vagus stimulation not based on a circus movement mechanism is of interest.

Summary. Focal application of aconitine to the dog's auricle in the form of a subepicardial injection is followed by the appearance of a prolonged regular tachycardia with a rate of approximately 200 to 300 beats per minute. Faradic stimulation of the vagus nerves in the neck always leads to a remarkable increase of rate of the auricles. Auricular fibrillation or the phenomenon of rapid reexcitation were never observed during the vagus stimulation.

Separation of the site of injection from the rest of the heart by clamping abolishes the tachycardia; it regularly reappears on removal of the clamp. Cooling of the site of injection by a thermode also stops the tachycardia, and it reappears immediately when cooling is discontinued.

The tachycardia shows characteristics of auricular flutter, but auricular tachycardia of the type "essential paroxysmal tachycardia" cannot be ruled out.

The results of the experiments cannot be explained under the assumption that the tachycardia is caused by a circus movement. Therefore the increase of rate during the vagus stimulation requires another explanation than the one given by Lewis.

15755

A Method for Intrathoracic Operation on the Rat.*

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Positive control of intrapulmonary tension and oxygenation is highly desirable for intrathoracic operations on any animal. The technic for larger animals, such as dogs, is well standardized, but because of the small size of the laboratory rat, none of the methods could be satisfactorily used in intrathoracic operations on that animal.

In connection with problems involving pneumonotomy and pneumonectomy in the rat, a simple and satisfactory method of positive pressure administration of oxygen has been evolved utilizing tracheal intubation. The rat is anesthetized with pentobarbital sodium intraperitoneally at a dosage of 30 mg per kg of body weight. In combination with this is given scopolamine hydrobromide, in a dosage of 0.6 mg for a 300 to 400 g rat.[1] The latter drug was found to increase rapidity and depth of anesthesia, reduce tracheal secretions and counteract the respiratory depression that pentobarbital sodium tends to produce. The pharynx is cleared by suction and the trachea is intubated with a special tube to be described later. The end of the tube is then connected to the oxygen line and valve apparatus. Respiration is not artificial but is performed in the natural manner with the rat working against a variable pressure water valve.

The intratracheal tube is constructed of plastic tubing† having an outside diameter of 0.08 inch (0.20 cm) and an inside diameter of 0.045 inch (0.11 cm) (Fig. 1). One end is sealed off by rotating in a gentle flame and molding with the fingers, and a slight point is produced by grinding with an emery wheel. Just above the point 3 small holes, staggered around the circumference, are cut with fine scissors and ground smooth with

* Work done in the laboratory of, and under the direction of, Dr. George M. Higgins, Division of Experimental Medicine, Mayo Foundation, Rochester, Minn.

1 Holck, H. G. O., Dosage of Drugs for Rats, in Griffith, J. Q., Jr., and Farris, E. J., *The Rat in Laboratory Investigation*, Philadelphia, J. B. Lippincott Company, 1942, chap. 13, pp. 297-350.

† Transflex, courtesy of the manufacturer, The Irvington Varnish and Insulator Company, Irvington, N.J.

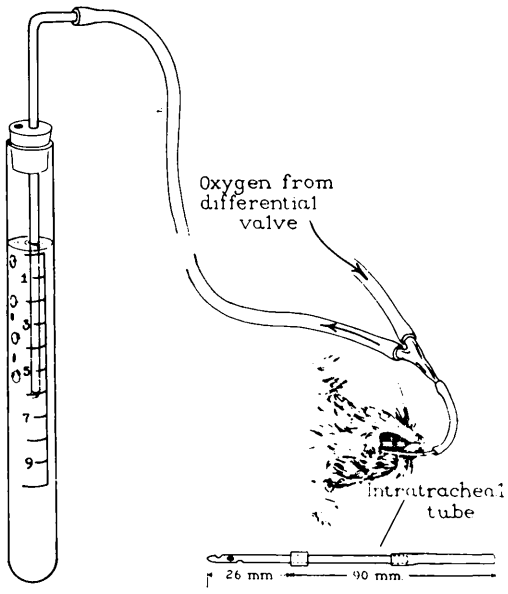

FIG. 1.
Positive pressure water valve, intracheal tube and method of connection. The test tube is conveniently supported by a buret clamp attached to a ring stand. See text.

a small dental burr. A cuff of rubber tubing is placed with its lower edge 26 mm above the tip, in order to prevent insertion of the tube beyond the carina. A similar piece of tubing is slipped over the upper end of the plastic tube to serve as a connector and both are cemented in place with rubber cement. A stiff wire stylet is used during insertion.

Intubation must be done under direct vision in the rat owing to the extreme mobility of the laryngeal structures. A satisfactory "laryngoscope" can be a bivalve electric otoscope with half of the objective removed or an ordinary electric otoscope with the objective cut in half lengthwise (Fig. 2). The anesthetized rat is placed on its back on a rat board, the tongue is pulled well out, the upper jaw is held down by a loop over the front teeth and the tube is inserted between the vocal cords with the aid of the converted otoscope.

