who underwent open heart operations with extracorporeal circulation disclosed the following changes in the postoperative period: mild anemia, minimal hemolysis of erythrocytes, leukocytosis, "atypical" lymphocytes, slight reticulocytosis and minimal prolongation of the prothrombin time. (*Battle, J. D. and Hewlett, J. S.: Hematologic Changes Observed After Extracorporeal Circulation During Open Heart Operations, Cleveland Clinic Quart. 25: 112 (April) 1958.*)

CARDIAC PACEMAKER To undertake open heart operations without a pacemaker at hand no longer seems justifiable. The electrodes should be placed on the heart of any patient in whom atrioventricular block occurs during the operation, even though the ventricular rate appears satisfactory at the time. The pacemaker should be used in children whose ventricular rates fall below 90, and in adults whose rates drop below 80. (*Olmsted, F., Kolff, W. J., and Effler, D. B.: Electronic Cardiac Pacemaker After Open Heart Operations, Cleveland Clinic Quart. 25: 81 (April) 1958.*)

PULMONARY COMPLICATIONS Temporary overloading of the pulmonary circulation is the most important single factor in the initiation of capillary damage that marks the beginning of severe pulmonary complications after open heart operations. Overloading may occur by forward overfilling, through collateral vessels and by retrograde overfilling. Other possible factors are pre-existing pulmonary vascular disease, oxygen intoxication of alveolar and capillary cells and exsiccation of the lungs. (*Kolff, W. J., and others: Pulmonary Complications of Open Heart Operations: Their Pathogenesis and Avoidance, Cleveland Clinic Quart. 25: 65 (April) 1958.*)

OPEN HEART SURGERY Extracorporeal circulation and hypothermia were used for open heart surgery in a series of 46 patients. Low flow extracorporeal circulation and hypothermia have proven to be complementary for open heart surgery. This procedure is supported by the high venous oxygen saturation and the minor alteration in the lactic acid levels in the blood during perfusion. Difficulties in temperature control have been solved by the use of a heat exchanger in the extracorporeal system. Cardiac irritability has not been a serious problem. (*Sealy, W. C., Brown, I. W., and Young, W. G., Jr.: Report on Use of Both Extracorporeal Circulation and Hypothermia for Open Heart Surgery, Ann. Surg. 147: 603 (May) 1958.*)

OPEN HEART MORTALITY With the use of extracorporeal circulation techniques, the mortality rate is now well under 5 per cent in the less serious cardiac defects. DeWall achieved a rate of 2.5 per cent in 40 consecutive cases; Spencer reports thirteen consecutive aortic commissurotomies with no mortality; Lillehei reports a mortality rate of 8 per cent in the last 25 consecutive patients undergoing complete correction of tetralogy of Fallot. (*Heimbecker, R. O.: Heart-Lung Machine in Open Heart Surgery, Canad. M. A. J. 78: 534 (April 1) 1958.*)

AORTIC VALVE SURGERY Two techniques for aortic valve surgery under direct exposure have been devised in dogs. Both utilize a pump-oxygenator which returns blood to the femoral artery while the aorta is clamped two inches distal to the aortic valve. To maintain myocardial integrity in one method, oxygenated blood is perfused through the coronary system in a retrograde fashion after inserting a cannula into the coronary sinus. The second method utilizes the induction of cardiac standstill with potassium to prevent myocardial damage. Both methods permit restoration of normal unsupported circulation in most instances. (*State, D., and others: Direct Visualization of Aortic Valve in Dogs, West. J. Surg. 66: 89 (March–April) 1958.*)

MYOCARDIAL CONTRACTILITY The effect of cardiac bypass with potassium induced arrest and right ventriculotomy was investigated in fourteen dogs and ten patients. Direct measurements of myocardial contractility in these studies showed that the heart was still capable of doing the same amount of work following re-

covery from cardioplegia and ventriculotomy. Data is presented which emphasizes the significance of neurogenic, metabolic and humoral factors in the regulation of myocardial contractility. (*Darby, T. D., and others: Influence of Cardio-Pulmonary Bypass with Cardiac Arrest and Right Ventriculotomy on Myocardial Contractile Force, Ann. Surg. 147: 596 (May) 1958.*)

