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A NOTE ON INTERACTION BETWEEN NERVE FIBRES

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It has previously been shown [see Katz & Schmitt, 1939, 1940 for details of problem and methods] that the passage of an impulse in a single nerve fibre of *Carcinus* (fibre I) is accompanied by a triphasic excitability change consisting successively of a fall, a rise, and a second fall of excitability in an adjacent fibre (fibre II). These changes were attributed to that part of the action current which penetrates the resting fibre and which reverses in direction twice as does the excitability change. Recently, Blair & Erlanger [1940] have raised the question whether those changes may not, to some extent, have been due to a resistance decrease of the active fibre [cf. Cole & Curtis, 1939]. It is conceivable, as they point out, that the active region of fibre I may provide a more effective shunt for the test stimulus and so cause an apparent fall in excitability of fibre II, possibly masking or preceding an excitability rise due to the action current.

In the case of two *Carcinus* fibres the question can be decided as follows. Consider the arrangement of Fig. 1*a*. The test shock is applied at *C* and *D*, with cathode at *D*. A depression of excitability due to more effective shunting would occur as soon as the impulse reached the interpolar stretch *CD*. The latency of this effect, therefore, depends upon the position of the anode *C*. On the other hand, changes due to penetrating action currents occur only when the impulse reaches the cathode *D* and are independent of the position of the anode.

Thus it is possible to distinguish between the two effects by interchanging the positions of electrodes *C* and *E* (anode and grid respectively). If the threshold rise in Fig. 1*a* were largely due to a shunting effect, then a major part of it should be delayed by at least 0·5 msec. (minimum conduction time for distance *CD*) in the case of Fig. 1*b*. As a consequence there would be an increased interference with the

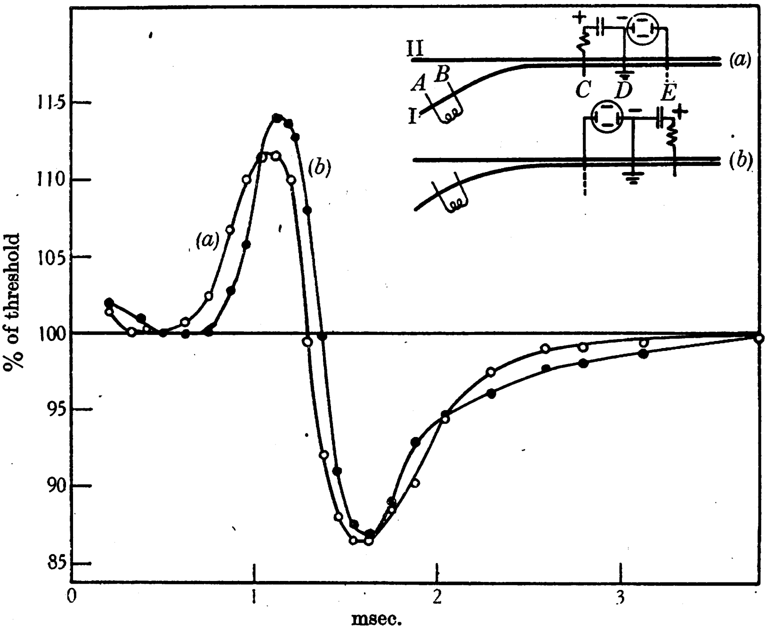

Fig. 1. Excitability changes in fibre II. Two *Carcinus* axons, at 19·5° C. Inset showing electrode arrangement. I and II, active and test fibre respectively. *AB*, stimulating leads to fibre I, *CDE* leads for test stimulus (cathode at *D*) and recording (earth at *D*). (*a*) and (*b*) are identical except that positions of test anode and grid lead (*C* and *E*) are interchanged. Distances *CD* and *DE* about 3 mm. Ordinates: threshold strength of test shock in percentage of normal. Abscissae: time interval between conditioning shock (applied at *AB*) and test shock, in msec. The small change during the first ½ msec. is due to interaction between the two stimulating circuits. This is followed by a diphasic excitability change; the third phase previously described was not observed in this case [cf. Katz & Schmitt, 1940, p. 475].

TABLE 1

	Peak time after first shock in msec.		Peak size in percent of normal threshold	
	(*a*)	(*b*)	(*a*)	(*b*)
Threshold rise	1·08	1·13	112	114
Threshold fall	1·61	1·63	86·5	87

opposite phase of threshold lowering: a much smaller initial rise of threshold would, therefore, be expected in Fig. 1*b*. These expectations, however, are not borne out by experiment (Fig. 1 and Table 1). The excitability changes remain essentially unaltered after reversal of electrodes *C* and *E*. The first phase, while delayed by about 0·1 msec., is actually somewhat larger than in Fig. 1*a*. The small delay must, in part at least, be attributed to the fact that, by reversal of electrodes *C* and *E*, the position of the cathode is moved effectively across the width of the contact *D* (150μ wire + droplet of saline giving a width of 0·2–0·3 mm.). It appears, therefore, that the impedance change in the active fibre is not large enough to alter appreciably the efficacy of the test stimulus and that transverse action currents, as previously explained, are mainly or solely responsible for the observed excitability changes.

SUMMARY

Further evidence is brought forward to show that the passage of an impulse in a single nerve fibre of *Carcinus* is accompanied by a genuine change of excitability in an adjacent fibre. The suggestion of Blair & Erlanger [1940] that the apparent change of excitability might be due to a change of resistance in the active fibre will not account for the observations here described.

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