BRIEFS FROM THE LITERATURE

JOHN W. PENDER, M.D. *Editor*

Briefs were submitted by Drs. C. M. Ballinger, Lee S. Binder, John P. Bunker, M. T. Clarke, Joaquin Coto, Cody Eames, D. W. Eastwood, J. E. Eckenhoff, Martin Helrich, J. R. Householder, S. J. Martin, R. E. Ponath and R. W. Ridley.

RESPIRATION Integration of respiration seems to occur at several levels. Four kinds of peripheral receptors influence respiration. (1) Slowly adapting inhibitory receptors located in the visceral pleura and lungs are influenced by inflation and act on inspiratory muscles. By cutting short the inspiratory discharge, they may increase respiratory rate. Although these receptors are most active during eupneic respiration, they may also induce an active expiratory effect. (2) Slowly adapting receptors located solely in the tracheobronchial tree and concentrated at sites of bronchial branching are stimulated by inflation and over-inflation and cause respiratory retardation and bronchoconstriction. (3) High threshold receptors stimulated by strong inflation only restrict excessive inspirations. (4) Four different cough reflexes are identified with receptors in the tracheobronchial tree and lungs. Nerve fibers from these pulmonary receptors are conducted by the ipsilateral vagus to enter the brain stem where they emerge into the solitary tract. In the rabbit they pass to two different areas, one with expiratory, the other with inspiratory function; there is no evidence that the two areas are clearly delineated in other animals. Some fibers follow the solitary tract caudad giving off fibers to the reticular formation, others pass directly to efferent motor nuclei. Aortic and carotid chemoreceptors normally exert a tonic influence so that their elimination causes a reduction in pulmonary ventilation. The chemoreflex thus is an essential factor in the finer adjustments of respiration to carbon dioxide. The pneumotaxic center is located in the tegmentum of the upper few mm. of the pons. Its section or destruction causes apneusis in vagotomized animals. In the cat an inspiratory center has been located in the ventral reticular formation overlying the inferior olive. Slightly rostral in the dorsal reticular formation is an expiratory center. These two centers were considered to be responsible for tonic inspiration and expiration. The respiratory rhythm was thought to be imparted to it by the pneumotaxic center and the vagus afferents by intermittent inhibition. These conclusions have been challenged on the basis of: (1) analysis of action potentials from the medulla which found no anatomic grouping of signals that indicated discrete centers; (2) other electrical stimulation experiments that also failed to confirm this clear cut separation of centers; and (3) transection at various levels which tended to disprove the postulated aperiodicity of the respiratory centers and suggested that their inherent periodicity was masked by tonic influences from the reticular formation and vagus. One may conclude that integration takes place at several levels. The vagi are important in coordinating respiration as demonstrated by changes following vagotomy. Bilateral coordination seems further to take place in the caudal part of the bulb. Further integration may take place in the reticular formation of the bulb which may function as the respiratory center. Maximal inspiratory or expiratory apneas may also be obtained on electrical stimulation of other levels, both spinal and medullopontine. The concept of integration at several levels is supported by the observation that vagotomy in the rabbit resulted not only in the classical changes but also in poor coordination of the respiratory activities of the thorax and diaphragm. (*Lilljestrand, A.: Normal Control of Respiration, Physiol. Rev. 38: 691 (Oct.) 1958.*)

NEWBORN RESPIRATION Thirty-seven newborn babies were kept under observation. For several hours after birth the type of res-

piration is mainly thoracic and later in most cases changes into abdominal. Respiratory rate is 44–49 per minute and tends to be higher in male than in female babies. The amplitude of respiratory excursions is at first (during the first few hours of life) maximal when the baby is in the dorsal or left lateral decubitus; later in dorsal decubitus and with slightly raised upper part of the body. (*Kvezereli-Kopadze, N. N.: Respiratory Dynamics of the Newborn Under Physiological Conditions, Sborn, Trud. Inst. Okhr. Mater. i Dets. 7: 325, 1956.*)

AIRWAY RESISTANCE Measurements of airway resistance and lung volume were made on 26 normal subjects. Studies were made at different degrees of inflation of the lung. Airway conductance, the reciprocal of resistance, was approximately linearly related to the degree of inflation of the lungs. Airway resistance in children is three to five times that of adults. This is related more to differences in lung volume than to differences in age. The small airways in which resistance to flow is located may be as distensible as the lung as a whole. (*Briscoe, W. A. and Dubois, A. B.: The Relationship Between Airway Resistance, Airway Conductance and Lung Volume in Subjects of Different Age and Body Size, J. Clin. Invest. 37: 1279 (Sept.) 1958.*)

CARDIOINHIBITORY REFLEX Activation of the pulmonary stretch reflex by such maneuvers as breath-holding, pressure breathing, and artificial respiration may in turn produce a vagal response characterized by cardiac arrhythmias and arrest. One of the mechanisms which may induce cardiac arrest during surgery is stimulation of the pulmonary stretch reflex with artificial respiration. Small preoperative doses of atropine (0.4 mg.) are inadequate to abolish the vagal effect of the pulmonary stretch reflex, although therapeutic doses of atropine (0.75–1.2 mg.) will abolish this cardioinhibitory response in susceptible individuals. (*Dermksian, G., and Lamb, L. E.: Syncope in a Population of Healthy Young Adults, J. A. M. A. 168: 1200 (Nov. 1) 1958.*)

HYPOXIA Pulmonary function was appraised in twenty patients with restrictive lung disease in which emphysema was not a significant factor. The primary causes of hypoxia were: presence of poorly ventilated alveoli, perfusion of blood through nonventilated areas of the lung, and right to left shunts in the heart. Alveolar-capillary block involving the pulmonary membrane was an insignificant factor. A 32 per cent oxygen mixture increased the inspired oxygen tension over 70 mm. of mercury and overcame an alveolar-capillary membrane block when that was the primary difficulty. A 32 to 40 per cent oxygen mixture did not restore to normal an unsaturation caused by shunting at or near the alveolar level, especially with exercise. Breathing 100 per cent oxygen tended to obscure shunting at or near the alveolar level, especially at rest, because of the large increase in oxygen pressure in the plasma. Also, at rest, the blood flow tended to be through the better ventilated areas as compared to exercise. The use of 32 to 40 per cent oxygen mixed with nitrogen differentiated shunting at the alveolar level from true diffusion difficulties with increased resistance for the transfer of oxygen through the pulmonary membrane. These studies indicate that the alveolar-capillary membrane block is not a significant factor in the hypoxia of pulmonary fibrosis, emphysema, and most of the related conditions. The true cause is primarily one of obstruction in which the air breathed does not get down to the alveolar level where the blood gas exchange occurs. (*Motley, H. L.: Studies on the Nature of Hypoxia With and Without Cyanosis in Chronic Pulmonary Disease, Geriatrics 13: 617 (Oct.) 1958*).

HYPOVENTILATION Thirty-eight patients were studied postoperatively—30 following thoracic surgery and 8 following abdominal surgery. Fourteen patients in the thoracic series showed a drop in *p*H of at least 0.10 unit. A significant difference between the 14 acidotic and 16 non-acidotic patients was found in the minute ventilation and alveolar ventilation. Minimal to moderate degrees of hypoxia were noted and spirograms demonstrated hypoventilation and respiratory irregularities. (*Hood, R. M., and others: Hypoventilation, Hypoxia and Acidosis Occurring in the Acute Postoperative Period, J. Thoracic Surg. 36: 729 (Nov.) 1958.*)