to be considered, but in addition the type of feedback can vary under the influence of motor discharge to the intrafusal muscle bundle with decisive influence on the characteristics of the servo. For example, the symptoms of spasticity might be due not, as Hughlings Jackson thought, to overactivity of the spinal cord consequent on its release from higher control, but to mere lack of control over the response of the muscle spindles—a notion which emphasizes our almost complete ignorance of the central connexions of the motor nerve fibres going to the spindles, although in number they are a large proportion of the total[4].

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[1] Matthews, B. H. C., *J. Physiol.*, **72**, 153 (1931).
[2] Matthews, B. H. C., *J. Physiol.*, **78**, 1 (1933).
[3] Fulton, J. F., and Pi-Suñer, J., *Amer. J. Physiol.*, **83**, 554 (1928).
[4] Leksell, L., *Acta Physiol. Scand.*, **10**, Supp. 31 (1945).

Effect of Indole and some Indolic Compounds on Muscle Sensitivity to Acetylcholine and Potassium

AMONG the indolic compounds formed from tryptophane in animal intestine, indole, skatole and indolethylamine are those reported to have the strongest pharmacological action. Their effect on plain or striated muscle has been studied in the past, either *in vivo* or in the isolated organs, although with no clear and consistent results[1-5]. More recently, Torda and Wolff[6] have examined the effect of indole, skatole, indole-3-acetate and tryptophane on the sensitivity of frog striated muscle to acetylcholine and potassium, finding that only indole increases the response to acetylcholine, while indole, skatole and indoleacetate increase the potassium effect. Since the presence in the bowel of indole and allied compounds seems to be a normal fact[7], and that the intestinal membrane can absorb and fix significant amounts of indole[8], and presumably other indole compounds as well, it seemed interesting to study their effect on the intestinal smooth muscle, as it might have implications in regard to the alterations of intestine motility.

Stimulant	Inhibitor	Per cent diminution of shortening
1·1 μgm. AcChol.	$2·0 \times 10^{-4}$ *M* indole	17·2 ± 1·4*
3·0 mgm. KCl	$1·2 \times 10^{-4}$ *M* ,,	7·4 ± 1·1
1·2 μgm. AcChol.	$1·1 \times 10^{-4}$ *M* skatole	54·4 ± 2·6
3·0 mgm. KCl	$1·1 \times 10^{-4}$ *M* ,,	53·0 ± 3·9
3·0 mgm. KCl	$1·5 \times 10^{-4}$ *M* indole	10·4 ± 1·8
3·0 ,, ,,	$4·2 \times 10^{-5}$ skatole	15·0 ± 0·3
3·0 ,, ,,	Indole plus skatole	30·0 ± 1·4
5·0 μgm. AcChol.	$1·8 \times 10^{-1}$ *M* indole	12·8 ± 2·9
5·0 ,, ,,	$2·7 \times 10^{-5}$ *M* skatole	13·8 ± 2·9
5·0 ,, ,,	Indole plus skatole	31·4 ± 2·0

*Probable error (see ref. 9).

Diminution (average of three to five experiments) produced by the inhibitor on the shortening of the muscle induced by acetylcholine (AcChol.) or potassium (KCl). Contractions in the presence of the inhibitor have been considered only when intercalated between two control contractions of the same height. Terminal portion of guinea pig ileum immersed in 18–22 ml. Tyrode solution, saturated with oxygen containing 5 per cent carbon dioxide at 38°. The amount of the muscle contraction was registered on a kymograph by an isotonic lever and measured

With a technique similar to that employed by Torda and Wolff[6], we have studied the effect of indole, skatole, potassium indoxylsulphate, indoleacetate, indolethylamine, indolepropionate and L-tryptophane on the sensitivity to potassium and acetylcholine of the terminal portion of the guinea pig ileum and, for comparison, the frog (*Leptodactylus ocellatus* (L.) Gir.) anterior rectus abdominis. When using the striated muscle we have been able to confirm Torda and Wolff's results; but with the smooth muscle the effect of the indolic compounds was completely different. As it is shown in the accompanying table, which reproduces typical experiments, relatively small concentrations of skatole and indole, which *per se* do not affect significantly the tonus or contractility of the intestine, diminished the shortening induced by potassium or acetylcholine. The inhibition was reversible, and required for its full development about 5–10 min. incubation of the intestine with the inhibitor. The pI_{50} ($-\log_{10}$ molarity producing 50 per cent inhibition) of indole and skatole were 3·3 and 4·0 respectively, with acetylcholine as stimulant. The relaxation of the intestine when contracted by acetylcholine alone was also affected by indole and skatole, proceeding in the presence of the inhibitors at a slower rate, and in some experiments the muscle remained in the contracted state. When acting together, indole and skatole added their effects either on contraction or relaxation. Indolethylamine slightly increased the effect of acetylcholine on smooth muscle, while indoxylsulphate increased the effect of potassium on the striated muscle. Indoleacetate, indolepropionate and L-tryptophane did not modify the effect of potassium or acetylcholine on the guinea pig ileum when tested in concentrations near or higher than those used for indole and skatole.

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[1] Yanai, B., *Tohoku J. Exp. Med.*, **25**, 385, 401, 407 (1935).
[2] Waddell, J. A., *J. Pharm.*, **31**, 205 (1927).
[3] Ets, H. N., and Feinberg, I. M., *Amer. J. Physiol.*, **136**, 646 (1942).
[4] Garcia Blanco, J., del Castillo, J., and Rodeles, J. F., *Rev. Soc. argent. Biol.*, **17**, 473 (1941).
[5] Guggenheim, M., and Löffler, W., *Biochem. Z.*, **72**, 303 (1916).
[6] Torda, C., and Wolff, H. G., *Amer. J. Physiol.*, **145**, 608 (1945).
[7] Alvarez, W. C., *Physiol. Rev.*, **4**, 352 (1924).
[8] Nicolai, H., *Klin. Wschr.*, **21**, 108 (1942).
[9] Crumpler, T. B., and Yoe, J. H., "Chemical Computations and Errors" (London: Chapman and Hall, Ltd., 1940).

Physiological Action of the Toxin of the Egyptian Scorpion

THE main physiological effects produced by the toxin of the Egyptian scorpion[1] are: (1) inhibition of rabbit smooth muscle; (2) acceleration of the isolated rabbit and frog heart (antagonized by ergotoxin); (3) rise of blood pressure of the dog (reversed by ergotoxin); (4) vomiting, and contraction of intestine and bladder of rabbit and dog in the intact animal (antagonized by atropine).

In considering whether the toxin acts as a stimulator of sympathetic nerve endings, a study has been made of the effect of the toxin on the blood-sugar levels of normal and immune animals. Using the method of Hagedorn and Jensen, it was found that