The gas chromatograph consists basically of a heated sample inlet system, a temperature-controlled column containing material which elutes various components from a mixture, a thermal conductivity cell and a reference gas system. Helium is used as the reference gas and as the vehicle or carrier gas for the samples. The sample is introduced into the stream of carrier gas and swept into the chromatographic column, where it is adsorbed (or absorbed) by the column filling material. As the carrier gas continually flows through the column it carries off individual components at different times. The time required for each component to pass through the column depends upon the equilibria between sample components, carrier gas, and column filling material. The gases flow from the column through the sensing side of the detector cell to the exhaust at the rear of the instrument. A corresponding flow of carrier gas flows through the reference side of the cell, first passing through the heated compartment so that it reached the cell at the same temperature as the sample-carrier gas mixture. Both carrier gas streams are exhausted at atmospheric pressure. The difference in thermal conductivity between the carrier gas in the reference side of the detector cell and the sample-carrier gas mixture in the sensing side produces a voltage differential which is indicated by the recorder. When only carrier gas is flowing through the system there is no voltage differential, hence no signal to be indicated by the recorder. The recorder to which the differential voltage is transmitted plots a curve showing the separation of the sample into its components. The area beneath the trace is proportional to the quantity of the sample component. The peak height, in many instances, may be used as a quantitative measure of each component particularly when the components are present in equal quantity in the mixture of gases.

The instrument was calibrated using samples containing known percentages of anesthetic gases determined by an anesthetic machine whose flowmeters had been checked for accuracy by calibrating flowmeters or water displacement. Analysis of vapors required preparation of standards under known conditions of temperature, volume and pressure. Calibration curves were plotted from data obtained from the peak areas and heights of the standards. During anesthesia, samples of expired air were analyzed accurately for concentrations of each component in any anesthetic mixture, oxygen and carbon dioxide. For these analyses, samples were drawn from beneath the face mask or when applicable from the endotracheal tube using a 50 cc. syringe and three-way stopcock attached to a polyethylene catheter. Contamination of the sample by room air was prevented by sealing around the catheter and by flushing the syringe several times with the sample to be analyzed. This technique has been used successfully for multiple analyses of cyclopropane, ether, fluothane, ethylene, nitrous oxide, oxygen and carbon dioxide. Blood gas analyses can also be performed by gas chromatography by extracting the gases from blood in the Van Slyke manometric apparatus and manipulating these gases through the waste arm of the blood gas apparatus and into the sampling inlet of the chromatograph. Experience gained in these gas chromatographic studies indicate a wide application of this technique can be made in anesthesiology for both clinical and laboratory purposes.

The Postoperative Renal Excretion of Water in Infants. DANIEL S. FLEISHER, M.D., WALLACE W. MCCRORY, M.D., AND LEONARD BACHMAN, M.D. *Children's Hospital of Philadelphia, Departments of Pediatrics and Anesthesiology, University of Pennsylvania Schools of Medicine, Philadelphia Pennsylvania.* Patterns of renal excretion of water during operation and postoperative periods have not been clearly defined. Present evidence would seem to indicate a limitation in water excretion in adults during the first postoperative day but similar evidence is lacking for infants hydrated before and during operation. No studies have included the immediate postoperative period; hence this period is the basis of this study. Water loads (3 per cent of body weight) were administered to a group of male infants immediately following surface surgical procedures. The subjects ranged in age from 3 to 27 months. The patient's response to an identical water load administered at a time unrelated to operation served as his control observation. No efforts were made to hydrate 5 infants prior to or during surgery. All of these subjects demonstrated a delayed response to the postoperative water loads. This was characterized by a drop in serum sodium and/or osmolality and no (or little) excretion of "osmotically free water." Seven infants were hydrated prior to and during operation. Two of these subjects revealed patterns of response similar to the nonhydrated

group. Three had some delay but at the end of six hours were excreting "free water." Two subjects responded immediately to the water loads. When a period of antidiuresis occurred in the hydrated infants, it could not be attributed to significant depression of glomerular filtration rates nor to the type of anesthesia administered. In all subjects, regardless of their response patterns, normal renal excretion of water seemed to be present by six hours postoperatively. Hence, even during and after relatively short surface surgical procedures, varying responses are noted in respect to the renal excretion of water in infants. Nonhydrated infants exhibited a severe delay in renal water excretion. Hydrated infants exhibited responses that varied from delayed to prompt. In all cases studied, when a period of antidiuresis existed, it appeared to end six hours postoperatively.

