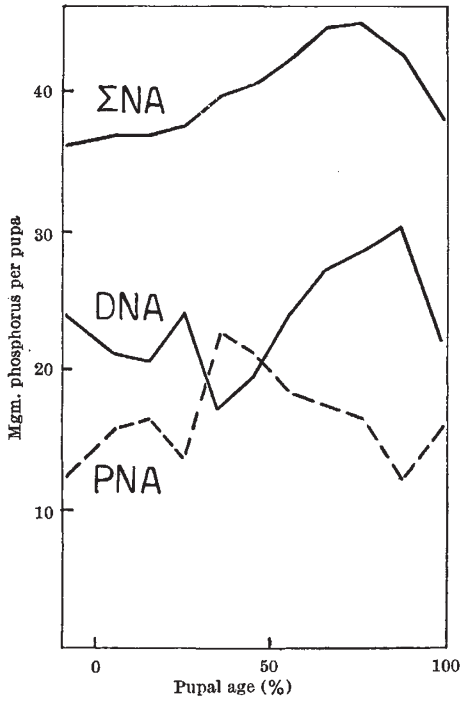
Nucleic Acid Metabolism during Insect Metamorphosis

THE transformation of the two nucleic acids, deoxyribonucleic acid and ribonucleic acid, one into the other has been postulated by Brachet[1], using developing sea urchin embryos as material for the investigation. Ribonucleic acid should be the precursor of deoxyribonucleic acid. These results have been questioned by Villee *et al.*[2] and Abrams[3], among others, who show that the amount of total nucleic acid phosphorus is not constant during development. Further, with the aid of phosphorus-32 and carbon-14 respectively, these investigators have demonstrated that the specific activity of deoxyribonucleic acid is much higher, up to fifteen times, than of ribonucleic acid. These results indicate that most of the deoxyribonucleic acid should arise from an endogenous precursor, which is not ribonucleic acid.

The insect pupa is a closed system in respect of nucleic acid metabolism. Moreover, metamorphosis is characterized by a profound histolysis of the larval tissues and a corresponding histogenesis of the imaginal organs. If there were any mutual interdependence of the two nucleic acids, this would be seen in such an organism. Therefore, investigations were carried out on the fly *Calliphora erythrocephala* (Meig.). As analytical method the phosphate fractionation devised by Ogur and Rosen[4] was used. The phosphorus determinations were checked by spectrophotometric readings at 2500 A.

As is clear from the graph, there is an obvious inverse relationship between the amounts of deoxyribonucleic acid and ribonucleic acid. Naturally this does not prove transformation from one acid to the other. However, it strongly suggests a mutual interdependence of the two nucleic acids as regards their synthesis.



Change in amount of deoxyribonucleic acid (*DNA*), ribonucleic acid (*PNA*) and total nucleic acids (*ΣNA*) during the metamorphosis period of *Calliphora*

There is an increase in total content of nucleic acid of about 25 per cent up to the point when histogenesis is almost finished. The phosphorus used seems to arise from the alcohol-soluble fraction. The final decrease is principally due to an increased decomposition of deoxyribonucleic acid during lysis of nuclei in the abdominal larval fat-body. The increase in amount of deoxyribonucleic acid during histogenesis is not only concerned with the growth of muscles in the thorax (cf. Agrell[5]). In the abdomen also there is an identical increase in deoxyribonucleic acid content, in spite of the fact that histogenesis processes are only very limited and consequently no increase in Feulgen-positive substance can be seen in this part of the body. It seems possible that deoxyribonucleic acid is synthesized in the cytoplasm of the abdominal fat-body cells in a form not detectable by the Feulgen reaction. The large cell granules of complex build could be the site of this process. The existence of cytoplasmic deoxyribonucleic acid has recently been shown to be probable by Zeuthen[6].

The inverse relationship in the amount of ribonucleic acid and deoxyribonucleic acid always shows the same course. However, the ratio of the two is remarkably different in different cultures of *Calliphora*; it varied from about 1·0 down to 0·4 in four experimental series of pupæ, all of which gave rise to normal imaginal flies.

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Progesterone in Body Fluids

A METHOD has been developed for the assay of progesterone by which as little as 4 μgm. of the hormone can be detected. It is based on the technique of extraction and partition between organic solvents[1] and subsequent separation and semi-quantitative estimation by chromatographic partition on filter paper[2]. The method has been used for the detection and semi-quantitative determination of progesterone in biological material. The results are summarized as follows.

Blood withdrawn directly from the ovarian vein of ewes contained progesterone in concentrations ranging from 0·5 to 2 μgm. per ml. (see table). On the other hand, all attempts to detect progesterone in peripheral blood were consistently negative, both in pregnant and non-pregnant animals, in mare, cow, ewe and sow, although the quantities of blood used for analysis ranged from 10 to 160 ml.; the blood analysed came mostly from the jugular vein (mare, cow, ewe and sow), occasionally also from the middle uterine artery and vein (ewe). No progesterone could be detected in blood from the caudal vena cava of a female rabbit seven days after ovulation.

In cases where progesterone was detected in blood, the residue left after extraction of the hormone was analysed for 'bound' or conjugated progesterone[3].