children. Butyrolactone (66 mg./kg.) produced an equivalent effect, but appeared to be somewhat more rapid in onset of action. In a double-blind study, butyrolactone (66 mg./kg.) caused profound sleep in 34 per cent of children, compared with 17 per cent of children receiving chloral hydrate (44 mg./kg.). Moderate drowsiness, on the other hand, was more frequently seen after chloral hydrate and other standard hypnotics than after butyrolactone or 4-hydroxybutyrate. Respiratory depression and prolonged postoperative sleep were rare. Emergence delirium and postoperative restlessness were no more common than after other hypnotic drugs. Parasympathetic stimulation, in the form of salivary secretions and bradycardia, was more often evident during cyclopropane anesthesia after 4-hydroxybutyrate and butyrolactone than after other drugs used for premedication. With ether and halothane, however, significant disturbances of this type did not occur. Emesis was fairly common in the period between 15 minutes and 60 minutes after administration (butyrolactone 19 per cent, 4-hydroxybutyrate 10 per cent). This usually occurred as marked drowsiness first became evident. Subsequent emesis during the anesthesia period may have been somewhat more frequent and profuse after the oral premedication, but not to a degree sufficient to cause clinical concern, especially when halothane was the anesthetic agent used. Measured gastric contents were increased by these medications in an amount approximating that of the ingested material. *Conclusion:* These compounds are potent hypnotics whose place in anesthesia will depend on the results of further clinical experience. They differ from the standard hypnotics in their ability to produce a profound effect of short duration and in the relative infrequency of a sluggish mental state in those children capable of being aroused by movement to the operating room.

**Serum Cholinesterase Activity During Pregnancy, Labor, and the Puerperium.** SOL M. SHNIDER, M.D., *Assistant Professor of Anesthesiology, Department of Anesthesia, University of California, San Francisco Medical Center, San Francisco.* Succinylcholine, a drug hydrolized by serum cholinesterase, is frequently used in obstetrical anesthesia. Prolonged muscular paralysis occurred in a healthy multiparous patient following the use of 400 mg. of succinylcholine during elective cesarean section. Serum cholinesterase activity was 32 units one day, 25 units three days, and 61 units six weeks postpartum. (Normal, 55 to 100 units.) The Dibucaine Number was normal; liver function studies performed two weeks postpartum disclosed a normal liver profile with an abnormally low cholinesterase activity (38 units). The following study was undertaken because previous studies of serum cholinesterase activity during pregnancy, labor and the puerperium have disclosed widely conflicting data. *Methods:* In each of 30 healthy obstetrical patients, determinations of serum cholinesterase were performed during labor, one day and three days postpartum. In addition, 10 of these patients were studied late in pregnancy and six weeks postpartum. Cholinesterase activity was determined by a spectrophotometric procedure which measures the change in *p*H of a buffered acetylcholine substrate with the use of phenol red as indicator. *Results:* Compared to their values in non-pregnant periods, there was a 28 per cent reduction of enzyme activity during late pregnancy, a 16 per cent decrease during labor, a 25 per cent fall one day postpartum and a 32 per cent decrease three days postpartum. Compared to their values during labor, over 90 per cent of the patients showed a decrease in cholinesterase activity three days postpartum. Abnormally low cholinesterase values (below 55 units/ml.) were found in 10 per cent of the patients in late pregnancy and during labor, 20 per cent of the patients one day postpartum and in 60 per cent of the patients two days later. *Conclusions:* These findings suggest that succinylcholine may be more slowly metabolized during pregnancy, labor and particularly in the immediate postpartum period and may on occasion result in prolonged paralysis.

