and Surgeons and the Anesthesiology Service, The Presbyterian Hospital, New York, New York. It is generally believed that succinylcholine, when usual doses are administered, does not cross the placenta in significant concentration. This belief is primarily based on the clinical observation that the infants usually breathe spontaneously and cry vigorously immediately after birth. However, before widespread use of this muscle relaxant in obstetrics can be recommended, the actual extent of its transmission across the placenta must be determined for various dose levels. With this objective a study of the maternal and fetal cord blood levels of succinylcholine was undertaken. Thirty-five patients, 14 Cesarean sections and 21 vaginal deliveries, have been studied. Premedication consisted of scopolamine or atropine (0.3–0.5 mg.) combined with either meperidine (50–100 mg.), secobarbital (50–100 mg.) or promethazine (50 mg.). High flows of 100 per cent oxygen were used for at least 3 minutes in order to secure maximum denitrogenation. For induction, 80 per cent nitrous oxide in oxygen at total flow rates up to 15 liters per minute were used and then reduced to maintenance levels of 6 : 2 after 2–3 minutes. Thiopental (60–175 mg.) was given to 3 of the 35 patients. The Cesarean section patients received a single dose of 100 mg. of succinylcholine during the induction followed by a continuous intravenous infusion of a 0.2 per cent solution throughout the remainder of the procedure. Prior to the delivery of the infant up to 600 mg. of the relaxant were used and the time under anesthesia ranged from a few minutes to one hour. Vaginal deliveries were given single doses of either 100 (8 cases), 200 (5 cases), 300 (6 cases) or 500 mg. (2 cases) of succinylcholine within 5.5 minutes of the infant's birth. A control sample of maternal venous blood was taken just before anesthesia and another from the opposite antecubital vein at the time of delivery. Fetal blood was drawn from the umbilical vein immediately after birth. All three specimens were preserved with physostigmine and immediately analyzed for succinylcholine. The method used is the biossay technique previously described by Norton and de Beer (J. Pharmacol. 110: 392, 1954) which is based on the response of the frog rectus abdominis to succinylcholine. This compound causes a sustained contracture of the muscle in concentrations down to 0.1 mg. in the bath fluid. The contraction is recorded by means of a delicate heart lever and a slowly revolving kymograph drum. The distribution of the Apgar scores of the infants compared favorably with those born under regional anesthesia alone. Most of the babies cried and had sustained respirations within 1 minute of birth. The maternal venous blood at delivery showed, with few exceptions, demonstrable levels of succinylcholine activity that were markedly higher than those in the infant blood. On the other hand, the fetal cord blood in the patients given single doses of up to 200 mg. of the relaxant did not reveal succinylcholine activity in amounts detectable by the sensitivity of the method. Definitely demonstrable quantities of succinylcholine were found in infants born following single doses of 300–500 mg. It was concluded that succinylcholine when administered in usual clinical doses does not cross the placenta in appreciable quantities. Only when given in many times the usual dose range does it appear in detectable amounts. However, even with these large doses, the infants were not clinically affected. [*This study was supported in part by a Research Grant H-2410 from the National Institute of Health, Public Health Service.*]

Individual Variations in CO_2 Balance and Ventilatory Response. FRANCES E. NOE, M.D., FERDINAND E. GREIFENSTEIN, M.D., AND HANNES P. PAULI, M.D. *Department of Anesthesiology, Wayne State University College of Medicine, Detroit, Michigan.* A study is in progress to evaluate the general physiological reactions to variations in CO_2 balance in human individuals. We are interested not so much in the extreme ranges of CO_2 balance as in the effects of clinical divergence from the normal homeostatic values on the debilitated patient, those with cardiopulmonary disease, and those with chronic respiratory alkalosis for any reason. Results so far indicated that those with low alkali reserve did not buffer respiratory acidosis as well as those whose blood levels showed a high level of CO_2 content. Hyperventilation preceding the respiratory acidosis impaired buffering capacity in normal

