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*Experimental Investigations on the Mero-
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(From the Institute of Comparative Anatomy and Experimental Zoology of the Latvian University, Riga. Director: N. G. Lebedinsky.)

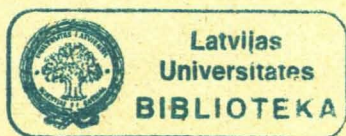
Experimental Investigations on the Merogeneous Somatic Induction.

By
V. Plesums.

Previous investigations have shown that with some agents it is possible to cause mutations and lasting modifications (Dauer-modifikationen). This is a proof that outer circumstances are capable of producing also genotypical changes in living organisms.

In the cases of direct induction, i. e. when the agent acts directly on the germ cells, there can be no doubt. Unexplained remains the nature of those experimental aberrations, where the agent acts directly on the somatic tissues only, or when it influences simultaneously the somatic as well as the germ cells. By this are meant chiefly the experiments of *Standfuss*, *E. Fischer*, *Tower*, *Dürken*, *Kühn*, and *Henkes* on insects as well as *Stieve's*, *Guyer's*, and *Smith's*, and many other investigations in this direction.

Especially in such cases where the direct parallelinduction does not come into the question there still remain two possibilities: 1) hologeneous somatic induction, i. e. when the general change of the somatic reaction influences the germ cells (*Dürken*, *Kammerer*) and 2) merogeneous somatic induction when the aberration is induced locally in some organ, and this fact becomes the cause of a corresponding induction in the germ cells. The latter case characterises Lamarckism; it is championed by *Simon*, and by *Dürken* it is also considered as a merogeneous induction which further on changes into a hologeneous one. While in the domain of experimental investigation several — though differently interpreted — examples of hologeneous induction may be indicated, the possibilities of merogeneous induction have not yet been thoroughly studied.



As the other branches of investigation have not yielded decisive facts, *Lamarck's* principle of inheritance in regard to the importance of variations acquired in the individual life for genotypical variations still remains to be proved or disproved.

The question might be elucidated by such experimental investigations in which the aberration were induced during the sensible period of development and by concentrating the outer agent only upon the corresponding organ, avoiding a direct induction in the germ cells and protecting also the remaining part of the organism against a direct influence of the agent. In the material chosen for this experiment the sensible period of the aberrant organ in question must be simultaneous with the development of the germ cells. Merogeneous induction would be proved beyond all doubt if the aberrant characters thus acquired showed also in the offspring.

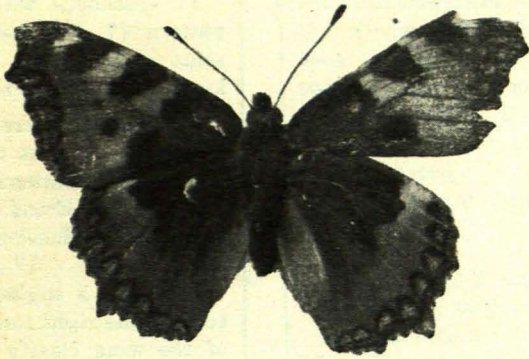
Guided by this idea my teacher, Professor *N. G. Lebedinsky*, suggested that I should undertake the experiments later described. The most convenient material are butterflies, for their wing-patterns are comparatively easily aberrantly influenced, the sensible period of the wing-patterns is short and simultaneous with the development of the germ cells. Up to now the difficulty lay in the finding out of a suitable method, as the experiments had been effected on chrysalids only totally.

Several methods of partial stimulation were tried until the experiments with ethyl chloride proved to be the most suitable for the purpose. The material chosen for the experiments was *Vanessa urticae* L.

In the summer of 1935 experiments were undertaken in order to obtain an aberration of the wing-pattern. In view of the sensible periods of these wing-patterns as described in 1934 by *W. Köhler* and *W. Feldotto* pupae at the stages of 1—12, 2—24, and 26—48 hours were chosen. One of the Anlagen of the wings in the pupa (the right one) was just once sprinkled with a thin trickle of chemically clean ethyl chloride. The ethyl chloride evaporating intensively, the besprinkled spot freezes. The time of the exposure to the action of the stimulous was approximately 30 seconds. All the rest of the time the pupa remained placed in vessels covered with nets, in normal circumstances, at a temperature of +20 — +25°C.

The imagines emerged from the pupae of the 1—12 and the 2—24 hours' stage gave positive results. Several butterflies showed a peculiarly good aberration of the marking on the right

forewing, the most characteristic change being that the twin black spots on the upper surface of the wing had entirely disappeared. The rest of the wing-pattern was normal, only the remaining black elements of the marking had become in some degree diffuse, not so sharply defined. The scaliness was somewhat slighter, the wing itself in most specimens a little narrower in shape (see figure). The marking on the under surface of the forewing was normal; the hindwing showed also normal marking, colouring, and shape. The left-side wings were normal in all specimens, with well defined black twin spots.



