 beds and 2,000 outpatients per day. The staff numbers 400, of whom 100 are physicians and 100 are nurses. Every year about 40-50 medical personnel are sent to the countryside and factories to treat the common diseases, train barefoot doctors and worker doctors, and to receive re-education. The hospital routinely uses acupuncture anesthesia, but with manual stimulation of the needles.

Afternoon. Visit to New Workers' Village, Pao Shan County.

Evening. Banquet hosted by Shanghai Branch, Chinese Medical Society (guest list included our hosts in Shanghai).

May 17, 1974 *Shanghai*

Morning. Visit to Third People's Hospital. Welcome by:
第三人民医院

Wang Yuan-fu 王元甫
Director
Revolutionary Committee

Wang I-shan 王一山
Deputy Director
Revolutionary Committee

Yuan Chi-min 袁济民
Member, Revolutionary Committee

Shao Chin-jung 邵祢荣
Responsible Person
Surgery

Liao Yao-lin 廖耀龄
Surgeon

Chou Hsiao-ta 周孝达
Neuropathological Physician

This is a general hospital, routinely using acupuncture anesthesia for heart, kidney, eye, and cranial surgery.

Afternoon. Visit to Shanghai Friendship Store.

Evening. Train to *Hangchow*. Welcome in *Hangchow* by:

Lai Kuang-hsing 赖光兴
Responsible Person
Che-chiang Branch, CMA

Ma Chen-shan 马振山
Deputy Secretary-General
Che-chiang Branch, CMA

Ma Lieh 马烈
Physician

Ch'en Ch'ing-lien 陈庆廉
Physician

Sheng Chen-hua (F) 盛振华(女)
Physician

May 18, 1974 Saturday.

Morning. Visit to commune engaged in harvesting and production of tea,* the Pagoda of Six Harmonies, and Tiger Spring.

Afternoon. Boat ride on the West Lake.

May 19, 1974 Sunday.

Morning. Visit to Jade Fountain and a tree nursery.

Afternoon. Plane to *Kwangchow*.

Welcome in Kwangchow by representatives of the Kwangtung Branch, CMA (see list on p. 53).

May 20, 1974 *Kwangchow*

Morning. Visit to Provincial People's Hospital of Kwangtung. Welcome by:

Cha Shu-lan 查树兰
President

Shih Hsueh-I 史学仪
Chief
Administration Office

Hsüan Hsiang-jung 禤祥荣
Director
Surgery Division

Wu Shan 吴山
Surgeon

Lo Cheng-hsiang 罗征祥
Surgeon

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* Lung Chin Production Brigade of Hsi Hu (West Lake) People's Commune.

Ch'en Chih-ming 陳志明
Director
Anesthesia Division

Yang Kui-hsiang 楊桂香
Director
Obstetrics Division

Hsiao Hui-mei 肖輝美
Obstetrics

Ts'ao Jui-hsin 曹瑞馨
Head Nurse

This is a large hospital with departments of surgery, obstetrics and gynecology, otorhinolaryngology, and others, as well as a nursing school. It sends mobile medical teams to the countryside and offers postgraduate training for doctors, nurses, and technicians. It does not use acupuncture anesthesia as often as hospitals in other parts of China. Acupuncture anesthesia was first used in 1960 and is used in 20-40 percent of all operations.

Afternoon. Discussion session.

May 21, 1974 *Kwangchow*

Morning. Division into two groups to visit:

A. Chung Shan University - Biological Department
中山大学 生物系

Chang Shun-nan 張順南
Chief, Executive Section
Revolutionary Committee

Huang I-ming 黃益明
Deputy Chief
Leading Section

Liu Hsueh-kao 刘学高
Responsible Person
Physiological Laboratory

Chung Shan University was founded in 1924 and became a general university after 1949. It has departments of mathematics, chemistry, physics, biology, geography, and language and literature, among others. There are 1,700 teachers and working personnel and 1,600 students.

B. Chung Shan Medical College 中山医学院

Yao Ts'ung-jen 姚崇仁
Responsible Person

Wu Han-pang 伍汉邦
Responsible Person
First Hospital of Chung Shan Medical College

Liu Ch'o-lin 刘焯霖
Physician
Neurological Division
First Hospital

Chung Shan Medical College was established in 1953 on the basis of three older medical schools: the faculty of medicine of Lingnan University, the faculty of medicine of Chung Shan University, and the Kuang Hua Medical College. There are five hospitals affiliated with the college, three of which are general hospitals, one a tumor hospital, and one an eye hospital. They total 2,100 beds.

There are now 1,200 students in the first two years of the post-Cultural Revolution curriculum, and 600 more will be admitted in the fall of 1974. The faculty numbers 800. There is also a 2-year nursing school with an enrollment of 120.

Following the practice of dispensing with entrance exams, the school admits workers, peasants, and soldiers who have had practical experience following graduation from junior middle school. Students must be unmarried and in good health and have demonstrated a good knowledge of Marxism-Leninism.

The College adheres to the policy of Mao Tse-tung of "open-door education" which stresses the following:

1. Maintain contact between the college and the commune and county hospitals; send students and faculty there to provide medical care and to learn to serve the people.
2. Establish a teaching base in the countryside, with classrooms and laboratories; send mobile medical teams there to provide care and train barefoot doctors.
3. Reduce the curriculum by (a) reducing the length of study from 6 years to 3 years to meet the needs of the people to train as many doctors as possible; (b) simplifying the courses from 36 down to 15 by removing duplicates and unnecessary subjects; (c) changing the method of teaching by integrating theory with practice, preclinical with clinical, Chinese with Western medicine, treatment with prevention.

Upon entering the college, the student spends 6 months in review courses, which include politics, foreign languages, math, physics, and chemistry. That is, the student enters the review course in April. In October, the first year of medical school begins, with the following curriculum:

Year I:	Function and Structure of the Human Body Anatomy, histology, biochemistry, physiology, parasitology, microbiology, pathology, pharmacology
Year II:	Diagnosis, internal medicine, surgery, ob-gyn, pediatrics, ENT, dermatology, traditional medicine
Year III:	Study of medicine through contact with patients; every student looks after 5-10 patients
	Preclinical courses
	Recent advances in medicine
	Clinical pathology and clinical pharmacology

Afternoon. Group discussion.

Evening. Banquet hosted by Kwangtung Branch of the Chinese Medical Society (the guest list included those listed on p. 53).

May 22, 1974 *Kwangchow*

Morning. Departure by train for Shum Chun and Hong Kong.