the hormonal background[9–11]. In the present study the vascular sensitivity to the drug was determined in terms of the dose per 200 g body weight required to raise the blood pressure by 10 mm Hg. In normal males 0.8–1.2 mU/200 g proved adequate. In the hypertensive animals of group I 1.4–3 mU/200 g was required to produce the standard response. In the remaining groups a smaller dose than normal (0.01–0.8 mU/200 g) was adequate. These changes in sensitivity were rarely associated with prolongation of the pressor response.

Normal female rats required 0.25–0.5 mU/200 g for the 10 mm Hg rise in pressure. In group I larger doses were needed (0.75–2 mU/200 g) whereas in group II smaller amounts were adequate (0.025–0.2 mU/200 g). After 4 weeks, however, the female rats again required larger doses of vasopressin, the amounts being 0.6–1.5 mU/200 g in group III and 0.7–1.4 mU/200 g in group IV.

In all groups of both sexes a preliminary fall in pressure after the injection of vasopressin preceded the pressor effect. This diphasic pattern was most common in group I, in which it was observed in each of the 12 males and in 8 of the 12 females. In every instance DHE failed to delete the depressor phase and occasionally enhanced it. Atropine given before or after DHE regularly abolished the depressor phase but bilateral vagotomy did not interfere with it. It was concluded that the depressor component was not mediated by sympathetic vasoconstrictor fibres and was similar to that induced by noradrenaline, being dependent upon some peripheral cholinergic mechanism. The pressor component was always enhanced by DHE but was enhanced, unaffected or even depressed by atropine.

Oxytocin: Like vasopressin, oxytocin exhibits vascular effects in the rat depending upon its hormonal status[9–11]. In the normal male and normal dioestrous female 100 mU oxytocin has no effect on the blood pressure trace although mesenteric vascular dilatation can be observed under direct vision. In the oestrous female the same dose of oxytocin produces a transient rise in blood pressure, while any interference with the sympathetic system converts oxytocin into a pressor substance[10].

In the present experiments the responses to 100 mU oxytocin were observed. Three patterns were obtained: (1) monophasic depressor; (2) monophasic pressor and (3) diphasic (depressor-pressor). In males, there was a predominance of the depressor response in groupe I (8 of 12 rats), of the pressor response in group III (7 of 8 rats) and again of the depressor response in group IV (7 of 9 rats). In females, the reaction was more variable. In groups III (8 of 9 rats) and IV (5 of 8 rats) oxytocin was predominantly pressor.

The monophasic depression and the preliminary depression in the diphasic pattern were not abolished by DHE or by bilateral vagotomy but were always suppressed by atropine. The depressor response to oxytocin, like those induced by vasopressin and by noradrenaline, was dependent upon a peripheral cholinergic mechanism. As in normal males and females, DHE enhanced the pressor component if already present or led to its appearance. Atropine caused further enhancement. The phase of the sexual cycle at the time of the experiment did not alter the response of the female hypertensive rat to oxytocin. No potentiation of the pressor response to oxytocin in the oestrous rat was seen.

Conclusions. During the development of adrenal-regeneration hypertension the pattern of vascular response to noradrenaline, adrenaline, vasopressin and oxytocin is changed but the response to hypertensin and to acetylcholine is unaltered. The change in pattern differs at different phases of the hypertensive state. With the exception of vasopressin, there is no increase in pressor reaction. The altered responses are presumably mediated by the endocrine disorder accompanying this form of experimental hypertension.

Résumé. La forme d'hypertension qui accompagne la régénération de la glande surrénale énucléée à été étudiée chez les rats. Au cours de l'évolution de l'hypertension, la réaction vasculaire à la noradrénaline, l'adrénaline, la vasopressine et l'ocitocine est modifiée de manière qualitative, mais les effets vasculaires de l'hypertensine et de l'acétylcholine restent inchangés. Ces modifications diffèrent selon la phase de développement de l'hypertension. Hormis la vasopressine, les agents hypertenseurs ne sont pas plus actifs. Ces changements reflètent en toute probabilité le déséquilibre hormonal lié à ce type d'hypertension.

