Isolated Nerve-Muscle Junction

A SINGLE muscle fibre with its nerve supply (Fig. 1) has been dissected from the M. adductor longus of the frog (*Hyla aurea*). This preparation survives for as long as twenty-four hours at a temperature of 18–20° C., and electric potential changes have been recorded from some twenty of these isolated nerve-muscle junctions during activity. In most experiments the muscle fibre was kept in saline at a paraffin interface while the nerve was lifted into the paraffin and stimulated there. A 50-μ diameter platinum wire served as leading electrode at the junction and was insulated except where it made contact with the muscle fibre. It was moved to different positions along the muscle fibre by means of a micrometer adjustment. The second leading electrode was in the saline below the fibre and acted thus as a diffuse lead.

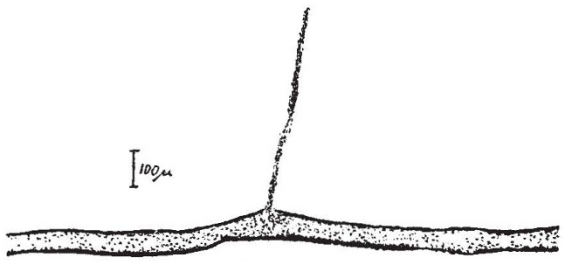

Fig. 1.

PHOTOMICROGRAPH OF A SINGLE MUSCLE FIBRE WITH NERVE SUPPLY.

A single stimulus to the nerve gives a propagated spike along the whole muscle accompanied by a contraction. Fig. 2*a* shows an action potential 0·23 mm. away from the nerve entry. Two components of the rising phase are seen; the larger and steeper one *s*, the muscle spike, which stays constant along the whole length of the muscle fibre, and an initial smaller component ε, which is only recorded near the motor end-plate (the end-plate-potential (e.p.p.), cf. Eccles, Katz and Kuffler[1]). At 150μ nearer the nerve entry (Fig. 2*b*) the e.p.p. rises much more steeply, reaching about 65 per cent of the action potential before the spike appears. With a further shift of 80μ to the nerve entry (Fig. 2*c*) the e.p.p. is so large that the spike component is barely seen rising above it. Indeed by careful adjustment the e.p.p. becomes so large that no phase of spike rise is observed. Curarization (Fig. 2*d*) diminishes the e.p.p. and the spike is delayed but not altered appreciably in total height. Below a critical e.p.p. height (Fig. 2*e*) no spike is set up and the e.p.p. alone is recorded.

Thus it can be shown that a nerve impulse gives rise at the nerve-muscle junction to a localized negative potential change as large as the muscle spike potential. This potential, in its turn, sets up the muscle spike. It decrements rapidly along the fibre and falls to about 20 per cent at a distance of 0·25–0·35 mm. from the neuro-muscular junction.

Early in the refractory period, a second nerve impulse sets up only an e.p.p. (similar to the e.p.p. in Fig. 2*e*); when later, a second muscle impulse is also set up but usually does not reach its full size until 0·5–0·8 mm. from the neuro-muscular junction. At times this impulse dies out after it has reached up to 30–40 per cent of the full spike potential and has propagated as far as 0·3–0·5 mm.

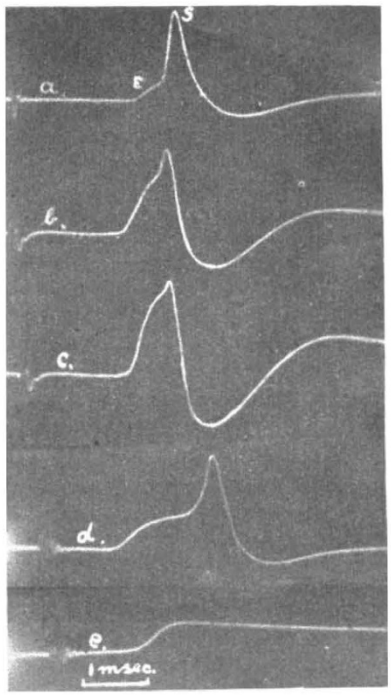

Fig. 2.

ACTION POTENTIALS. (*a*), 200μ AND (*b*) 80μ AWAY FROM THE NERVE-MUSCLE JUNCTION; (*c*) AT THE NERVE-MUSCLE JUNCTION; (*d*) SUBPARALYTIC DOSE OF CURARINE; (*e*) PARALYTIC DOSE OF CURARINE.

When recording in paraffin oil, action potentials up to 55 mv. have been obtained.

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Effective and Ineffective Association between Root-Nodule Bacteria and the Host Plant

IN a recent paper, Chen, Nicol and Thornton[1] present results from which they conclude that "the production as a result of infection of soluble substances affecting the growth of the bacteria affords an explanation of those differences in nodule growth that determine the effectiveness or ineffectiveness of the different strains of bacteria as regards nitrogen fixation within the host".

A closer examination of the data given in the paper fails to confirm the validity of this conclusion. Controls do not seem to have been adequate, and there is no information as to the nutrients supplied in the plant juices which were added to such a high concentration (18 per cent). These omissions are the more surprising since the authors, in explaining the variable nature of their results, state:

"Composition of the root juice is liable to be affected by the growing conditions of the plant and by details in the method of extraction and filtration that are very difficult to control."

Briefly, three levels of growths were obtained in the