

THE ACTION OF MENISINE AND MENISIDINE ON AMPHIBIAN SKELETAL MUSCLES

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Menisine, $C_{19}H_{22}O_3N$, and menisidine, $C_{36}H_{41}O_6N_2$, were isolated from Mu-fang-chi by Chou in 1935. Chen and Chou [1937] found that these two alkaloids depress cardiac activity, lower blood pressure, and produce primary stimulation followed by depression and paralysis of smooth muscles. They also observed that "fatal doses of menisine and menisidine induce paralysis of limbs in frogs before cardiac arrest." This observation forms the point of departure of the investigations reported in the present paper. We wish to find out whether this paralysis of the limbs of an amphibian is due to the action of these two alkaloids on the nervous system or to that on the muscle.

EXPERIMENTAL

Action on muscle.

In a series of experiments, we tested the action of menisine and menisidine on isolated skeletal muscle of toads (*Bufo bufo asiaticus*). In each experiment the two sartorii with their nerves were prepared, one being used for the test while the other immersed in Ringer solution was kept as a control and also for a second test. The tested muscle was alternately stimulated directly and indirectly with a condenser discharge delivered through silver-silver-chloride electrodes. The pair of electrodes for direct stimulation was placed in contact with the pelvic nerve-free end of the sartorius. The contraction of the muscle was recorded isotonicly. One direct and one indirect stimulation were given every minute. A 0.1 to 0.5 per cent solution of the hydrochloride

of menisine or menisidine in Ringer fluid was dropped on to the muscle after 5 to 10 pairs of normal records were obtained. Then, after each pair of stimulation, the muscle was bathed with drops of menisine or menisidine-Ringer while the nerve was painted with Ringer alone. Care was taken to prevent the drops of fluid from accumulating between the electrodes. In such experiments we found (*a*) that both menisine and menisidine gradually abolish the response of the sartorius to both direct and indirect stimulation; (*b*) that the response to indirect stimulation was abolished sooner than that to direct excitation; and (*c*) that menisine and menisidine produced no contracture of the muscle (see fig. 1).

