variation, occurring more frequently after exposure during the day than during the night (8.0 per cent v. 1.9 per cent, $P < 0.001$). Incidences of vertebral and rib anomalies also show diurnal variation but at lower levels of significance, $P < 0.05$ for both. These findings are relevant to Matthews' work on periodicity analysis in mice (Toxicity of Anesthetics, ed. B. R. Fink, Williams and Wilkins, in press). The sex distribution in the halothane groups showed the normal preponderance of males, 54 per cent, while the starvation group showed a decrease in the proportion to 49 per cent. The significance of this difference is of low order ($P = 0.15$). It appears that halothane does have some teratogenic activity in rats. Comparison of these data with those from the study of nitrous oxide indicates that the abnormalities observed are strikingly similar both qualitatively and quantitatively, and suggests that the insult is inversely related to the duration of exposure during a susceptible period. It also raises the possibility that teratogenicity may be characteristic of anesthetic agents generally rather than being an isolated effect of a specific agent. Starvation and dehydration appear to contribute to the occurrence of malformations, but they do not account for the whole picture.

The Circle Semi-closed System Control of Pa_{CO_2} by Inflow Rates of Anesthetic Gases and Hyperventilation. DONALD W. BENSON, M.D., PH.D., THOMAS D. GRAFF, M.D., H. H. HURT, JR., M.D. and H. S. LIM, M.D., *The Johns Hopkins University School of Medicine, Baltimore, Md.* To investigate the semi-closed circle system incorporating mechanical ventilation and to ascertain the feasibility of eliminating carbon dioxide by means other than chemical absorption, the following studies were carried out with a conventional anesthesia apparatus. *Methods:* Utilizing directional valves in the chimney piece and a Ventilation/Ventimeter (Air-Shields) connected into the circuit at the rebreathing bag port, nitrous oxide, oxygen and halothane anesthesia was administered to a series of patients. The total capacity of this system excluding the patient was 8 liters and of this there was a total mixing space of 5.86 liters. The gas inflow rates and minute ventilation were calculated in milliliters per pound body weight per minute. Ventilation was measured with a Wright Ventilometer. Respirations were controlled throughout. Ventilation and gas inflow rates were then varied at 20–40 minute intervals to secure a representative plot of Pa_{CO_2} gas inflow rate and ventilation. At these same intervals arterial blood samples were obtained for measurement of Pa_{CO_2}, pH, and standard bicarbonate. The flow rates were classified in four groups: I—no flow to 20 ml./lb. body weight per minute, II—20 to 40 ml./lb.; III—40 to 100 ml./lb.; IV—100 ml./lb. or more. The minute volumes were grouped in the same manner: I—30–50 ml./min. lb. body weight (average 6.5 l., 17 determinations); II—60–90 ml. (average 11.2 l., 35 determinations); III—90–120 ml. (average 16 l., 20 determinations); and IV—120–150 ml. (average 20 l., 22 determinations). *Results:* Equilibration of CO_2 production and loss from the system as indicated by a stable arterial P_{CO_2} occurred at approximately 40 minutes. It was apparent that both minute volume and gas inflow rates were important for CO_2 homeostasis. A P_{CO_2} of 40 mm. Hg or below could be maintained with a minute ventilation of 90 to 120 ml./lb./min. and an inflow rate of 40 ml./lb./min. If the ventilation were raised to 120–150 ml./lb./min. or an average of 20 l. per min. a P_{CO_2} of 40 or below could be obtained with only 33 ml./min./lb. of gas inflow. Conversely, with inflow rates of 20 to 40 ml./lb./min. any ventilation greater than 110 ml./lb./min. resulted in a P_{CO_2} below 40. An inflow rate of 50 ml./lb./min. and a minute volume of 100 ml./lb./min. uniformly resulted in a P_{CO_2} below 40. *Conclusion:* It is our impression at this stage of the study that satisfactory CO_2 elimination can be obtained consistently without chemical absorption by utilizing gas inflow rates totalling 50 ml./lb./min. and a ventilation of 100 ml./lb./min.

Effects of Anesthesia and Operation upon Respiratory Flow-Volume Loops. KALMAN J. BERENYI, M.D., STANLEY W. WEITZNER, M.D., I-PING TANG, M.D. and MEREL H. HARMEL, M.D., *State University of New York-Downstate Medical Center, Brooklyn, N. Y.*

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