Vanessa urticae L. An aberration in the pattern of the right forewing. Produced by freezing with ethyl chloride. There are no black twin spots.

As to number, this aberrant form could be obtained in 5% of the specimens used for experimental purposes. Of the remainder 70% were normal or showed only a slight diffusedness of the elements of the black pattern and a slighter scaliness on the right forewing, 20% exhibited a crippled right forewing, especially the inner edge being shrivelled or even quite undeveloped, so that the twin spots were not discernible and the nature of the aberration could not be defined.

It must here be said that the disturbances in the development that cause crippling are not to be confounded with the deviation which produces aberration. In a few cases of severe crippling of the forewing the hindwing was also injured, but its pattern and colouring were normal in all cases. The mortality amounted to 5%; one half of these insects perished soon after the experiment; in the other pupae there were found normally developed butterflies, but with still greater defects in the area of the rudiment of the right wing; the wings had not developed at all.

Vanessa urticae L. Experiments with Ethyl Chloride, Summer 1936.

Freezing of the rudiment of the right wing in the pupa by one besprinkling with ethyl chloride.

Group & number of pupae	Date of change into pupae	Age of pupae under experiment	Date of emerging of the imagines	Number of imagines	Results
I. gr. 17 specimens	from 17, VI, 8 o'clock till 18 th VI. 8 o'clock	2—26 hours	25. VI.	14.	11 specimens with normal wing-pattern (7 ♂♂ and 4 ♀♀); only some of them with a fainter marking of the forewing. 2 ♀♀ with severely injured right forewings, so that the wing-pattern cannot be distinguished; in the region of the front edge dark gray colour discernible. Hindwings normal.
			26. VI.	2	1 ♂ with a slightly injured inner edge of the right forewing; marking of the wing clearly discernible; no black twin spots (on the left side they are well pronounced); the yellowish brown ground is darker; the remaining black spots and the band of the outer edge somewhat diffuse, but not larger. 1 ♀ with a normal wing-pattern. 1 ♀ with a strongly defective right forewing and also a slightly injured hindwing. 1 pupa perished — the butterfly had normally developed excepting the rudiment of the right wing which had not developed at all.
II. gr. 23 specimens	18. VI. 8 o'clock till 19. VI. 8 o'clock	2—26 hours	26. VI.	17	*) 14 specimens with normal wing-pattern (5 ♂♂ and 9 ♀♀) 1 ♀ with a slightly narrower right forewing without black twin spots; otherwise the marking and the colouring of the wings are normal, as is also the hindwing.

*) The ♀ was taken for pairing experiments, which produced normal offspring (see text).

Group & number of pupae	Date of change into pupae	Age of pupae under experiment	Date of emerging of the imagines	Number of imagines	Results
III gr. 16 specimens	19. VI. 8 o'clock till 20. VI. 8 o'clock	2—26 hours	27. VI.	5	2 ♂♂ with defective right forewings.
					3 specimens (♂♂) with normal marking of the wings.
			27. VI.	2	2 specimens with strongly defective right forewings, weak; though the wings straightened the insects soon perished. Normal wing-pattern in such places where injuries did not prevent their being seen.
			28. VI.	11	1 pupa perished, the butterfly had not developed.
					1 ♂ and 1 ♀ with normal wing-pattern.
					5 spec (2 ♂♂ and 3 ♀♀), with normal wing pattern.
					3 spec. with a fainter marking on the right forewings (2 ♀♀ and 1 ♂).
IV. gr. 27 specimens	22. VI. 10 o'clock till 23. VI. 10 o'clock	2—26 hours	29. VI.	1	*) 3 ♂♂ with a strongly defective right forewing, otherwise normal.
			2. VII.	21	1 ♂ with normally developed wings, 2 pupae perished; one of them contained a normally developed butterfly, excepting the right wing that had retained its rudimental form.
					9 spec. (5 ♀♀ and 4 ♂♂) normally developed, 5 spec. (4 ♀♀ and 1 ♂) with a fainter scaling of the right forewing, pattern normal. 6 spec. (4 ♀♀ and 2 ♂♂) with greater or slighter defects of the right forewing, the pattern being not entirely distinguishable, the region of the twin spots not discernible.

*) One specimen was taken for pairing experiments, which produced normal offspring (see text).

