

mice. Previous thyroidectomy, when complete, prevented this rise in metabolism in rabbits.<sup>16</sup> On the other hand, feeding a glycerol emulsion of fresh beef adrenal cortex to rabbits lowered the respiratory metabolism.<sup>17</sup> Oehme<sup>18</sup> obtained a similar lowering of metabolism with an adrenal cortex extract in thyroxine treated guinea pigs. Also significant are the observations that feeding a residue of whole beef adrenal to dogs caused a marked increase in iodine content of the thyroid gland,<sup>19</sup> and that administering corticotropic hormone to dogs definitely lowered the blood iodine and caused involution of the thyroid gland to the colloid state.<sup>20</sup>

### 10775 P

#### Electrical Anesthesia in Rats.

M. L. SILVER. (Introduced by R. W. Gerard.)

*From the Department of Physiology, University of Chicago.*

Electrical anesthesia in mammals, produced by means of an interrupted direct current, is reported by Leduc,<sup>1</sup> Robinovitch,<sup>2</sup> von Neergard,<sup>3</sup> and Ivy and Barry,<sup>4</sup> and denied by Sack and Koch.<sup>5</sup> Von Haareveld and Kok<sup>6</sup> obtained narcosis in the dog with a sinusoidal current and Scheminzky and others<sup>7</sup> in the frog with a constant one. Conflicting results may have prevented the use of electro-narcosis in the clinic, yet it seems to offer much promise. This is a preliminary report of the successful production of anesthesia in rats by a constant direct current.

Large dry cells (145 volts), a graphite rheostat, a milliammeter, and a reversing switch are connected in series with a rat through

<sup>16</sup> Marine, D., and Baumann, E., *Am. J. Physiol.*, 1922, **59**, 353.

<sup>17</sup> Marine, D., and Baumann, E., *Am. J. Physiol.*, 1925, **72**, 248.

<sup>18</sup> Oehme, C., *Klin. Wschr.*, 1936, **1**, 512.

<sup>19</sup> Black, E. M., Hupper, M., and Rogers, J., *Am. J. Physiol.*, 1922, **59**, 222.

<sup>20</sup> Reiss, M., and Peter, F., *Zeitsch. ges. exp. Med.*, 1938, **104**, 49.

<sup>1</sup> Leduc, S., *Arch. d.'Elect. Med.*, 1902, **10**, 769.

<sup>2</sup> Robinovitch, L. G., *Sommeil électrique, épilepsie électrique et électrocution*, Thèse, Paris, 1906.

<sup>3</sup> von Neergard, K., *Arch. für Klinische Chirurgie*, 1923, **122**, 100.

<sup>4</sup> Ivy, A. C., and Barry, F. S., *Am. J. Phys.*, 1932, **99**, 298.

<sup>5</sup> Sack, G., and Koch, H., *Z. f. d. g. Exp. Med.*, 1933, **90**, 349.

<sup>6</sup> von Haareveld, A., and Kok, D. J., *Arch. néerl. Phys.*, 1934, **19**, 24.

<sup>7</sup> Scheminzky, F., Hochstädt, O., and Adler, P., *Pflüger's Arch.*, 1936, **237**, 284.

non-polarizable, zinc-zinc sulfate electrodes. The cathode is firmly pressed against the roof of the mouth and the anode is inserted about 1 cm into the rectum. The animal lies with his legs dependent through holes in a platform.

The rat is usually anesthetized with ether prior to the application of current, to avoid struggling against confinement. Control animals without current, emerge from this anesthesia in 5 minutes (never more than 10 minutes). The experimental animals are subjected to a current of 10 mA (rheostat at 11,500 ohms) gradually increased from zero during a period of 3 minutes. As long as this current flows, the animal remains quiescent and gives no response to severe noxious stimuli, such as cutting, burning, or powerful tetanizing shocks. (Tests have been continued up to 4 hours. After a half-hour the anesthetizing current can be reduced to 8 mA.) To terminate anesthesia, the current is decreased to 4 mA during a minute, its direction reversed for 10 seconds, and then discontinued. The animal regains normal reflex thresholds within 5 minutes; fully normal behavior returns within 10 minutes.

Repeated periods of electroanesthesia (10 hours total anesthesia) have led to no detectable physiological defects or neurohistological changes.

With the cathode on the shaved skin of the shoulder region instead of in the mouth, the head and forelimbs are largely outside the current path and are spared its narcotic action. Such rats respond normally to stimulation of the fore parts, not at all to stimulation of the hind parts.

Studies on the site and mechanism of action of the current are being continued. Reflex block is definitely in the central nervous system, and not in peripheral structures.