**Investigations into the Teratogenic Effects of Anesthetic Agents: The Fluorinated Agents.** BRADLEY E., SMITH, M.D., MARGARET L. GAUB, M.D., and FRANK MOYA, M.D., *Department of Anesthesiology, University of Miami School of Medicine, Miami,*

*Florida.* Surgical anesthesia has been implicated as a possible teratogen in the nearly 50,000 women yearly in the United States who undergo operation and anesthesia during gestation. Regrettably, there is little direct evidence to support or refute this accusation. A comprehensive laboratory investigation of the teratogenic effects of anesthesia on the embryo and fetus has been instituted at the University of Miami. *Methods:* Chick embryos were chosen for the initial studies in order to eliminate complications of anesthesia in the mammal such as hypoxia and hypercarbia, which are known teratogens. After three days incubation and determination of viability by candling, 2,507 eggs containing live, genetically controlled embryos were divided into several test groups totaling 1,553 and control groups totaling 954 eggs. The anesthetic agent was passed over the eggs for six hours under incubation while compressed air flowed at the same rate over the control eggs. Anesthetics tested were 0.25, 0.5, 1, and 1.5 per cent methoxyflurane (Penthrane) in air; 0.5, 1, and 2 per cent halothane (Fluothane) in air; 1.25 per cent and 2.5 per cent fluroxene (Fluoromar) in air; and 25 per cent and 40 per cent tetraflurobromethane (Teflurane) in oxygen. Both test and control eggs were candled for viability each day and opened and examined for anomalies on the day of death, or, if still living, on the tenth day. All specimens were preserved in Bouin's solution and those not showing external anomalies were dissected and examined for internal anomalies. *Results:* The death rate of controls between exposure and day 10 was 12 per cent. This rate was not markedly changed after ½ per cent and 1 per cent halothane, 1½ per cent and 2½ per cent fluroxene, or ¼ per cent methoxyflurane. The increase to 19.5 per cent with 2 per cent halothane was not significant ($P < .06$). However, ½ per cent methoxyflurane caused a 22.4 per cent death rate ($P = 0.01$); 25 per cent tetraflurobromethane caused a 30 per cent death rate ($P < 0.01$); 1 per cent methoxyflurane caused a 54 per cent rate ($P < 0.001$); 40 per cent tetrafluobromethane 92 per cent ($P < 0.001$); and 1¼ per cent methoxyflurane 96 per cent death rate ($P = 0.001$). Fetal anomalies appeared in 5.2 per cent of control embryos. Increases appeared after ½ per cent methoxyflurane—15.6 per cent ($P < 0.01$); after 2½ per cent fluroxene—16.5 per cent ($P < 0.001$); and after 25 per cent tetraflurobromethane—23.3 per cent ($P < 0.01$). The rate of anomalies did not increase with the higher fetal death rates. The combined risk to the embryo of death or a major nonlethal anomaly (control 14.8 per cent) was not increased by ½ per cent and 1 per cent halothane, but became 26.5 per cent after 2 per cent halothane ($P < 0.001$); after 2½ per cent fluroxene 25.6 per cent ($P = 0.01 - 0.02$); after 0.5 per cent methoxyflurane 29.1 per cent ($P < 0.001$); 53 per cent after 25 per cent tetraflurobromethane ($P < 0.001$) with higher concentrations tested slightly higher than the very high death rate. The particular type of anomaly encountered bore no relation to the agent used. *Conclusions:* Species differences, unequal rates of diffusion through the shell and the long duration of exposure greatly limit the clinical implications that may be drawn from this preliminary laboratory work in chicks. The findings underscore the necessity for concern and further study of the teratogenic potential of anesthesia in the human. (This work was supported by a grant from the Abbott Laboratories, North Chicago, Illinois.)

**Acute Hemodilution with Plasma Expanders.** MASUHIKO TAKAORI, M.D., LEROY C. HARRIS, JR., M.D., ROBERT LOEHNING, M.D., and PETER SAFAR, M.D., *Department of Anesthesiology, University of Pittsburgh, School of Medicine, Pittsburgh.* Treatment of massive hemorrhage with plasma expanders in the absence of sufficient cross-matched blood can maintain near-normal arterial pressures but reduces oxygen-carrying capacity. The degree of acute reduction of hemoglobin which can be tolerated has not been delineated. This study attempts to elucidate some of the circulatory and metabolic changes which occur in severe hemorrhage treated with dextran. Results of three controlled studies are presented. *Methods:* In all three studies, dogs (9–15 kg.) were anesthetized with pentobarbital (25 mg./kg. intravenously) and tracheal intubation was performed. The animals were then prepared for some or all of the following measurements: ECG, arterial pressure, carotid flow (rotameter), cardiac output (dye