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Respiratory Activity of Grasshopper Embryo as Contrasted with Intact Egg

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respiration of actively developing eggs is profoundly depressed after centrifugation by forces ranging from 1500 to 400,000 times gravity. The respiration of blocked eggs (in a state of physiological quiescence of diapause) remains unaffected after centrifugation by forces of the magnitude indicated. Complete stratification of the egg contents occurs in all eggs, regardless of their physiological state, with rotational forces in excess of 1800 times gravity. Recovery of the eggs from the effects of centrifugation (as evidenced by hatching) occurs after exposure to dosages of 20,000 times gravity or less.

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RESPIRATORY ACTIVITY OF GRASSHOPPER EMBRYO AS CONTRASTED WITH INTACT EGG

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An attempt has been made to localize the important respiring components of the grasshopper egg and to estimate the relative respiratory intensity of each.

Prior to the process of blastokinesis or yolk engulfment, the differentiated embryo is responsible for only one-third of the oxygen uptake shown by the intact whole egg. This figure remains approximately the same in the blocked or diapause state, where development is at a standstill, as well as in pre- and post-diapause states where cell division and differentiation are actively occurring. Respiration of the whole egg in developmental states is 4 - 5 times greater than during diapause, and the same general difference in magnitude of O_2 uptake is exhibited by the embryos. In terms of unit mass of respiring material, the respiratory activity of the embryonic cells is 10 times greater than that of the extra embryonic material.

During blastokinesis the extra embryonic materials in the egg are engulfed by the embryo where they are gradually incorporated into differentiated embryonic structures. At the completion of this process the respiration of the embryo is the same as that of the intact egg. In the remaining days of development before hatching the embryos show an O_2 uptake in excess of that of the whole eggs. This is due to the fact that in such older embryos vigorous appendicular and abdominal movements are possible after the

embryos have been removed from the narrow confines of the egg membranes.

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THE ORDER OF EMBRYONIC DETERMINATION OF SEVERAL ORGANS IN MACROSIPHUM SOLANIFOLII

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Aphids in nature are normally either winged or wingless. However, it has been found that there also occur individuals which are intermediate in wing development: that is to say, some individuals have only partly formed wings and therefore are intermediate between the winged and wingless types. The production of large numbers of intermediate-winged aphids can be induced in the laboratory by artificial means such as certain combinations of light and temperature.

The author's studies indicate that the intermediate-winged individuals are the result of a change from winged to wingless as well as from wingless to winged. Histologically, the direction of change may be recognized by the condition of the wing muscles. Wing muscles of intermediates which resulted in a change from wingless to winged are normal histologically but reduced in amount, whereas wing muscles of those which resulted in a change from winged to wingless were degenerate in character. It appears possible, then, by environmental means, to bring about physiological changes which will reverse the direction of development; that is, a winged form can be changed into a wingless or vice versa. This change would seem, necessarily, to be due to environment rather than to genetical factors as the experimental aphids came from a parthenogenetical line in which there was only a minimum of opportunity for genetical variation.

The various intergrades of intermediacy produced by changing aphids from winged to wingless or wingless to winged made it possible to ascertain whether the several organs of intermediacy which included ocelli, wings, and wing muscles were determined all at one time or at different times in development. It was found that the wings, wing muscles and ocelli were determined in the embryo at different times. The order of physiological determina-