plantation Test (I.T.), which guarantees their freedom from toxicity should be used. The major cause of reactions, however, is ethylene oxide or its products, ethylene glycol and chlorohydrin, which are formed in the presence of moisture and chloride. All of these are highly irritant, absorb into the sterilized item and only slowly elute. *Results:* The rate of elution is slowed if the article is PVC; if the thickness of the plastic is increased; if ambient temperature rather than 50 C. temperature is used during elution; if Freon/Eto mixtures rather than CO_2/Eto mixtures are used for sterilization; if the article is wrapped in polythene rather than cloth or paper; if the article is PVC and has been previously gamma-ray sterilized. This forms HCl in PVC and more ethylene chlorohydrin (boiling point = 139) is formed. *Summary:* Since maximum tolerable levels of these residuals are unknown, complete elimination must be attempted. Recommendations for achieving this include: (a) adequate aeration of gas-sterilized materials for a minimum of five to seven days at ambient temperature or, better still, aeration at 50 C for six to eight hours in a properly designed aerator with bacterial filters; (b) avoidance of the use of 3-ml polythene wrap, plastics containing acid phthallic ester plasticizers which absorb Eto selectively, and any previously gamma-ray-sterilized items; (c) increased use of disposable items.

Alteration, by Halothane, of the Effect of Isoproterenol on Maximum Acceleration of Ejected Left-ventricular Blood. B. F. Rusy, M.D., R. J. Tallarida, Ph.D., A. I. Karetas, M.D., and M. H. Loughnane, M.S., *Departments of Anesthesiology and Pharmacology, Temple University School of Medicine, Philadelphia, Penna.* The maximum acceleration of ejected left ventricular blood ($\dot{Q}_{max}$) has been shown by Noble *et al.* (Circ. Res. 19: 139, 1966) to be a satisfactory index of the inotropic state of the myocardium. The effects of isoproterenol on $\dot{Q}_{max}$ in the conscious dog have been compared with similar effects observed during halothane anesthesia. The questions asked are to what extent halothane antagonizes the contractile response to isoproterenol, and what the nature of the antagonism is, *i.e.*, is it simple competitive inhibition involving a single receptor, or do these drugs act independently at separate receptor sites. *Methods:* Electromagnetic flow probes were implanted on the ascending aortas of mongrel dogs one or more weeks prior to study. $\dot{Q}_{max}$ was computed electronically as the first time derivative of instantaneous aortic flow. The effects on $\dot{Q}_{max}$ of 10, 15 and 20 μg isoproterenol, injected intravenously, were observed first in the conscious animal and then during 1.25 per cent halothane anesthesia. *Results:* The $\dot{Q}_{max}$ response to isoproterenol is markedly depressed by 1.25 per cent halothane. The absolute value of the response to 15 μg isoproterenol during halothane anesthesia is 56 per cent of the response observed during the conscious state ($P < 0.05$). During halothane, a definite plateau in the curve of $\dot{Q}_{max}$ response *vs.* dose of isoproterenol is observed. In order to predict what the maximum obtainable $\dot{Q}_{max}$ responses to isoproterenol would be, Lineweaver-Burke plots of $1/\dot{Q}_{max}$ *vs.* 1/dose isoproterenol were constructed. The y intercepts of these plots (representing the maximum responses theoretically obtainable) were significantly ($P < 0.02$) less during halothane anesthesia. *Summary:* The antagonism of the positive inotropic effect of isoproterenol by halothane is not one of simple competitive inhibition; rather, these agents probably act independently at separate receptor sites.

Correlation of Mechanical and Electrical Events in Depolarization Paralysis of Isolated Human Intercostal Muscle. P. B. Sabawala, M.D., *Baylor University College of Medicine, Houston, Tex.* When depolarizing, drugs are allowed to remain in contact with isolated nerve-muscle preparations in unchanged concentrations, a paralysis develops due to a persistent depolarization at the endplate and at the small area of muscle membrane immediately surrounding it (J. Physiol. 115: 41, 1951). Later evidence showed that this period of depolarization is short and that the muscle remains paralyzed in spite of repolarization of the membrane (Acta Physiol. Scand. 34: 218, 1955). *Methods:* We have repeated these experiments using the isolated human intercostal muscle and extracellular electrodes in

an attempt to correlate these findings with those in human muscle. *Results:* Decamethonium always produces depolarization, even when the dose is so small that the resulting paralysis is negligible. With adequate doses, depolarization and the resulting first phase of paralysis are much more prolonged in isolated human intercostal muscle than the 10 to 15 minutes described by Thesleff for isolated frog sartorius and gastrocnemius muscles. The waning of the first phase is signaled by a recovery of the indirect response and a reduction of the depolarization. The gradual development of the second phase is shown only by the mechanical events, since membrane potential now returns to and remains at resting levels. (Supported by USPHS grant GM 14874.)