CARDIOTOMY MONITORING The electrocardiogram and electroencephalogram are helpful monitors in the management of patients undergoing cardiotomy. The electrocardiogram affords immediate evidence of cardiac arrhythmias, the most serious of which are those resulting from high vagal tone or ventricular irritability. The energy output of the brain is revealed by the amplitude and frequency of the electroencephalogram tracing and is seen to decrease with deeper anesthesia, hypoxia, hypotension, hypothermia and hypercarbia. The electroencephalogram summates these effects and indicates changes during anesthesia and surgery which are not specific but indicate the need for reevaluation of the patient's essential physiological functions. (*Hale, D. E., and Moraca, P. P.: Electrocardiogram and Electroencephalogram in Elective Cardiac Arrest, J. A. M. A. 166: 1672 (April 5) 1958.*)

HYPOTHERMIA The purpose of hypothermia is to reduce body metabolism and thus diminish the need for oxygen. Hypothermia may be achieved by external surface cooling (ice water immersion, ice bags, cooling blanket); internal surface cooling (cold solutions applied to the open chest or aorta, or cold fluids circulated through the stomach or rectum); and by cooling the patient's blood externally and returning it either into his arterial or venous circulation. Shivering is inhibited by anesthetics, muscle relaxants, and chlorpromazine. Hypothermia affects many physiologic processes. (1) *Metabolism.*—Oxygen consumption decreases with temperature, but the effect of this reduction upon organ function is variable. In the liver, detoxification of drugs may be prolonged far out of proportion to diminution in oxygen consumption. (2) *Cardiovascular.*—Blood pressure and pulse rate diminishes with temperature. Blood flow and oxygenation of tissues are adequate. The electrocardiographic effects include: decreased amplitude or absent P waves, increased QRS interval, increased length of ST segment, and prolongation or inversion of T waves. Below 28 C varying degrees of heart block, ventricular extrasystoles and nodal rhythms may appear. Ventricular fibrillation is uncommon provided the heart is not manipulated or operated on and correct electrolyte balance and oxygenation is maintained. (3) *Respiration.*—Although reasonably normal respiration can persist to well below 28 C., hypothermia increases the dead space and the oxygen dissociation curve is shifted to the left. (4) *Central nervous system.*—In many, electrical cortical activity progressively diminishes until at about 18 C. electrical silence ensues. The cerebrospinal fluid pressure decreases, the brain contracts and seems to be less vulnerable to operative trauma. (5) *Renal function.*—Urinary output may be increased at 25 C. Reabsorption at the distal tubule is unchanged and excretion of water and sodium is unaltered. (*Eckenhoff, J. E.: Physiology of Hypothermia, Bull. New York Acad. Med. 34: 297 (May) 1958.*)

HYPOTHERMIA Total body cooling in man to 28–30 C. during thiopental-curare anesthesia and hyperventilation was associated with arterial blood electrolyte changes similar to those observed during respiratory alkalosis without hypothermia. Metabolic acidosis did not occur during uncomplicated hypothermia. Shivering, occlusion of major blood vessels and the transfusion of routinely collected blood (citrated) led to moderate to severe metabolic acidosis. (*Henneman, D., and others: Immediate Metabolic Response to Hypothermia in Man, J. Appl. Physiol. 12: 1[illegible] (March) 1958.*)

HYPOTHERMIA Observations of cerebrospinal fluid pressure were made in [illegible] patients during intracranial surgery. Anesthesia consisted of thiopental and nitrous oxide with succinylcholine. Operation began when the rectal temperature was 30 C. Cerebrospinal fluid pressure uniformly rose during the induction of anesthesia and the insertion of the endotracheal tube. The