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IV. Irregular Respiration, and the Response of Tibialis Muscle to Reflex and Direct Motor Stimulation.

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In the course of the series on reflex response of the tibialis anterior muscle several animals were found in which the respiration was very irregular. There were periods of hyperpnea followed by varying periods of apnea. In 3 experiments in which periodicity occurred during the administration of room air, hyperpnea was accompanied by increased reflex response and apnea, especially when profound and long continued, by periods of reduction or total disappearance of reflex response. In one experiment periodicity occurred during both the administration of room air and of 7% oxygen in nitrogen. The effect here was the same as in the 3 experiments above. In another, irregular respiration occurred while the animal was breathing room air and while breathing pure oxygen. Again the results were the same. The response of the muscle to direct motor nerve stimulation was similar to the reflex response of the opposite muscle.

From these and the preceding experiments it seems probable that there is no single point in the system which can be said to control the response of the anterior tibialis muscle to sensory stimulation. The evidence seems, rather, to suggest that the response may be the result of a number of factors which may vary individually. On the whole, with the exception of carbon dioxide, the reflex response and the response of the tibialis muscle to direct motor nerve stimulation varied roughly with the magnitude of respiratory movements.

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Cerebral, Head and Body Flow of Blood During Periodic Ventilation.

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(Introduced by Robert Gesell.)

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Periodic ventilation was produced in dogs under morphine-urethane anesthesia by (a) increased intracranial tension and (b) blocking of cerebral arteries. Practically complete control of head

flow was obtained by ligating the vertebral arteries, and anterior spinal arteries and small arterioles of the cord, all in the region of the second cervical vertebra. All muscles at this level were severed. The vagi were left intact and one carotid was used for volume flow measurements. Blood volume flow changes were followed in the carotid and femoral arteries by the thermo-electric method (Gesell and Bronk.¹ The external jugular, vertebral, and femoral venous return was measured by the enclosed drop method; the sub-maxillary vein by the external drop. Blood pressure, ventilation, oxygen consumption, and time were simultaneously registered with the blood volume flow changes.

Two types of respiration were obtained. Type 1 gave typical symmetrical Traube Herring blood pressure waves whose frequency was that of the respiratory waves. Apneas were either short (2 seconds) or lacking; respiration in other characteristics was quite normal. The depth of respiration decreased as the carotid flow increased, sometimes to the extent of apnea; as the flow decreased to a minimum, respiratory depth increased to a maximum. The respiratory depth again decreased as the flow increased. Type 2 was characterized by very pronounced blood pressure changes which were not typical Traube Herring waves. Apneas occurred. An apnea of 123 seconds was obtained in one animal during periodic breathing. The respiratory groups usually begin during some phase of the decreased flow or they may begin as late as the very end of decreased flow. Increasing respiratory movements may or may not carry on into the period of increasing blood flow. These increasing respiratory movements may suddenly give way to apnea which is associated with a high flow of blood.

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Acid Changes in pH of Portal, Hepatic, and Arterial Blood on Administration of Sodium Cyanide.

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In view of the fact that the liver reconverts lactic acid into glycogen (Himwich¹), changes in acidity of blood as it passed through the liver were studied in a series of experiments undertaken on dogs. Following the intravenous injection of sodium cyanide, which leads

¹ Gesell, R., and Bronk, D., *Am. J. Physiol.*, 1926, lxxix, 61.

¹ Himwich, H. E., *J. Biol. Chem.*, 1923, lv, 525.