in the bronchus. At this time the patient appeared slightly cyanotic. After the bleeding stopped and clots were sucked out, his color and oximeter reading improved. Another patient had a similar experience, but the oximeter was not attached. Two other patients had temporary bouts of cyanosis. One was a patient for laryngoscopy, who was obstructed while the laryngoscopist was trying to locate her glottis. The other became cyanotic when a biopsy was taken of a tumor of the pharynx and bleeding was produced. If obstruction is avoided or corrected, the Emerson wrap-around chest respirator, properly used, provides adequate respiration.

Effect of Ether Anesthesia on Human Skeletal Muscle Metabolism. DOROTHY H. HENNEMAN, M.D., AND LEROY D. VANDAM, M.D. *Division of Anesthesia, Peter Bent Brigham Hospital, Boston, Mass.* Phosphocreatine, total creatine, and lactic acid were measured in triplicate on paired biopsies of nontraumatized *rectus-abdominis* muscle taken at the time of initial abdominal incision and of final abdominal closure, 25 to 150 minutes after induction of ether anesthesia in fifteen women. Surgery included ovarian biopsy. Simultaneous measurements of blood *p*H and serum inorganic phosphorus were made. Standard error of technique for phosphocreatine was 0.43 micromoles per gram of wet tissue. In the first sample obtained prior to surgery or trauma by abdominal retraction, mean concentrations of phosphocreatine varied inversely with the time between induction and biopsy: 20–30 minutes after induction total creatine was 37.2 and phosphocreatine 21.3 micromoles per gram of wet tissue; after 30–60 minutes total creatine was 24.4 and phosphocreatine 12.9 micromoles per gram. Between the first and second biopsy in the same patient, during the course of surgery, and with minimal retraction of the muscle biopsied, concentrations remained low or fell further: after 60 minutes of surgery (120 minutes of anesthesia) total creatine was 25.5 and phosphocreatine 11.5 micromoles per gram of wet tissue. Since a decrease in phosphocreatine occurred prior to surgery or abdominal retraction, trauma was not responsible. Concentrations of free creatine did not increase as phosphocreatine fell, hence our technique of tissue handling was not responsible. Skeletal muscle lactic acid did not change significantly as phosphocreatine decreased. No change in blood *p*H occurred, but serum total inorganic phosphorus increased as expected. When hypotension occurred prior to the time of initial biopsy concentrations of phosphocreatine were abnormally low (7.0, 8.0, 9.0, 10.1, 10.4 micromoles phosphocreatine per gram) even though duration of anesthesia was relatively short. In addition, if hypotension occurred, with or without the subsequent administration of ephedrine, between the first and second biopsy the fall in phosphocreatine was more pronounced (23.0 to 16.0, 24.5 to 10.6, and 13.6 to 4.3 micromoles phosphocreatine per gram). Muscular contraction produces a fall in skeletal muscle phosphocreatine; anesthesia, however, produces relaxation. Normally, contraction increases muscle lactic acid; none was observed by us in muscle although blood lactic acid regularly increases during ether anesthesia. Earlier studies from this laboratory demonstrated that ether produces abnormal elevations in serum inorganic phosphorus and blood glucose following the administration of glucose or epinephrine. In addition, ether produces resistance to the glucose and phosphorus lowering effects of insulin. Abnormalities in lactic, pyruvic, and citric acids were not present under the same conditions. In view of this, it was suggested that ether alters the entrance of glucose into the cell due perhaps to changes in cellular permeability, glucose phosphorylation, or insulin activity. The present data are in keeping with this suggestion and indicate further that ether in some manner decreases the availability of high-energy phosphate compounds. Does such a fall in phosphocreatine occur also in cardiac muscle? Is this in part responsible for myocardial depression during general anesthesia?