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The Effect of Nandrolone Decanoate upon the Alkaline Phosphatase of the Adrenal Cortex of the Mouse

The sexual dimorphism in the distribution of alkaline phosphatase in the adrenal cortex of the adult mouse has been previously reported[1]. This enzyme occurs in a marked concentration in the cells of the fascicular and reticular zones of the adrenal cortex of the male mouse. It is absent, or present only in traces, in the female. Castration abolishes activity of alkaline phosphatase in the male; and the treatment with testosterone results in the reappearance of the activity after castration.

It has been considered that testosterone has two main effects on the living body: the virilising and the anabolic. Many other steroids possess both of these effects too, though they are proportionally very different in various compounds. Thus, the virilising effect of nandrolone decanoate is very weak, but it is, on the other hand, regarded as an extraordinarily powerful anabolic agent.

The purpose of this study was to analyse the mode of action of testosterone on the mouse adrenal cortex: whether the effect produced by it is due to the virilising or to the anabolic 'factor'. It was performed by comparing the effect of testosterone propionate and nandrolone decanoate on adrenocortical alkaline phosphatase of the mouse.

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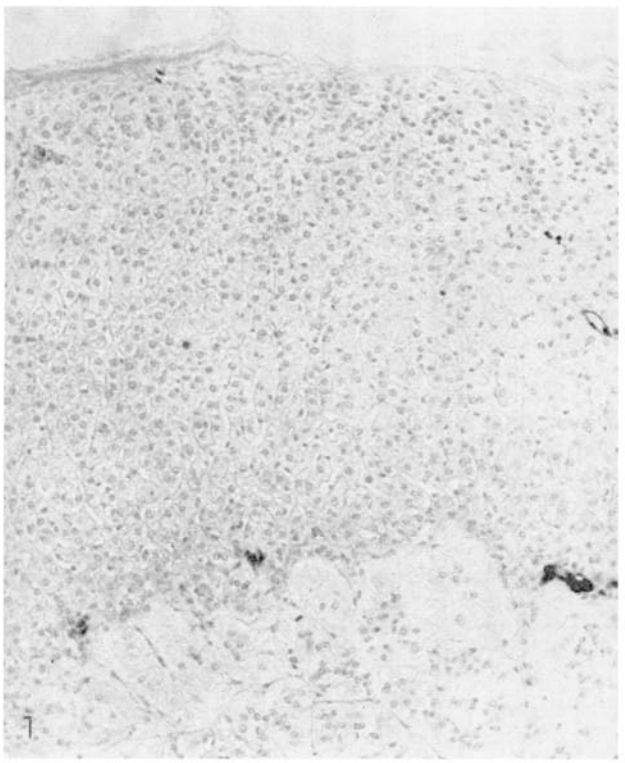

Fig. 1. Castrated male. No reaction for alkaline phosphatase in the adrenal cortex. 128 ×.

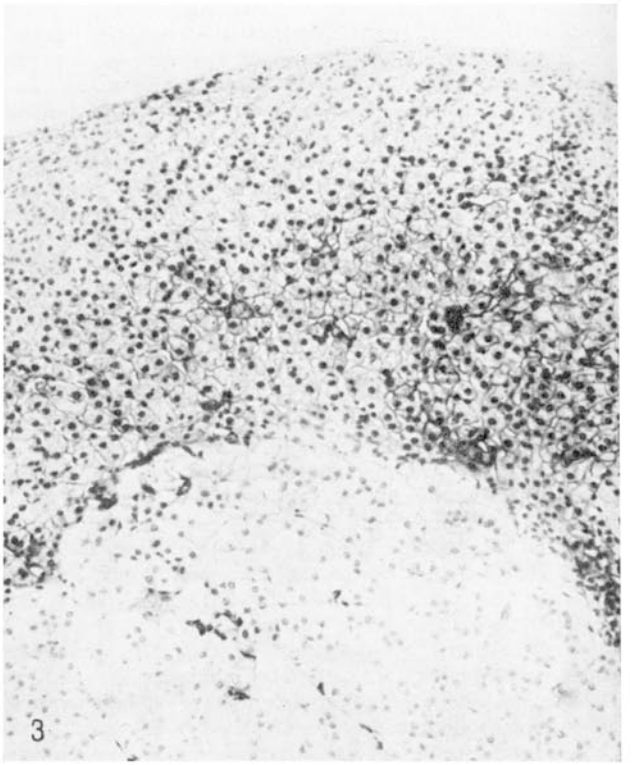

Fig. 3. Castrated male treated with nandrolone decanoate. A weak reaction for alkaline phosphatase in the fascicular and reticular zone. 128 ×.