Postoperative Hypoventilation and Hypoxia in Man Following Hyperventilation. A. J. SALVATORE, M.D., S. F. SULLIVAN, M.D., and E. M. PAPPER, M.D., *Department of Anesthesiology, Columbia University, College of Physicians and Surgeons, and the Presbyterian Hospital, New York, N. Y.* Hyperventilation lowers Pa_{CO_2} and, with time, the CO_2 stores of the body. It has been shown in dogs (J. Appl. Physiol. 21: 247, 1966) that spontaneous recovery of the depleted CO_2 content of the body requires a period of relative hypoventilation. Breathing air during this recovery period results in hypoxia. This potential cause of hypoxia in man following anesthesia with controlled hyperventilation was the subject of the present study. *Methods:* Thirteen patients, free of cardiopulmonary disease, who had been hyperventilated an average of 2¾ hours during anesthesia and operation, were studied. At the end of anesthesia the inspired mixture was changed to 100 per cent oxygen for 15 minutes, Pa_{O_2}, Pa_{CO_2} and pH_a were measured, and hyperventilation subsequently was discontinued. *Results:* Apnea lasted 6½ minutes, on the average, upon cessation of hyperventilation. During this time the Pa_{CO_2} rose from 18 to 38 mm Hg. When spontaneous ventilation began the patients were allowed to breathe air. Tidal volume and minute volume increased progressively throughout the remainder of the hour, V_E/kg at 15 min was 63.6 ± 2.2 ml (mean ± SE) and at 60 min, 102.3 ± 12.7 ml, while Pa_{CO_2} during this time varied less than 2 mm Hg from the value obtained at the end of apnea. Twenty minutes after the onset of spontaneous respiration, Pa_{O_2} reached an average low value of 72 ± 7.3 mm Hg and then progressively increased toward normal, averaging 83 ± 4.1 mm Hg at 30 minutes and 88 ± 3.5 mm Hg at 60 minutes. At the end of the hour the patients were allowed to breathe 100 per cent oxygen for ten minutes. Pa_{O_2} averaged 587 mm Hg and was essentially unchanged from the values measured at the end of hyperventilation. *Summary:* The hypoventilation which follows a period of hyperventilation can result in a significant lowering of Pa_{O_2} in man if the inspired gas is room air. Yet, this hypoventilation, due to its occurrence in an unsteady state, is associated with normal Pa_{CO_2}.

Effect of Ethrane on the Performance of the Left Ventricle. S. SHIMOSATO, M.D., P.-Y. CHEN, M.D., J. B. GILBERT, M.D., and B. E. ETSTEN, *Department of Anesthesiology, Tufts University School of Medicine, and New England Medical Center Hospitals, Boston, Mass.* Recent studies showed that Ethrane (2-chloro-1,1,2-trifluorethyl difluoromethyl ether), a nonexplosive volatile agent, is a potent anesthetic in both animals and man. However, there is no information related to the effect of Ethrane on myocardial performance. *Methods:* The present study was designed to determine the action of Ethrane on the contractile state of the intact canine left ventricle as determined by the force–velocity relations (ANESTHESIOLOGY 29: 538, 1968) and the active state, which is a measure of the force-generating process of the contractile protein (J. Gen. Physiol. 40: 661, 1967). Thirteen dogs were studied. *Results:* Ethrane induced negative inotropism in all dogs. An average arterial concentration of Ethrane of 18 mg/100 ml produced a 50 per cent depression in peak force with relatively unchanged maximum velocity of shortening. Both maximum isovolumic pressure and the first derivative of left ventricular pressure (LV dP/dt) decreased, indicating decreases in the intensity of the active state. *Summary:* The marked decrease in maximum force as manifested by