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and cardiac subjects. In some cardiac patients blood levels seemed adequate but buffering capacity, poor. Alveolar CO_2 is said to be low in such subjects—this is being investigated. Test results showed poor buffering capacity in some normal individuals, in patients with congenital heart disease and restrictive or fibrotic pulmonary insufficiency. Good buffer capacity was found in most patients with cardiac valvular disease and pulmonary emphysema. Work completed to date has dealt with the blood chemistry changes only. Observations during this study tend to support our hypothesis that if blood buffer capacity can be shown to be impaired, threshholds for important clinical effects such as the cardiovascular response to changes in CO_2 balance may be directly related. We have observed marked intolerance to minor increases in CO_2 as evidenced by weakness and dyspnea greatly out of proportion to the stimulus in some of our subjects who had very low blood CO_2 content. Our present work is designed to evaluate this hypothesis.

Intravenous Lidocaine as an Adjuvant to General Anesthesia: A Clinical Evaluation. Otto C. Phillips, M.D., Alfred T. Nelson, M.D., William B. Lyons, M.D., Thomas D. Graff, M.D., Leroy C. Harris, M.D., and Todd M. Frazier, Sc.M. *Department of Anesthesiology, The Hospital for the Women of Maryland, Baltimore, Maryland.* The purpose of the present project was to evaluate further in a blind study the contribution of intravenous lidocaine to thiopental–nitrous oxide–succinylcholine anesthesia in humans. *Methods:* Two groups of white female patients were included in this study: those undergoing minor perineal procedures, and those undergoing major intraperitoneal pelvic procedures not including bowel surgery. The patients in the minor group were anesthetized with 200 mg. of thiopental, and then an intravenous infusion containing a coded vial of either water or lidocaine 250 mg. in a 0.15 per cent solution was allowed to run freely through a 18 gauge needle. Nitrous oxide and oxygen, 6 liters to 2 liters, was then administered by a semiclosed system. Anesthesia was induced in all patients undergoing major pelvic operations with thiopental, and an effort made to give each patient as nearly as possible 500 mg. of this drug for the entire procedure. An intravenous infusion was then started, containing 500 mg. of succinylcholine (0.05 per cent) and a coded vial of either lidocaine 1 Gm. (making a 0.1 per cent solution) or water. Nitrous oxide and oxygen, 6 liters to 2 liters, were given in a semiclosed system, an endotracheal tube being used at the discretion of the anesthesiologist. *Results.* This blind study included 214 patients undergoing minor perineal procedures and 227 patients undergoing major intraperitoneal pelvic procedures. Preoperative medication, sex, weight, age and duration of anesthesia were either controlled or comparable. In the minor group the amount of thiopental necessary to accomplish smooth anesthesia was reduced by 52 mg. when lidocaine was used as contrasted to the placebo. In the major group the amount of succinylcholine necessary was reduced by 62 mg. when intravenous lidocaine was used. These differences are statistically significant, though not striking. The incidence of uneven anesthesias was lower in both groups in which lidocaine was used, and this suggests that lidocaine contributes to the smoothness of anesthesia. There were no significant differences between the lidocaine and placebo groups with regard to blood pressure changes, reaction time, and postoperative analgesia requirements. The results of this study of 441 patients showed that lidocaine used intravenously made a significant, though not dramatic, contribution to the maintenance of a thiopental nitrous oxide–succinylcholine anesthesia, that adverse effects on the circulation were not evident, and that the postoperative reaction time and analgesic requirements were not affected. [*Mr. Frazier is Director, Bureau of Biostatistics, The Baltimore City Health Department.*]

Comparative Effects of Anesthetic Agents on Toothpulp Thresholds in Rabbits. C. B. Pittinger, M.D., H. H. Keasling, M.D., and R. L. Westerlund, M.D. *Division of Anesthesiology, Department of Surgery and Department of Pharmacology, College of Medicine, State University of Iowa, Iowa City, Iowa.* Clinical experience with halothane anesthesia suggested a deficiency of the drug as an analgesic agent. This impression prompted the comparative study of the analgesic potencies of

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