by necrotizing liver changes in the groups of rats subjected to fasting or low oxygen concentrations. Halothane appeared from the histologic sections to be relatively innocuous in the rat, and showed only transient effects in the dogs as measured by a battery of liver function tests. Some of the dogs subjected to chloroform exhibited reduction in hepatic function. In clinical usage, however, significant alteration in hepatic function was *not* produced in the patients studied subsequent to chloroform (*Poble, F. J.: Wisconsin Med. J. 47: 476, 1948*) or trifluoroethylvinyl ether (*Stavney, L. S., and Morris, L. E., unpublished data*) or halothane (*Morris, L. E., and Feldman, S. A., unpublished data*) if careful attention was paid to avoidance of hypoventilation and hypotension. Definite interference with hepatic function was shown after administration of chloroform in which high levels of carbon dioxide were allowed to occur during the period of anesthesia (*Sims, L., Morris, L. E., Orth, O. S., and Waters, R. M., J. Lab. & Clin. Med. 38: 388, 1951*). Similar investigations in which patients were exposed to halothane and carbon dioxide demonstrated closely comparable hepatic damage as measured by liver function studies. On the other hand, patients subjected in a similar way to trifluoroethylvinyl ether and carbon dioxide showed no apparent change in liver function. This indicates a marked species variation in the response to various halogenated anesthetics, the need for further study in humans, and the need for selecting laboratory animals which behave similarly to humans in the particular functions under study.

The Effects of Depressant Drugs on Respiratory CO_2 During the Anesthetic Period. D. W. Morrow, M.D., J. R. Miller, M.D., R. W. Gardier, Ph.D., and V. K. Stoelting, M.D. *Department of Anesthesiology, Indiana University School of Medicine, Indianapolis, Indiana.* This study was undertaken to establish the factor(s) responsible for carbon dioxide accumulation in the immediate postoperative period (*Hamilton, W. K., and Devine, J. C.: Surg. Gynec. & Obst. 105: 229, 1957*). Patients were selected at random without regard to surgery, anesthetic or anesthesiologist. End-expiratory carbon dioxide was monitored before and after premedication when given, during surgery and for 30 minutes postanesthesia using a to-and-fro sampling method (*Collier, C. R., Affeldt, J. A., and Farr, A. F.: J. Lab. & Clin. Med. 45: 526, 1955*). Except during operation, spirometric tidal and minute volumes were measured concomitantly. Continuous blood pressure, electrocardiographic and electroencephalographic recordings during anesthesia were made on a 4-channel Grass polygraph. Nitrous oxide, ether, halothane and cyclopropane were the anesthetic agents used. Nitrous oxide was supplemented with a barbiturate (methohexital, thiamyal or thiopental) and meperidine or a barbiturate alone, with or without premedication. Anesthesia was induced with an ultrashort acting barbiturate in patients given halothane. Either dimethyl tubocurarine iodide or succinylcholine chloride was used for relaxation if necessary. Premedication with morphine sulfate (9 ± 0.3 mg.) and scopolamine (0.4 mg.) intravenously caused an average 20 per cent decrease in both tidal and minute volume within 15 minutes after administration without changing the mean recorded end-expiratory carbon dioxide. During operation, carbon dioxide accumulation occurred in only 2 of the 6 anesthetic series. These were (1) during the induction period in the series with nitrous oxide and barbiturate without premedication and (2) during the midsurgical period with halothane. Also, only in these groups was there carbon dioxide accumulation in the immediate postoperative period. Carbon dioxide levels returned to normal within 20 minutes. The recorded increases in mean tidal volume were apparently responsible for reducing the postoperative elevated end-expired carbon dioxide. The carbon dioxide retentions were in the range of those mentioned by Hamilton and Devine (45–61 mm. Hg). In this series, premedication did not appear related to the observed expiratory carbon dioxide elevations. Overly zealous administration of barbiturates might be a factor responsible for the postoperative respiratory depression.

Succinylcholine in Obstetrics: Investigation of Its Transmission Across the Placenta. F. Moya, M.D., N. Kvisselgaard, M.D., and L. S. James, M.D. *Department of Anesthesiology, Columbia University College of Physicians*

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