workers: (Anesthesiology *19:* 770, 1958) reported cardiac sensitization with norepinephrine and epinephrine intravenously in dogs and monkeys, while Dawson and associates (Anesth. Analg. *39:* 59, 1960) reported injections of 0.5–1.0 ml. of 1:10,000 epinephrine directly into the right ventricle of patients under halothane anesthesia, caused a few extrasystoles occasionally. Since halothane is a useful, nonexplosive agent for surgery of the head and surgeons often prefer to use epinephrine in these cases, we believed an evaluation of the effects of subcutaneous and topical epinephrine on patients undergoing halothane anesthesia would be desirable. *Method:* Patients in good physical condition, except for the condition for which operation was contemplated, were studied. Premedication consisted of an opiate, scopolamine 0.3 mg., and atropine 0.3 mg. The patients were connected to either an Electrodyne cardioscope or Cambridge oscilloscope ECG monitor. Either lead 1 or lead 2 was routinely monitored, with frequent checks of the standard and augmented limb leads when the Cambridge instrument was used. Anesthesia was induced slowly with thiopental (200–300 mg. of 2.5 per cent solution). The patients were then given 50–50 nitrous oxide-oxygen mixture and halothane slowly introduced, using the Ohio Vernitrol vaporizer and a semiclosed circle system. Just prior to intubation, the nitrous-oxide was stopped and oxygen and halothane given (average of 1 per cent halothane) and 40 mg. succinylcholine administered intravenously. Following intubation, the patient was again given the nitrous-oxide oxygen-halothane mixture and the ECG observed for 10–15 minutes. The precordial pulse and brachial blood pressure also were monitored. Epinephrine was used in the concentration of 1:150,000 in saline, if topical, or in 0.5 per cent lidocaine, if subcutaneous. The average operation lasted 1–2 hours and 30–45 cc. topical and 15–20 cc. subcutaneous epinephrine were given for a total dose of about 0.5 mg. The maximum dosage used in any one case was 1 mg. At the beginning of the series, epinephrine 1:200,000 was used. Later in the series, 5 pediatric cases of ages 5 to 8 were included, using 1:200,000 epinephrine. *Results:* To date, 181 cases have been included in this series. No arrhythmias have been seen in 180 of these. One patient developed a persistent bigeminy which responded to decreasing halothane concentration. The onset of the bigeminy was not coincident with an epinephrine injection. One patient was not included in the series because of persistent and frequent multi-focal premature ventricular contractions during the first 15 minutes of halothane anesthesia before any epinephrine was given. *Comment:* Although the number of cases in this series is still too limited to make any definite conclusion, the present trend seems to indicate that epinephrine 1:150,000, topical and subcutaneous, does not cause cardiac arrhythmias in patients anesthetized with halothane. [This article reflects the personal views of the author and is not to be construed as being statements of official U. S. Air Force policy.]

Solubility of Halothane in Blood and Tissue Homogenates. C. P. Larson, Jr., M.D., E. I. Eger, II, M.D., and J. W. Severinghaus, M.D., *Department of Anesthesia, and Cardiovascular Research Institute, University of California Medical Center, San Francisco, California.* To study the pharmacokinetics of halothane anesthesia, it is necessary to know the solubility of halothane in blood and other body tissues. Such knowledge would provide a better understanding of the distribution of halothane in the body as well as its rate of uptake and clearance from the body. The only available data to date is the work of Duncan and Raventós (Brit. J. Anaesth. *31:* 302, 1959) who report the oil/water partition coefficient for halothane to be 330 and the blood/air partition coefficient to be 3.6. *Method:* Our technique consisted of delivering a constant aliquot of liquid halothane to a known volume of blood or tissue homogenate in a closed flask held at a constant temperature (37° C.) in a water bath. Assuming complete equilibration with time, the halothane concentration in the gaseous phase over the liquid was determined with an infrared analyzer. Knowing the volume of the flask, the volume of liquid and the total volume of halothane vapor obtained from the aliquot of liquid halothane permitted calculation of the solubility coefficient for that liquid. *Results:*

