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(From the German Institute for Brain Research, Blackforest/Schwarzwald)

**The production of gonadotropin hormones by the ring gland  
by the first larval instar of *Drosophila***

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The consequence of the adult corpus allatum the cyclorrhaphous Diptera for ovary maturation was first discerned by THOMSEN (1940). So far we now know nothing about the role of the larval corpus allatum in the same group of insects. As is presently well known, the corpora allata of other insect orders has the important task of "inhibition of the metamorphosis" - that is, a prevention of the premature formation of adult characteristics. The proof of a similar metamorphosis-restraining effect of the larval corpus allatum of the cyclorrhaphous Diptera is so far still pending. Nevertheless, we are reminded of the fact that recently here (VOGT, 1943) found for the first instar larvae of both *Calliphora* and *Drosophila* acidophilic cells, which are already understood to be a histological indicator of physiological activity of the corpus allatum cells of this stage. A first step that would aid in the physiological insight would be if it were similarly uncovered for the early larval corpus allatum of this group of insects what Thompson uncovered for the adult and what I subsequently proved for the older larvae about the production of gonadotropin (1941). We would have with such ascertainment at least the first experimental proof for a hormone production also by the early larval corpus allatum and thus an essential condition for the acceptance of a metamorphosis inhibition by the latter.

In order to clarify this question, the following procedure was used. Two to three hours after eclosion of adult female *Drosophila hydei*, the corpora allata together with the corpora cardiaca and the hypocerebral ganglion were extirpated.

Because of the condition that the corpus allatum in *Drosophila* is of such small size, it cannot be extirpated alone, and it must be stressed that the operation is very difficult and connected with a high mortality. With finely sharpened tweezers the corora allata were pulled out with its attached organs into Ringer's solution and immediately after the operation checked for intactness, and only in such cases the females were kept for the further study.

Five days after the extirpation – with *D. hydei* at 25° C the first oviposition is found after four days – six ring glands (in these the central part constituting the corpora allata had formed), from 21 hours old larvae, i.e. at the first instar, were implanted into the middle of the abdomen of the same females. As a control, six brains (supraesophageal ganglia) of the same donor larvae or Ringer's solution were injected with the same capillary into the abdomen of likewise extirpated females. 48 hours later the ovaries of all females were examined. The results are summarized in the Table.

Table. Influence of implanted ring glands of the first instar larvae on the ovary maturation of females, from which the corpora allata was extirpated 5 days before. Dissection was two days after the implantation. 1 micrometer unit (M. E.) = 17. The length of the most mature egg was 32 M.E.

Study series number	Implanted Organ	Developmental stage of the ovary								n		
		Length of the largest oocyte in micrometer units						Ripe egg				
		0	1	2	3	4	5	6	without oviposition		with oviposition	
A	six ring glands of 21 hr old larvae									11 <sup>1)</sup>	6	17
B	six brains of 21 hr old larvae	1	4	8	3				1			17
C	-	4	6	12	5	1	1					29

First, the control series C, in which only Ringer's solution was injected, shows that 7 days after day extirpation of the adult corpora allata of the 2-3 hour old adult, the oocyte exhibited only the first beginning of yolk formation. We have hereby for the first time proof also for *Drosophila* that the ovary connected to the presence of adult gondotropic

<sup>1)</sup>The total number mature eggs amounted to in the individual females: 3, 20, 30, 35, 36, 40, 51, 55, 56, 57, 57.

hormones, as similarly found previously by THOMSEN (1940) for some muscids.

In contrast to this, the cases in which ring glands of the first larval stage were implanted (Series of A of the Table) always resulted in the formation of ripe eggs and in 6 cases also in oviposition. In the brain series (Series B), an influence upon the ovary was missing. We see thus further that the implanted ring glands of the first larval instar are already able to form gonadotropic hormones.

From the latter findings, are we now entitled to infer production of gonadotropic hormones by the early larval corpus allatum of *Drosophila*? This question may, in my opinion, be answered positively. One could object that the cells of the corpus allatum were not implanted alone, but together with the likewise hormone-producing remaining cells of the ring gland. Now it seems to me at this point, however, very improbable that the gonadotropic hormone formed by imaginal corpus allatum cells at early development stages may be formed by other cells that also differ clearly in their coloring material affinity.

I believe the correctness of this conclusion is able to be also supported by the following experiments. Into a group (A) of 5 days old extirpated females the two thigh ends not containing corpus allatum (VOGT, this same journal., in the press) of three ring glands of pupation-ripe larvae were implanted. Into another group (B) of likewise extirpated females were implanted the central, corpora allata containing, end piece of the upper transverse arch (VOGT, loc. cit.) of the same three ring glands. The total quantity of transplanted ring gland tissue was approximately twice as large in group A. Nevertheless, the outcome was that only 5 ripe eggs formed from 34 cases, while the latter was found in all 35 cases of group B (in 20 of the 35 cases it even reached to oviposition.) With the difficulty of the technology, which can lead easily to an imperfect extirpation of host corpus allatum or an incorrect sectioning of the ring gland, the 5 positive cases may probably be easily neglected in relation to the 29 negative cases. If this happens, then it thus arises that the ring gland thigh cells, and the corpora cardiaca cells likewise lain in the thigh ends, do not produce gonadotropic hormones.

If we seize however the test results described above as if proof for production of gonadotropic hormones by the early larval corpora allata, it naturally urges itself the following questions: Does this hormone not have also already a special meaning at early larval stages in normal development? Is it perhaps identical to what so far is the only metamorphosis-restraining hormone discovered in other groups of insects? Only the future will be able to bring an answer to these questions.

## References

- THOMSEN, E., 1940, Relation between Corpus allatum and ovaries in adult flies (*muscidae*). *Nature* (London) 145.
- VOGT, Marguerite, 1941, Weiterer Beitrag zur Ursache der unterschiedlichen gonadotropen Wirkung der Ringdrüse von *Drosophila funebris* und *Drosophila melanogaster*. *Naturw.* Berlin 29.
- 1943, Zur Kenntnis des larvalen und pupalen Corpus allatum von *Calliphora*. *Biol. Zbl.* 63.