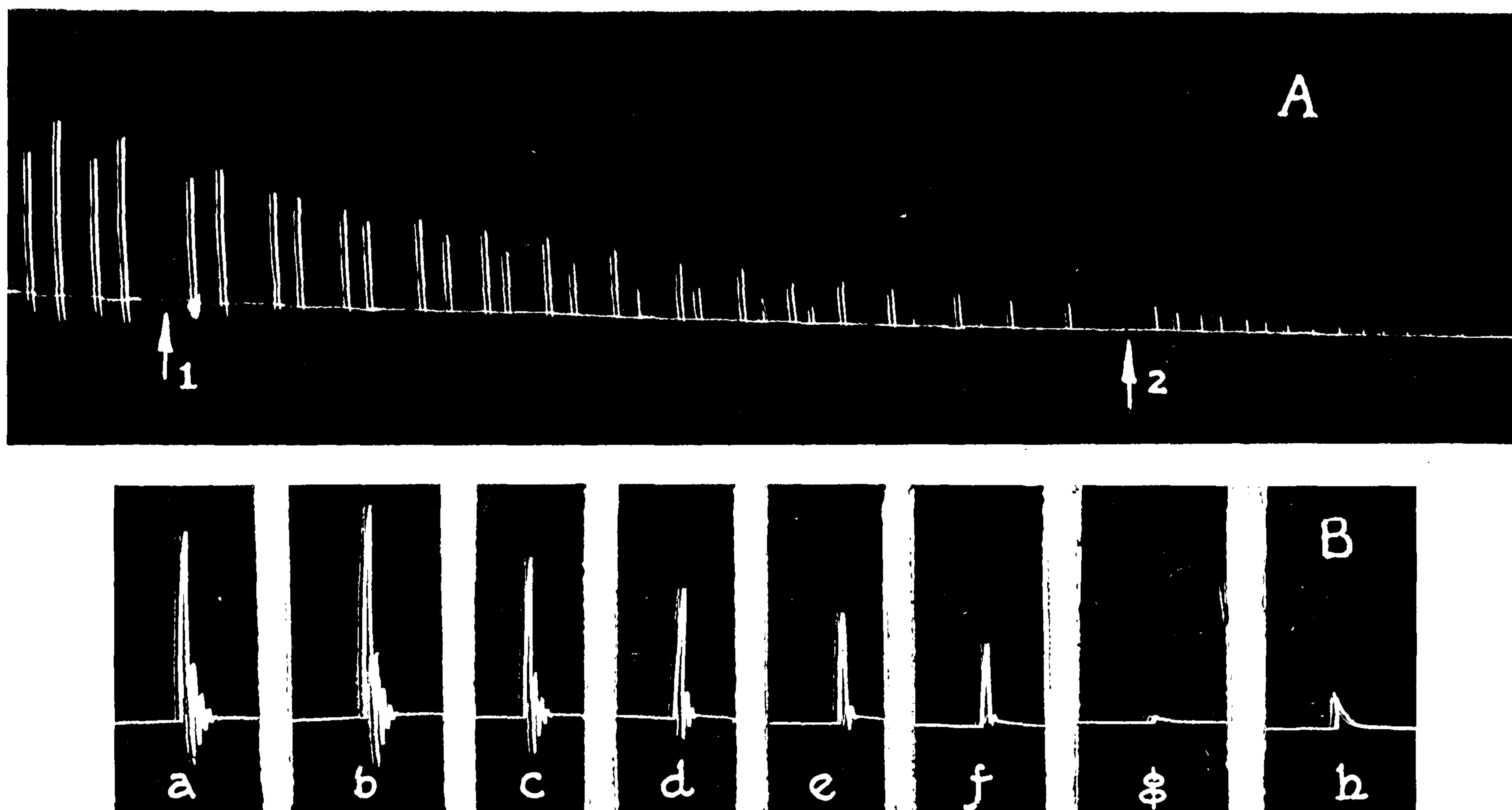


Fig. 1. A. Showing the order of disappearance of responses to direct and indirect stimulation after the application of menisine hydrochloride to the muscle. A pair of first direct and then indirect stimulation every minute with a condenser discharge (22 v., $0.05\mu F$). Two pairs of records of normal responses to direct and indirect stimulation are shown in this figure. (1) shows the commencement of application of 0.5 per cent menisine hydrochloride in Ringer solution to the muscle. After (2) only direct stimulation is used.

B. Showing the same phenomenon after the application of menisidine hydrochloride to the muscle and also the absence of contracture.

a (direct stimulation) and *b* (indirect stimulation) before the application of 0.5 per cent menisidine hydrochloride in Ringer solution to the muscle. *c-f* (indirect stimulation) at 1, 2, 3 and 4 minutes after the application of the alkaloid. *g* (indirect stimulation) at 14 minutes after. *h* (direct stimulation) at 15 minutes after. Direct and indirect stimulation by a condenser discharge (10 v., $0.05\mu F$).

The time interval between the first application of the alkaloid and the complete paralysis of the muscle varied according to the size of the muscle and the concentration of the alkaloid used. Small muscles were paralysed sooner than large ones. With muscles of approximately the same size, large concentrations of menisine or menisidine paralysed the muscle in a shorter interval of time. With the concentration used in these experiments, we did not observe any case of recovery of response to either direct or indirect stimulation after bathing the poisoned muscle for several hours in Ringer solution.

Action on nerve

In a few experiments, we painted the nerve with menisine- or menisidine-Ringer and the muscle with Ringer alone, and observed no change in the response of the muscle to indirect stimulation.

Conclusion.

It is evident from the results mentioned in the preceding paragraphs that the paralysis of the limbs of amphibians caused by menisine or menisidine is due to the action of these two alkaloids on the muscle fibres.

SUMMARY

Application of menisine or menisidine to the sartorius of the toad abolishes first its response to indirect stimulation and then that to direct excitation, while application of these two alkaloids to its nerve produces no change.

LITERATURE

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木防己素甲及木防己素乙對於 兩棲類骨骼肌之影響

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一九三五年趙氏從木防己提出兩種植物鹼，木防己素甲及木防己素乙。陳氏及趙氏又發現此兩種植物鹼之致死量，先使蛙四肢痲痺，繼則心臟停息。現在之實驗欲證明此兩種藥物使蛙四肢痲痺，究為對於神經系統之影響，抑為對於肌肉之影響。

本實驗所用之動物為蛤蟆。結果：塗此兩種植物鹼於蛤蟆縫匠肌上以後，該肌肉無論對於直接的或間接的刺激，均失去反應之機能。若只將藥物塗於該肌肉之神經上，而肌肉之反應，則毫無影響。