because of the afferent sciatic stimulation) indicates that many other factors must operate to influence the definition of "depth of anesthesia." It would seem that definition of the status of observable functions would facilitate the transfer of information presently lost by the use of terms such as "lightly or deeply anesthetized." [*Supported by USPHS Grant B-1079.*]

A Method of Indirect Blood Pressure Measurement During Cardiopulmonary Bypass. DOUGLAS W. EASTWOOD, M.D. *Department of Anesthesiology, University of Virginia Hospital, Charlottesville, Virginia.* To circumvent the difficulties of detecting blood pressure during cardiovascular bypass, a method utilizing a photoelectric cell has been developed and used satisfactorily during most of our "heart pump" operations. Each arterial pulsation fluctuation in the blood volume of the vessel network causes fluctuating changes in the density of the tissue. Using a sensitive photoelectric cell, a low voltage light bulb and a transistorized, battery powered amplifier, these fluctuations were picked up from any vascular mass of tissue through which the light could be transmitted. These amplified fluctuations were recorded on a graphic recorder, or used to produce an audible tone. The time constant of the system was adjusted so that only rapid fluctuations in density will be detected. A technical description of the instrument has been reported (*Anesthesiology 20: 74, 1959*). The photoelectric cell and light source were placed on opposite surfaces of the finger of an adult or the wrist of a baby and the light intensity and amplifier sensitivity adjusted to produce an intermittent tone or movement of the needle on the meter with each pulse. A pneumatic cuff was wrapped around the arm and inflated above the point at which the signal of the fluctuations disappear. The cuff is then slowly deflated. The point at which the signal again appears approximates the systolic pressure. During the use of a pump oxygenator for heart surgery a pulse may be felt and Korotkow sounds heard if the pulse pressure is high. This is especially true if the heart is beating and the aorta is not clamped. When the blood flow is dependent entirely on the "heart pump," the pump stroke volume is small, the pulse pressure is small and not detectable by palpation or auscultation. The pulse monitor was capable of detecting the systolic pressure in these circumstances. During the past ten months cardiopulmonary bypass techniques were used in 57 cases in our hospital. The anesthesia was nitrous oxide to which was added one or more of the following: halothane, meperidine, succinylcholine, curare, and thiopental. In most of these cases the systolic arterial pressure was measured by this indirect technique. The patients ranged in age from 4 months to 51 years. The highest systolic pressure measured during use of the "heart pump" was 100 mm. Hg. Pressures were obtained by this method as low as 35 mm. Hg. When pressure fell below this point this method of pulse detection became unsatisfactory. Vasoconstriction was found to make the changes in tissue density too small to be detected, however a routine digital nerve block will remedy this situation. The validity of this technique was checked by direct arterial pressure measured by means of a Statham strain gauge and compared to the pressure recorded simultaneously by this indirect method. This method has been used also to measure systolic arterial blood pressures in infants and children, during hypothermia, and in obese patients.

Influence of Anesthetic Agents and Adjuvants Upon Intestinal Tone. JAMES E. ECKENHOFF, M.D., AND THOMAS H. CANNARD, M.D. *Department of Anesthesiology, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania.* Measurements of intestinal tone were sought in 12 patients scheduled for abdominal operation whose intestinal tracts had been intubated with a Miller-Abbott tube. In the operating room, that portion of the tube leading to the balloon was connected to a strain gauge and intraluminal pressures were recorded on a Brush Recorder. Sufficient air to obtain an adequate recording was injected into the system to inflate the balloon. This was 30–60 ml., yielding a pressure of 5 to 15 mm. Hg. Control recordings were made for 10–30 minutes. Anesthesia was then induced and observations made of the influence of the various agents and adjuvants on bowel pressures. The posi-

