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The Action of Ephedrine on Melanophores.

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Nadler¹ found that in the squid, *Loligo pealii*, ephedrine injected subcutaneously, produced a local blanching which was considered as due to an inhibition of the smooth muscle of the chromatophore system and a generalized reddish coloration ascribed to a stimulation of the central nervous system. These experiments have been repeated on several other kinds of fish, namely *Cyprinus rubrofasciatus*, *Mylopharyngodon aethiops*, *Cyprinus abbreviatus* and *Ophiocephalus argus* and they all responded by a generalized paleness. Examination of the scales showed that all the melanophores were contracted. One fish remained in such state for 36 hours. It appears therefore that, in the fresh water fish studied, ephedrine does not exert a double action, or both the peripheral and the central actions bring about a similar change, namely contraction of the black pigment cells. Experiments with adrenalin appear to substantiate the latter view, since this drug caused only a local blanching and no generalized paleness of the scales.

The generalized contraction of the melanophores caused by ephedrine has been found to be true also in the frog, *Rana nigromaculata*. Injection into the dorsal lymph sac of 20 mg. per kilo caused the skin of the frog to remain pale for 6 hours.

Other observations on small, salt water fish, *Trigentiger bifasciatus* and *Microcanthus serrus*, with a few drops of ephedrine solution added to the surrounding sea water showed in a minute or even less a generalized blanching and the melanophores began to contract. The contraction gradually became more marked and in 15 to 20 minutes most of the black pigment cells contracted to their minimal sizes. This contraction of the melanophores usually lasted from one half hour to 2 hours, after the fish had been transferred to ordinary sea water, depending upon the time of the previous immersion in the ephedrine-sea water. Adrenalin in sublethal dose produced little or no such effect.

That there is a local action of the ephedrine is further supported from the experiment by Barbour and Spaeth² with isolated scales of *Fundulus heteroclitus*.

¹ Nadler, J. E., *Chinese J. Physiol.*, 1927, **1**, 271.

² Barbour, H. G., and Spaeth, R. A., *J. Pharmacol. and Exp. Therap.*, 1917, **9**, 356.

The findings obtained with isolated fish scales of fresh water fish with the drugs other than ephedrine and pseudoephedrine were essentially the same as those obtained by Barbour and Spaeth,² except pilocarpine, which showed a contraction instead of expansion and, in the case of *Ophiocephalus argus*, expansion with BaCl₂ and contraction with pituitrin instead of contraction and expansion respectively. This difference might be peculiar only to certain fish.

The degree of contraction or expansion of the individual cells and the number of cells undergoing either of these changes varies with the time of immersion and the drug used, some having a much quicker action than others. Table I illustrates the point.

TABLE I.
Isolated scale of Mylopharyngodon aethiops.

	2 min.	5 min.	10 min.	30 min.	1 hour	2 hours
Ephedrine 0.1%	2 C	3 C	4 C	4 C	4 C	3 C
„ 1.0%	1 C	2 C	2 C	2 C	4 C	4 C
Pseudoephedrine 0.1%	2 C	2 C	1 C	1 E	2 E	3 E
„ 1.0%	1 C	1 C	1 E	4 E	4 E	4 E
BaCl ₂ 0.1%	1 C	1 C	2 C	2 C	3 C	3 C
„ 1.0%	1 C	2 C	3 C	3 C	4 C	4 C
Pituitrin	B	1 E	2 E	2 E	3 E	3 E
Adrenaline 1:10,000	2 C	4 C	4 C	4 C	4 C	4 C
NaCl	2 E	2 E	4 E	4 E	4 E	4 E
KCl	2 C	4 C	4 C	4 C	4 C	4 C
Water (distilled)	1 C	1 C	2 C	3 C	4 C	4 C

E denotes expansion, C contraction, B balanced, and the figure in front of the letter the extent of contraction or expansion, 4 being maximal.

I have also repeated Spaeth and Barbour's experiment³ with ergotoxine and found that it reversed the action of ephedrine. Spaeth and Barbour obtained a similar effect with adrenalin. They assume that ergotoxine acts on the myoneural junction. If so, then the site of action of ephedrine on the isolated melanophores is at the myoneural junction also.

With atropinization it was found that the melanophores still contract toward ephedrine even when the scales were previously treated with atropine. This action again is similar to that of adrenalin.

³ Spaeth, R. A., and Barbour, H. G., *J. Pharmacol. and Exp. Therap.*, 1917, **9**, 431.