Effect of Inhalation Anesthetics on Cardiac Cell Membrane Potentials. Evan L. Frederickson, M.D., Joseph V. Levy, Ph.D., and K. Ichiyanagi, M.D. *University of Washington, School of Medicine, Seattle 5, Washington.* There is ample evidence that inhalation anesthetic agents pass through cell membranes; this is easily demonstrated in red blood cells when separated from plasma. Changes in the cell membrane as recorded by transmembrane action potentials have not been demonstrated, and no references are known to us referring to the action of inhalation anesthetics. Transmembrane potentials from single cells of isolated rabbit atrial tissue were recorded *in vitro* during perfusion with modified Tyrode's solution containing various concentrations of cyclopropane, oxygen and carbon dioxide. These were recorded by means of a glass capillary microelectrode adapted for moving tissue (*Woodbury, J. W., and Brady, A. J., Science 123: 100, 1956*). Samples of the perfusate were analyzed for these 3 gases, at various times. Controls were run by replacing the cyclopropane with nitrogen to see if the effects noted were due to hypoxia. Contractile tension was recorded by utilizing a transducer attached to one end of the isolated atrium while the other end was supported by stimulated electrodes. Rate was controlled by driving at a constant rate. Results demonstrate that cyclopropane does effect the transmembrane action potential (MAP) by shortening the duration mainly by decreasing repolarization time. This change is most marked in phase I. However, this effect is blocked by atropine. There is no significant change in membrane resting potential even at high concentrations of cyclopropane—in contrast to the change occurring with hypoxia. The negative ionotropic change that occurs is directly related to concentration and is not changed by blocking the MAP changes with atropine. This is the first evidence of the effect of inhalation anesthetics on cardiac cell membrane we have seen wherein the dissociation of electrical and contractile events has been recorded.

Blood Gas Exchange During Endobronchial Anesthesia. Mitsugu Fujimori, M.D., W. Curtis Pearcy, M.D., and Robert W. Virtue, M.D., Ph.D. *Division of Anesthesiology, National Jewish Hospital, University of Colorado Medical Center, Denver, Colorado.* The value of endobronchial intubation in certain instances, as compared to endotracheal intubation, has been recognized for some well-defined reasons. Among these are that purulent material, blood, or secretions do not flow from the diseased lung to the good lung (*Bonica, J. J., and Hall, W. M.: Anesthesiology 12: 344, 1951; Bjork, V. O., Carlens, E., and Friberg, O.: Anesthesiology 14: 60, 1953; Oech, S. R.: Anesthesiology 16: 468, 1955, and Ruth, H. S., Grove, D., and Keown, K. K.: Anesthesiology 9: 422, 1948*), and that the surgeon has a nearly motionless operative field. Since Bonica and Hall gave no measurement of blood gas concentrations using this technique, it seemed worth while to measure blood gas exchange during administration of anesthesia through one lung and through both lungs. Measurements of end-expiratory (alveolar) carbon dioxide, arterial blood carbon dioxide content, and arterial oxygen saturation were made in 25 patients undergoing thoracic surgery, chiefly for lobectomies, with cyclopropane anesthesia. Premedication was 100 mg. pentobarbital and 0.4 mg. scopolamine per 70 kg. body weight. Anesthesia was induced in about half the patients with 75 to 150 mg. of thiopental before administering the cyclo-