The positive pressure apparatus consists of a simple water valve (Fig. 1). A large test tube about 20 cm long is fitted with a 2-holed rubber stopper and filled about two-thirds full of water. A glass tube about 6 mm in outside diameter slides through one of the holes in the stopper; the depth of immersion of the tube determines the amount of positive pressure. The second hole in the stopper allows escape of the excess gases. A centimeter scale marked on the side of the test tube allows exact settings. A glass Y tube completes the apparatus. One arm is connected to the differential valve on the oxygen tank, the second arm is connected to the water valve and the base of the Y is connected to the rubber tubing on the end of the intratracheal tube. It is very important to keep the last connection short in order to reduce the amount of physiologic dead space created by the intratracheal tube.

In using the apparatus a positive pressure of 1 to 2 cm of water is used until the thorax is about to be opened. For pneumonectomy or any operation in which maintaining a fully expanded lung is not important, the pressure is increased to 5 or 6 cm of water during the period when the thorax is open. If continued full expansion of the lung is desired, a pressure of 7 to 8 cm of water is necessary but this sometimes causes leakage of air into the mediastinum or the opposite pleural cavity, so that the lower pressures are generally more practical. Inflation of a

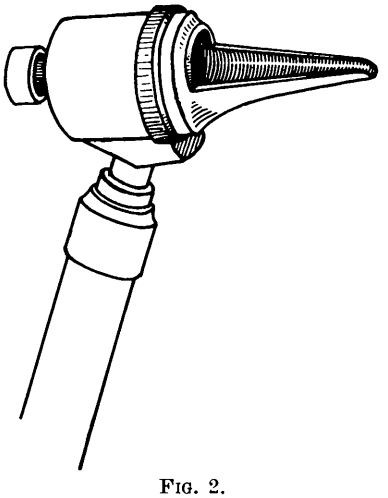

FIG. 2.
Converted electric otoscope used for the insertion of the intratracheal tube. Most of the top half of the objective has been cut away to form a miniature "laryngoscope."

partially collapsed lung may be obtained by briefly pinching off the rubber tubing leading to the water valve.

Oxygen flow is carefully regulated by means of the differential valve on the oxygen tank. When the flow is properly regulated, oxygen bubbles gently through the water valve at all times except during inspiration, when the flow is temporarily interrupted. Even during inspiration there should not be much rise of water level in the glass tubing of the valve.

For satisfactory operation, obstruction of the intratracheal tube must be avoided. If there is excessive trauma during intubation, blood is almost sure to clog the tube. Rats that have colds or mild chronic pneumonitis should not be used because excess secretion clogs the intratracheal tube. Suction or repeated insertion of the stylet will sometimes free a clogged intratracheal tube.

We have used the method described in this paper in more than 300 thoracotomies on rats, about 200 of which were pneumonectomies. It has proved satisfactory and easy to use once the technic has been mastered. Best results were obtained when temperature and humidity were moderate. Hot, humid days seemed to cause a definite increase of the operative mortality rate.

Summary. For performance of intrathoracic operations on the rat pentobarbital sodium and scopolamine were found to be effective anesthetic agents. A plastic intratracheal tube was devised for use in such operations and has proved to be satisfactory. A simple water valve apparatus for administration of oxygen under positive pressure was devised for use with the intratracheal tube.

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Intravascular and Intracardiac Pressure Recording in Man: Electrical Apparatus Compared with the Hamilton Manometer.*

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An electrical apparatus has been used for recording blood pressures, (peripheral artery, right auricle, right ventricle and pulmonary artery), pleural pressure, and mask pressure in man. The method was tested for accuracy and fidelity in reproduction of the pressure tracings by comparison with the Hamilton manometer[1] used extensively for the recording of right heart pressure.[2,3] Records were obtained of simultaneous tracings on both systems, permitting a beat to beat study (Fig. 1, A and B). A record was also taken on the Hamilton manometer with the electrical recording off (Fig. 1, C).

The electrical pressure pick-up unit used was the Clark Pressure Capsule.† This capsule consists of 2 small coils mounted in a small round metal case (38 mm in diameter and 12.5 mm thick) and separated by a

* Under contract with Aero-Medical Laboratory, Wright Field, Dayton, Ohio. Additional support was provided by the Commonwealth Fund and the Life Insurance Medical Research Fund Gift for Study of Action of Certain Cardiovascular Drugs.

1 Hamilton, W. F., Brewer, G., and Brotman, I., *Am. J. Physiol.*, 1934, **107**, 427.

2 Cournand, A., Lauson, H. D., Bloomfield, R. A., Breed, E. S., and Baldwin, E. de F., PROC. SOC. EXP. BIOL. AND MED., 1944, **55**, 34.

3 Bloomfield, R. A., Lauson, H. B., Cournand, A., Breed, E. S., and Richards, D. W., Jr., *J. Clin. Invest.*, 1946, **25**, 639

† Clark Capsule, designed by James C. Clark, Wright Field, Dayton, Ohio. Aerotronics Inc., Camden, Ohio, licensed to manufacture the capsule.