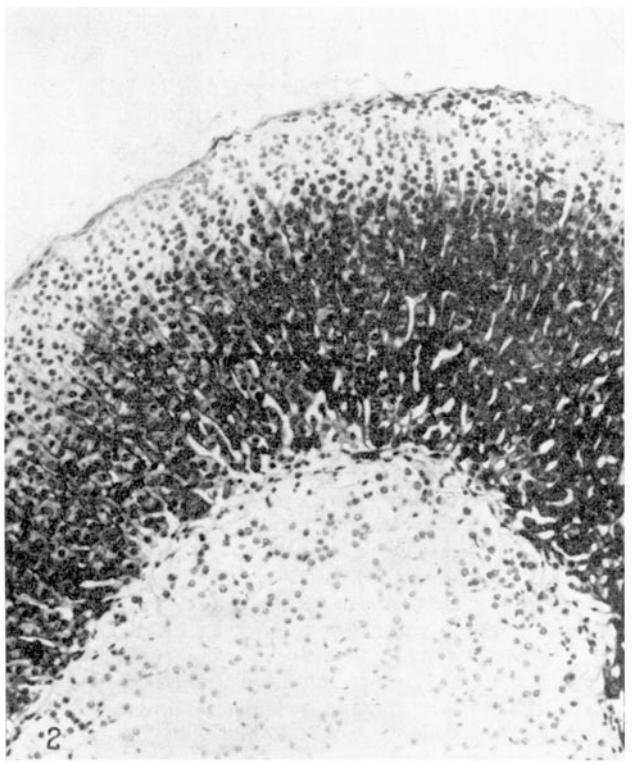

Fig. 2. Castrated male treated with testosterone propionate. The distribution of alkaline phosphatase similar to that of the normal male. 128 ×.

Material and Method. The material consisted of 40 male and 30 female adult mice. 30 of the males were castrated. A group of 10 castrated males and 10 females were treated with subcutaneous testosterone propionate (Testosteron forte, Orion) injection once a week. A similar group was injected with nandrolone decanoate (Deca-Durabolin, Organon) also once a week. The injection dose was 5 mg of both compounds. The test period was 8 weeks.

For the histochemical demonstration of alkaline phosphatase Gomori's method was used as described by LILLIE[2]. Incubation times were 1 to 24 h.

Results. The adrenal cortex of the females and the castrated males did not give the reaction for alkaline phosphatase (Figure 1). In the untreated normal males, and in the castrated animals and in the females treated with testosterone, a distinct reaction was present in the fascicular and reticular zone (Figure 2). In the females and in the castrated males, administration of nandrolone decanoate resulted in the appearance of the activity of this enzyme. However, this activity was clearly weaker than that after testosterone propionate administration (Figure 3).

Discussion. It may be concluded that both testosterone propionate and nandrolone decanoate have the ability to reactivate the adrenocortical alkaline phosphatase in the males after castration. Both compounds have also the ability to provoke this activity in the females. The

[2] R. D. LILLIE, *Histopathologic Technic and Practical Histochemistry* (New York and Toronto 1954), p. 200.

effect of nandrolone decanoate was, however, much weaker than that of testosterone propionate.

These observation suggest that the effect of steroids on the alkaline phosphatase in the mouse adrenal cortex is more dependent on the virilising properties of the compound than on the anabolic. The weak activation of enzyme after administration of nandrolone decanoate may be evidence of a weak virilising effect of this steroid; one can state that this virilising property will be manifested by the relatively large doses used in this experiment[3].

Zusammenfassung. Verabreichung grosser Dosen Nandrolondecanoat hemmt das restlose Verschwinden der Aktivität alkalischer Phosphatase der Nebennierenrinde bei männlichen kastrierten Tieren und aktiviert das Enzym bei weiblichen Tieren. Der Effekt war wesentlich schwächer als bei Testosteron.

