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The response of single cells to electrical stimulation.

By R. A. SPAETH. (By invitation.)

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There is an accumulation of embryological, morphological and physiological evidence at hand showing that the melanophores of vertebrates are to be considered highly modified smooth muscles cells. By means of a simple recording device the responses of single melanophores of *Fundulus heteroclitus* to faradic and galvanic stimulation have been studied in some detail.

In faradic stimulation it appears that as regards the duration of the latent period, the quantity of current necessary to bring about a response in the cell, the increased height of the contraction curve with an increase in the strength of stimulus and the development of tetanus by properly spaced single break shocks, the contraction curves for a single melanophore show a striking resemblance to smooth muscle graphs obtained from the bladder of the cat (Stewart) and the stomach of the frog (Howell).

A constant current, which has previously been supposed to produce an expansion of the melanophores, causes a contraction when applied through non-polarizable electrodes of the Zn-ZnSO₄ type. An expansion of the melanophores may be produced by galvanic stimulation if platinum electrodes are used but this has been shown to be due to hydroxyl ions liberated at the cathode. Both the make and the flow of the constant current are effective contracting stimuli. With currents of moderate strength there is, at first, a rapid rise in the contraction curve due to the combined effects of make and flow but subsequently a partial falling off of the contraction giving a typical plateau. Stewart has found precisely the same conditions in the bladder of the cat. No response to the breaking of the constant current has thus far been observed in the melanophore.

The evidence obtained from these experiments with the responses of single melanophores to electrical stimulation, appears to strengthen and corroborate the writer's contention that in the

melanophore we are dealing with a modified and disguised type of smooth muscle cell.

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Characteristics of the precipitation reaction.

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In a previous communication I showed that when a chemically pure protein, such as crystallized egg albumin, is used as antigen, it combines with the precipitin of immune serum to the complete exhaustion of either factor from the mixture. From these observations the conclusion was drawn that an equilibrium subject to the laws of mass action, such as had been previously described in precipitation reactions, does not exist in these reactions, those results being attributable to the use of impure antigens, such as complex native sera. Further study has shown that chemically pure antigen unites with the precipitin in proportions that are definite and constant. The same amount of precipitinogen always "binds" an equivalent amount of precipitin, regardless of the relative excess of the latter substance in the mixture. The reverse of this statement likewise holds true. Hence it follows that it has not been possible to demonstrate the Danyz-Dungern phenomenon in the precipitation reaction when carried on with pure reagents. It appears likely, therefore, that the reaction conforms to the type of quantitative chemical reactions, and is not comparable to the adsorption phenomena exhibited by mutually precipitating colloids.