Hospital for Women, we have investigated the effects of hyperventilation on the human mother and her infant. It appears that moderate shifts in maternal acid-base balance toward alkalosis are reflected in the infant at birth by an improvement in his acid-base status. However, above a maternal *p*H of 7.55 the infant ceases to follow the mother, and at a *p*H level of about 7.68 actual adverse changes were observed in the biochemical status as well as the clinical condition of three infants. The present study was designed to determine the influence of severe maternal hyperventilation and respiratory alkalosis upon the acid-base status of the newborn animal, and to relate these data to the phenomena observed in the human being. *Method:* Forty-three pregnant guinea pigs near term were divided into two groups: the first group breathed spontaneously, while the second group was hyperventilated by controlled respiration during the study period. Immediately following cesarean section umbilical cords were clamped before the piglets started to breathe. Maternal and newborn *p*H, P_{CO_2}, buffer base, and hematocrit value were determined in simultaneous samples taken from the maternal carotid artery and the placental side of the clamped umbilical vein. *Results:* The mothers in the control group had a mean arterial *p*H value of 7.43 and a mean P_{CO_2} of 34.8 mm. of mercury. In the hyperventilated group the mean values were 7.75 and 14.6 mm. of mercury, respectively. The respiratory origin of the alkalosis was confirmed by the linear relationship of the P_{CO_2} values to blood *p*H. The umbilical vein blood in the hyperventilated group had a mean *p*H of 7.05, which was clearly lower than the control group. The *p*H gradient between maternal and cord blood was also higher in the hyperventilated group. Furthermore, statistically-significant elevation of P_{CO_2} and depresison of buffer base were found in the umbilical vein samples of the hyperventilated group. The clinical status of the newborn animals was assessed by a scoring system similar to the Apgar score used in human infants. The piglets of the hyperventilated group had low scores, which appeared to be related to the increased *p*H gradients between maternal and cord blood. *Conclusion:* It was concluded from these observations that placental perfusion diminished with hyperventilation, perhaps as a result of vasoconstriction associated with severe alkalosis in the mother. This is indicated by the findings of low *p*H, high P_{CO_2} and lowered buffer base in umbilical vein blood of the hyperventilated group. [This work was supported in part by research grants from the National Institutes of Health, the Public Health Service (RG-9069, formerly H-2410 and H-5877 (R1).]

Effect of Trichlorethylene and Methoxyflurane on Central Respiratory Mechanisms. S. H. Ngai, M.D., R. L. Katz, M.D., and D. C. Brody, M.D., *Departments of Anesthesiology and Pharmacology, College of Physicians and Surgeons, Columbia University, New York, New York.* Recent studies in our laboratory (Fed. Proc. *21:* 328, 1962) indicated that diethyl ether is primarily a respiratory depressant. In decerebrate cats diethyl ether caused a transient tachypnea which was abolished by vagotomy. Continued inhalation of this agent progressively decreased the respiratory amplitude and minute volume. Ventilatory response to CO_2 inhalation decreased. The medullary inspiratory center became less responsive to electrical stimulation. Prolonged inhalation of diethyl ether led to a secondary tachypnea which was related to the development of acidosis. The present report deals with parallel studies with trichlorethylene and methoxyflurane. *Method:* In cats 60 to 90 minutes after decerebration, oxygen or anesthetic mixture was inhaled through a non-rebreathing system. Ventilation was measured with a Servo-spirometer. Respiratory movements were registered with a thoracic pneumograph. Arterial pressure was measured from the femoral artery with a Statham transducer. Recordings were made on a Grass polygraph. Arterial blood samples were obtained for analysis of *p*H and P_{CO_2} (Astrup). In some experiments the medullary inspiratory center was electrically stimulated before and during anesthesia to determine the stimulus threshold and maximal response. *Results:* One per cent trichlorethylene progressively increased respiratory rate and decreased respiratory amplitude. The minute volume generally increased, but this change was not consistently observed. There was either no change or a