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[3] We sincerely thank phil. mag. H. WILLAMO and Messrs. Organon, N.V. Oss, Holland, for a generous gift of nandrolone decanoate employed in this study.

A Study of the Training Possibilities of *Araneus diadematus* Cl.[1]

Though the behavior of spiders appears largely to be organized in rigid patterns which are innate, observations have been reported which show their ability to modify such behavior through experience. When the PECKHAMS[2] in 1887 'describe an attempt to teach a very interesting docile little female spider of the species *Cyclosa conica* Menge to listen composedly to the vibration of the tuning fork' they find it 'remarkable that one (spider) of them should have learned the sound of the vibrating fork so soon, and should have modified her action accordingly'. Recent observations on conditioning in a flatworm *Dugesia dorotocephala*[3] indicate too that invertebrates are more plastic in their behavior than expected. The description of the spider vibration receptor[4] and its electrophysiological analysis[5] point towards the ability of the spider to discriminate between different frequencies of vibration. It should be possible to measure this discriminatory ability in a spider's learned behavior.

For these experiments the spider *Araneus diadematus* Cl. was used. The adult female lives in the middle of its geometrical orb web and can be enticed to run to any part of that web if a vibrating tuning fork is held against it[6]. Five spiders were kept in individual aluminum frames with removable glass doors in the front and back (for details of method see[7].) They received a minimum diet of house flies and an 8% glucose water solution. In the first phase of the training period the spider was exposed to a dead fly which had been dipped first in AF type Anti-foam liquid emulsion and then in water containing 0.5% (w/v) quinine or 6% glucose. The dead quinine fly – presumed to carry an aversive taste – was thrown into the web first and made to vibrate through the touch of a C tuning fork. About 5 min later the glucose fly – presumably of agreeable taste to the spider – was presented together with a C^1 tuning fork. The spiders reacted in 4 different ways to the presentation which can be described as enwrapping, discarding, biting or no reaction. The experiment was repeated 48 times during 90 days according to the same pattern. After 15 trials all spiders regularly discarded and/or enwrapped the quinine-C fly and bit the glucose-C^1 fly. These results indicate that all spiders learned to distinguish between the first-quinine-C combination and the second-glucose-C^1 combination. In the second phase the sequence was switched for 4 trials. The spiders still bit the glucose-C^1 fly and discarded and/or enwrapped the other fly every time showing that the sequence did not affect the spiders' reaction. In a third phase the taste was paired with the opposite tone four times for each spider. Here they bit the glucose-C fly and discarded and/or enwrapped the other, obviously taking their clue from the taste. Consequently a fourth period of 16 trials was conducted in the same way as the first. The spiders, however, arrived at the originally learned pattern already after 5 trials. This seemed to indicate some retention on the spiders' part of the first learned behavior. In the last phase the flies were replaced by glass beads to which no taste was added. Supposedly the frequency of the tuning fork was now the sole clue for the spiders. The resulting constant behavior of discarding and/or enwrapping the C-bead and biting the C^1-bead indicates that the spiders could discriminate between these frequencies. This constitutes a quantitative behavioral proof for the postulate from Walcott's electrophysiological experiments[5], namely, that a spider can discriminate accurately two frequencies of vibration. The spiders, furthermore, associated each frequency with a previous experience as was shown in the last phase of the experiment. Such a learned behavior could be elicited soon again after several weeks, indicating good retention. These findings together with previous observations that some changes in the web with age depend on the spiders' change in body weight and leg length[8] and that food deprivation can change the mesh width of the web[9] point towards considerable plasticity which is superimposed on the innate patterns of behavior of the invertebrate spider.

Zusammenfassung: Kreuzspinnen verhielten sich verschieden, je nachdem ob eine tote Fliege mit Chininlösung, die durch eine vibrierende C-Stimmgabel in Bewegung gesetzt war, zuerst, oder eine Fliege in Glukoselösung, die durch eine C^1-Stimmgabel vibrierte, als

[1] This work was supported by PHS grant B-1791(C4).

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