tion of all balloons in the small bowel was verified at laparotomy. Observations were without value in 5 patients. In two of these satisfactory inflation of the balloon could not be obtained because the tube was kinked. In two no changes in intestinal tone were apparent and motility was absent. In the remaining 7 patients, satisfactory recordings were obtained. Spinal anesthesia was administered to five. Sensory anesthesia to T6–T4 was obtained. Intraluminal pressure rose in all, the degree of rise varying from 15 to 100 per cent. Three of these patients were given thiopental intravenously in increments of 50 to 100 mg. In all intraluminal pressure decreased within 30 seconds. In one patient, the pressure remained low for several minutes but the picture was complicated by systemic hypotension. The intraluminal pressure returned promptly to former levels with the intravenous injection of phenylephrine. In one patient, the fall in pressure was transient. In the other 2 patients, after spinal anesthesia was established, the patients were given a minimal dose of thiopental, followed by curarization with 15 and 21 mg. *d*-tubocurarine, endotracheal intubation and controlled respirations with O_2 and subsequently N_2O and O_2. In both intraluminal pressure which had risen following the spinal fell below the control levels after the curare and remained low for 15 minutes, when it gradually began to increase though never reaching control levels. The final two patients were given general anesthesia. In one, anesthesia was induced with two 100 mg. doses of thiopental. Intraluminal pressure fell below control levels. Succinylcholine 40 mg. was given intravenously and the trachea was intubated. Nitrous oxide 6 l./min. and oxygen 2 l./min. was given with controlled respiration. Intraluminal pressure gradually rose and remained about 50 per cent above control levels for 5 minutes at which time 18 mg. *d*-tubocurarine was given intravenously. Intraluminal pressure then fell to about 20 per cent below control levels and remained there for 16 minutes at which time the operation began. In the last patient anesthesia was induced with 75 mg. thiopental followed by 50 mg. Intraluminal pressure declined slightly but definitely. Cyclopropane was then given for 2 minutes at which time intraluminal pressure rose slightly. Eighteen milligrams *d*-tubocurarine were given intravenously followed in 5 minutes by an additional 9 mg. Intraluminal pressure declined rapidly to about 70 per cent of control levels with minimal evidence of intestinal motility. It remained there for 15 minutes while light cyclopropane anesthesia was continued. At this time 0.5 mg. prostigmine was given intravenously. In 3 minutes intraluminal pressure had returned to control levels or slightly above with vigorous intestinal motility. The factors that have already been described as leading to a diminished intestinal tone and motility are numerous and have not all been verified in man. Only a relatively few factors have been described as causing an increase in intestinal tone and motility. These include vagal stimulation, oxygen, prostigmine, avertin, light cyclopropane and spinal anesthesia. Our observations of the effects of spinal anesthesia, thiopental, cyclopropane, hypotension, *d*-tubocurare, and prostigmine agree with the above categorization. Nitrous oxide, on the other hand, did not appear to be an intestinal depressant. It would appear that the effects produced by anesthetics on bowel tone is a function of dose of drug and depth of anesthesia. Even though a drug such as curare, used in relating large dosage, decreases intestinal tone, this appears limited to about 15 minutes. The effect of repetitive doses is undetermined, nor did we investigate the effects of narcotics which presumably would have a more prolonged effect. Manipulation of the bowel, as might occur during abdominal operation, might significantly affect the results as described.

The Effect of Various Concentrations of Oxygen on the Pulmonary Circulation. G. W. N. Eggers, Jr., M.D., and H. W. Paley, M.D. *Departments of Anesthesiology and Internal Medicine, University of Texas Medical Branch, Galveston, Texas.* The recent advent of cardiac catheterization has made possible the exploration of the pulmonary circulation. While many investigators have studied the effects of hypoxia and certain drugs on the pulmonary circulation (*Euler, U. S., and Liljestrand, G.: Acta. physiol. scandinav. 12: 301, 1946; Lanari-Zabiaur, F. J., and Hamilton, W. F.: Circulation Res. 6: 289, 1958*), only a