Oswald solubility coefficient values for halothane were: human blood (2.3), 0.9 per cent saline (0.70), pure hemoglobin (6.7), beef lecithin (126), and oil (224), giving an oil-water partition coefficient of 302. Solubility coefficients for tissue homogenates were: human kidney (3.5), liver (6.0), muscle (8.0), brain (6.0), and perirenal fat (138). Values for the corresponding beef tissues were also obtained. *Comment:* These results indicate the position which halothane occupies on the solubility scale of anesthetics in blood, being five times as soluble as nitrous oxide or cyclopropane and about 1/3 as soluble as chloroform and 1/6 as soluble as ether. With this information, we would predict that the rate of rise of the alveolar and arterial halothane tension will be slower for halothane than for nitrous oxide or cyclopropane and faster than for ether or chloroform. Values for tissue homogenates show halothane to be 1½ to 3½ times as soluble in tissue compartments as in blood. This finding is at variance with that for most other anesthetics which have a tissue/blood solubility ratio of about 1. The explanation for this difference is probably halothane's extreme fat solubility. The increased solubility of halothane in tissues will tend to prolong both the induction and recovery time from anesthesia, beyond that occuring with agents whose tissue-blood partition coefficients approach 1.

A Study on the Analgesic Action of Propiomazine and Morphine, with a Method for Assessment of Pain in Man. H. S. LIANG, M.D., R. B. DODD, M.D. and P. H. DEBRUINE, M.D., *Division of Anesthesiology, Washington University School of Medicine and Barnes Hospital, St. Louis, Missouri.* We have found that propiomazine can replace a narcotic as an adjuvant in thiopental-N_2O anesthesia. This prompted us to investigate the analgesic action of this new phenothiazine derivative. *Method:* Normal adult volunteers were employed and tested by two techniques. (1) Pain was produced by electrical stimulation of subcutaneous sensory nerves. An electronic stimulator (Bishop, G. H.: Electroenceph. Clin. Neurophysiol. 5: 105, 1953) which delivered shocks of variable duration, frequency and intensity in the pain-stimulating range of peripheral cutaneous nerves was used. With a large metal plate serving as the indifferent electrode, a needle-electrode was inserted under the skin close to a sensory nerve of the forearm. When a current of preset duration and frequency was used, usually 2 milliseconds at 3 per second, the sensation perceived by the subject varied with the intensity. This sensation was interpreted as light touch, pressing pain or pricking pain. The latter two were used as pain end points. The number shown on the dial regulating the current intensity reflected the amount of current required for the production of each response. These numbers were recorded at two minute intervals during the control and drug test periods. Results were analyzed for significance by use of the *t* test. (2) Ischemic muscular pain (Hewer, A. J. and Keele, C.A., Lancet 2: 683, 1948) was produced by a pneumatic cuff placed on the upper arm and maintained at a pressure of 220–230 mm. Hg followed by hand exercise by the subject. Exercise consisted of rhythmic compression of a bulb 60 times which produced a deep aching pain of increasing degree in the forearm and hand. The pain could be graded as slight, moderate, severe, very severe and intolerable. There were no clear end points, but the degree of pain could be plotted against time and usually showed a linear pattern. The inflatable cuff was released at the end of fifteen minutes. All grades of sensations were reported verbally by the subject. An intravenous infusion was started prior to each experiment. A five to ten minute period was usually required to provide a steady state of response to a given stimulation. The use of the two techniques simultaneously did not interfere with the results from either, as shown in our control series. Three coded solutions were used. Neither the tester nor the subject know which solution was given. The solutions were normal saline, as placebo, morphine 0.4 mg. per cc. and propiomazine 4 mg. per cc. Five subjects completed the series of tests. Each subject received a different amount of each solution at a different time. An interval of one week was allowed between tests. *Results:* By comparing the means taken prior to and after the injection of the drug in each series, we observed the following: (1) Morphine produced significant elevations of both