slight decrease in arterial *p*H and increase in P_{CO_2}. Two per cent trichlorethylene caused a greater increase in respiratory rate and decrease in amplitude. Arterial *p*H decreased 0.06–0.16 unit and P_{CO_2} increased 5–20 mm. of mercury. The ventilatory response to 5 per cent CO_2 inhalation decreased. The electrical stimulus threshold of the medullary inspiratory center was elevated, but the maximal inspiratory response to supramaximal stimulation did not change significantly. Vagotomy delayed the onset of tachypnea for only 10–20 minutes. Carotid denervation did not alter the ventilatory changes. Furthermore, in vagotomized animals the onset of tachypnea was not related to the occurrence of acidosis. Inhalation of 0.5 per cent methoxyflurane decreased minute volume primarily through a reduction in respiratory rate. Arterial *p*H decreased 0.01–0.10 unit and P_{CO_2} increased 2–15 mm. of mercury. One per cent methoxyflurane also reduced the respiratory amplitude significantly. The accompanying acidosis was more pronounced, arterial *p*H decreased 0.04–0.22 unit and P_{CO_2} increased 11–35 mm. of mercury. The ventilatory response to 5 per cent CO_2 decreased markedly. In most of the animals studied CO_2 did not accelerate respiration. The electrical stimulus threshold of the medullary inspiratory center was elevated. The maximal inspiratory response to supramaximal stimulation was not affected. *Conclusions:* These results indicate that like diethyl ether, both trichlorethylene and methoxyflurane are respiratory depressants. Tachypnea during trichlorethylene inhalation cannot be explained by sensitization of pulmonary receptors as previously proposed. In contrast to diethyl ether and trichlorethylene, methoxyflurane appears to depress respiration principally through its effect on the rhythm regulating mechanisms. Further study is in progress to elucidate the action of these anesthetics on respiratory controlling mechanisms. [Supported by USPHS, grant No. B31 C and RG 9069.]

Analysis of CO_2 and Nitrogen Curves for Estimating the Efficiency of Ventilation. F. E. Noe, M.D., and F. E. Greifenstein, M.D., *Department of Anesthesiology, Detroit Receiving Hospital and Wayne State University College of Medicine, Detroit, Michigan.* Digital computer analysis was used to develop a system of respiratory measurements necessary for a general research program. By following the shape of the curves of the air flow rate and various gas concentrations in an expired breath, we measured: (1) the distribution of a breath in the lungs, using the nitrogen dilution curve, (2) the volume of space in the lungs in which no gas exchange takes place (dead space), using the carbon dioxide and air flow rate curves, (3) the distribution of dead space in the lungs—normally limited and restricted for the most part to the early portion of expired air (varies greatly in disease and is important for our understanding the cause and mechanism of specific lung conditions), (4) the effective pulmonary blood volume using N_2O curves after the lung air volume has been equilibrated for N_2O. As physiologic measurements, the data gave (1) a good estimate of lung efficiency using a system which requires no subject cooperation and which can be done continuously during treatment, exercise, surgery, etc., (2) a method for evaluating new techniques in anesthetic practice, therapeutic medicine and surgery, and (3) most important, a method for the study of the pathogenesis of lung disease. With our present methods, we cannot localize areas of impaired function, but for many of our proposed studies it is more important to know the extent of functional impairment. We have demonstrated changes in volume and distribution of gas exchange in pulmonary pathology and in normal subjects with breath-holding and added dead space. Though our primary purpose has been to develop a system of respiratory measurements for the study of large numbers of subjects and for serial or continuous sampling for the duration of a procedure where static measurements are not sufficient, our general interest is broader. Much of our practical knowledge in the biological sciences comes from the measurement of a great many experiments to learn the general reaction. Some form of automatic data analysis could be invaluable in experiments involving a complex set of measurements, which would entail many hours of individual calculation. The first completed section of our work includes a system of anal-