The Effect of Cyclopropane and Cyclopropane Plus Hypercarbia on Blood Clotting. WILLIAM S. HOWLAND, M.D., M. B. ZUCKER, M.D., E. E. CLIFFTON, M.D., AND C. P. BOYAN, M.D. *Department of Anesthesiology and Enzyme Research Section, Sloan-Kettering Institute, Memorial Center for Cancer and Allied*

Diseases, New York, N. Y. The mechanism of increased bleeding with cyclopropane has not been determined. In order to assess the effect of cyclopropane and cyclopropane plus hypercarbia on the clotting mechanism a battery of clotting tests was performed before anesthesia, during anesthesia, after rebreathing carbon dioxide for 15 minutes (in 6 cases), and after anesthesia. These tests were the tourniquet test, bleeding time, platelet count, clotting time glass, clotting time silicone, prothrombin time, prothrombin content, factor V activity, factor VII activity, prothrombin consumption, thromboplastin generation test, thrombin clotting time, fibrinogen concentration, fibrinolytic activity, whole blood clot lysis and antiplasmin activity. Fifteen patients received cyclopropane for operations lasting one to two hours, and 6 patients undergoing two to three hour operations received cyclopropane with deliberately induced carbon dioxide levels of 56 to 62 mm. of mercury for a duration of 15 minutes. The only changes in blood clotting noticed were those in the fibrinolytic system. Fibrinolysis occurred in 10 of the 21 cases studied but 5 of these showed preoperative fibrinolysis. Thus only 4 of the patients receiving cyclopropane and one patient with hypercarbia developed intra-operative fibrinolysis. None of these patients showed increased bleeding at the operative site. This incidence of fibrinolysis is no different than

CLOTTING CHANGES WITH CYCLOPROPANE

	C_3H_6	$C_3H_6 + CO_2$
Patients	15	6
No change	9	2
Fibrinolysis	6	4
Preoperative only	1	
Preoperative and during operation	1	1
Preoperative, during and postoperatively	0	2
During operation only	4	1

that previously reported in a series of 38 cases receiving ether anesthesia (*Zucker, M. B., Siegel, M., Cliffton, E. E., Bellville, J. W., Howland, W. S., and Grossi, C. E.: J. Lab. & Clin. Med. 50: 849, 1957*). Thus it appears that the increased bleeding with cyclopropane anesthesia is not due to clotting disturbances.

A Clinical and Electroencephalographic Study of the Changes Observed in Humans During Prolonged Administration of Low, Graded Concentrations of Diethyl Ether. BENTON D. KING, M.D., STANLEY W. WEITZNER, M.D., AND HARRY A. KAPLAN, M.D. *Departments of Anesthesiology and Neurosurgery, State University of New York College of Medicine at New York City, Brooklyn, N. Y.* Investigations were undertaken to study the effects of the administration of low, graded concentrations of ether on the electroencephalogram and the behavior patterns of man. Continuous electroencephalographic recordings, simple psychological assessment, and gross sensory testing were utilized for testing. By means of an EMO vaporizer (*Anaesthesia 11: 83, 1956*), and using a nonrebreathing technique, 14 subjects were given slowly increasing, precisely graded concentrations of ether over a period of several hours. An effort was made to present subanesthetic concentrations of ether for prolonged periods in order that some semblance of body equilibration with the inspired mixture might take place. Changes in concentration were made gradually so that surgical anesthesia could not be attained rapidly. Duration and pattern of experiments varied somewhat, but in the later typical ones psychological and sensory tests were performed after the subject had been breathing concentrations of 1, 2, and 3 per cent ether, each for a period of an hour. These later experiments usually terminated when 4 per cent ether was being inhaled because of the onset of vomiting or surgical anesthesia. Several subjects vomited during the advance from 3 to 4 per cent ether; all were sufficiently coherent at the time to be able to state that they noted no prior nausea. In those instances where surgical anesthesia was produced the subjects never exhibited a true excitement stage. The general pattern of the electroencephalogram in most instances showed progressively the following changes as the ether concentration was slowly increased: (1) a dropping-out of alpha waves, (2) an increase of slow activity, (3) a lowering of the voltage, (4) an appearance of beta waves, and (5) an increase in the number of slow waves with a dropping-out of beta waves. High voltage slow waves appeared with development of surgical anes-