Group & number of pupae	Date of change into pupae	Age of pupae under experiment	Date of emerging of the imagines	Number of imagines	Results
			3. VII.	6	<p>nible, black spots on the front edge slightly diffuse. One butterfly soon perished. 1 ♀ with a slightly injured right forewing, absence of twin spots clearly visible.</p> <p>3 spec. (2 ♂♂ and 1 ♀) normal. 2 ♂♂ with severely injured right forewings: one of them showed also a slightly injured hindwing. Pattern normal. 1 ♂ with a somewhat narrower right forewing with no black twin spots; the dark band of the edge slightly diffuse, darker, indistinct; the other wings show normal marking.</p>

In the experiments with pupae taken at a later stage, especially at that of 26—48 hours, no aberration in the marking of the wing was ascertained. The imagines that emerged from these pupae were either quite normal or showed a mechanical crippling of the corresponding wing. For this reason only pupae of the stage of 2 to 26 hours were used for the experiments which followed in the summer 1936. The results obtained were similar to those above described (see table).

As regards the progress of the development of the pupae it must be stated that the pupae remain mobile during the action of the ethyl chloride, no general «lethargic» condition was observed. The duration of the pupa stage equals that in normal circumstances of development, not being perceptibly lengthened as it is in the cases of total exposition.

In the summer of 1936 pairing of specimens of the aberrant forms succeeded only in one instance, ♀ having a typically aberrant right forewing without black twin spots, and ♂ a defective right forewing, so that only the front edge with the normal marking could be seen, the black elements being slightly diffuse and the marking fainter, while the inner edge with the twin spots had not developed and the nature of the aberration could not be defined. From the eggs 30 caterpillars hatched and were kept in normal

circumstances during the whole period of development. 29 of them changed into pupae and one perished of a caterpillar disease. The imagines were all normal. The wing-pattern was similar on both sides, the twin black spots on both forewings were also similar and varied within the usual limits.

In view of the small number of offspring and the indistinct characteristics of δ these results cannot be regarded as decisive in the question of merogeneous induction, but further experiments intended by me promise to bring out important facts for the elucidation of the problem. The chief aim of this preliminary note is to make known the very simple and convenient method of induction above described.

Eksperimentāli pētījumi par merogeno sōmatisko indukciju

V. Plēsums.

Minētā jautājuma atrisināšanai autore cenšas eksperimentāli iegūt aberrātīvu formu, ārējam kairinātājam iedarbojoties tikai uz attiecīgo sōmatisko organu, ar ko ir izslēgta direktā dzimumšūnu indukcija un pasargātas arī pārējās organisma daļas no tiešās kairinātāja iedarbības. Eksperimenta materiāls jāizvēlas tāds, kur aberrātīvi ietekmējamā attiecīgā organa sensiblais periods sakrīt ar dzimumšūnu jūtīgo periodu. *Standfuss'a*, *E. Fischer'a* un citi eksperimenti rāda, ka tāds materiāls ir tauriņi.

Mēģinājumi izdarīti ar *Vanessa urticae* L. Kūniņas 2—26 stundu stadijā, labais spārnu aizmetnis vienreizīgi apšļakts ar smalku chloretila strūklu (apm. 30 sek.). Pati kūniņa visu laiku paliek kustīga. Daži no šīm kūniņām iznākušie imagines (ap 5%) uzrāda aberrātīvu labā priekšspārna rakstu. Spārna virspusē pilnīgi izzuduši melnie dviņu laukumi; bez tam vērojams vēl neliels pārējo, normāli novietoto melno raksta elementu izplūdums, vājāks zvīņojums un parasti arī pats spārns mazliet šaurāks. Pakalšpārns krāsas un formas ziņā normāls, tāpat kreisās puses priekš- un pakalšpārns. Pārējie 70% normāli, 20% ar kroplu labo priekšspārnu un apm. 5% kūniņas nobeidzas. Kūniņas stadijas ilgums normāls, nav ievērojami pagarināts.

No pārøšanas mēģinājumiem izdevies viens. ♀ jemta ar tipiski aberrātīvu labo priekšspārnu, uz kuŗa nav melno dviņu laukumu un ♂ kam chloretila iedarbības sekas ir labā priekšspārna defekts — neattīstīta spārna iekšmala, ieslēdzot arī melno dviņu laukumu apvidu, tā kā aberrācija nav nosakāma. Pārøšanas rezultātā iegūti 29 normāli pēcnācēji.

Nelielais iegūto pēcnācēju skaits un nenoskaidrotās ♂ īpašības nav pietiekoši fakti, lai taisītu kādus slēdzienus par merogenās indukcijas iespējamībām, bet mēģinājumus turpinot ir cerības iegūt vērtīgas atziņas šīs problēmas atrisināšanā.

