

Vagal Influence on Reflexes of Somatic Musculature.*

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Johnson and Luckhardt,¹ King, Blair, and Garrey,² and Schweitzer and Wright³ demonstrated that stimulation of the central vagal stumps inhibits reflex activity of the knee jerk and that, in general, this reflex inhibition is independent of secondary circulatory and respiratory changes incident to central vagal stimulation. It was thought desirable to investigate the effects of interrupting the normal vagal afferent stream upon reflex contractions of the tibialis anticus muscle.

Dogs anesthetized deeply with morphine and urethane were used as experimental animals. The vago-sympathetic trunks were isolated for cold block. The trachea was directly connected to rebreathing tanks designed to absorb carbon dioxide; oxygen was added as necessary. Respiration was recorded by a spirometer directly connected with the rebreathing tanks. Blood pressure was recorded by a mercury manometer from the right femoral artery. The left sciatic nerve was isolated in the thigh; the hamstring branches cut, the posterior tibial nerve identified, severed, and the central end placed on shielded electrodes of special design. The electrodes were connected to the secondary coil of an inductorium whose primary received the discharge from a Thyatron stimulator. After the left leg was immobilized, the tendon of the tibialis anticus muscle was freed for a distance of about 6 cm above its insertion and connected to an isotonic spring tension myograph. A slight constant tension was exerted on the muscle throughout the experiment.

The vagi were cold blocked and recordable reflex contractions were elicited from the tibialis anticus muscle at a constant rate (40 to 60 stimuli per minute). Upon deblocking the vagi, the reflex amplitude gradually decreased to zero, indicating inhibition of the tibialis anticus reflex; upon blocking of the vagi, the reflex contractions of the tibialis anticus muscle gradually reappeared. In some

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¹ Johnson, C. A., and Luckhardt, A. B., *Am. J. Physiol.*, 1927, **83**, 642.

² King, G. E., Blair, E., and Garrey, W. E., *Am. J. Physiol.*, 1931, **97**, 329.

³ Schweitzer, A., and Wright, S., *J. Physiol.*, 1937, **88**, 459.

animals, this type of alternation was "inexhaustible"; *i. e.*, it could be demonstrated indefinitely by alternate blocking and deblocking of the vagi. In some animals "exhaustible" alternation only could be elicited; *i. e.*, after a short period of vagal blocking and deblocking the reflex arc involved would "fatigue" and only after a period of rest would the alternate inhibition of the somatic reflex be elicited by alternate deblocking of the vagi. In some animals the vagal influence on the reflex contractions of the tibialis anticus muscle could not be demonstrated at any time.

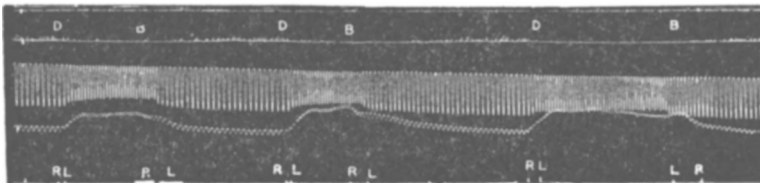


FIG. 1.

Recordings from above downward:

- (1) Time
- (2) Reflex contraction of the M. tibialis anticus
- (3) Respiration
- (4) Blood pressure
- (5) Signal

Legend:

- D = Vagi deblocked
 B = Vagi blocked
 R = Right vagus
 L = Left vagus

As indirect evidence of the tonic inhibitor action of the normal vagal afferent stream, it has been shown (King, *et al.*,² and Kaufman⁴) that where respiratory rhythms are evident in continuously elicited reflex contractions, vagotomy or vagal block accentuates these respiratory rhythms.

In a previous paper (Kaufman⁴) it has been shown that the blood pressure changes incident to alternate vagal blocking and deblocking in animals deeply anesthetized with morphine-urethane have no effect directly or reflexly through the pressoreceptor mechanism on the reflex contractions of the tibialis anticus muscle.

It is concluded that the normal afferent vagal stream can reflexly inhibit reflexes of somatic musculature and that the degree of this inhibition varies from animal to animal.

⁴ Kaufman, W., in press.