

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  $63.6 \pm 2.2$  ml (mean  $\pm$  SE) and at 60 min,

$102.3 \pm 12.7$  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  $72 \pm 7.3$  mm Hg and then progressively increased toward normal, averaging  $83 \pm 4.1$  mm Hg at 30 minutes and  $88 \pm 3.5$  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  $\bar{E}$ thane 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  $\bar{E}$ thane (2-chloro-1,1,2-trifluoroethyl 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  $\bar{E}$ thane on myocardial performance. *Methods:* The present study was designed to determine the action of  $\bar{E}$ thane on the contractile state of the intact canine left ventricle as determined by the force-velocity relationship (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:*  $\bar{E}$ thane induced negative inotropism in all dogs. An average arterial concentration of  $\bar{E}$ thane 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

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