

SCHNEIDER and DUYVENÉ DE WIT¹) and narcotics (DE GROOT and DUYVENÉ DE WIT²). This report, however, only deals with natural agents affecting the development of the ovipositor during spawning time.

MELTZER³ has shown that the ovipositor growth is subject to cyclic changes during the spawning season. At fairly regular intervals of 6–8 days, the ovipositor develops to its maximal length. Oviposition only takes place during the days on which "oviposition peaks" are produced.

Since, at least in Western Europe, the ovipositor of the female bitterling develops anew in every spring, the problem arises to what factor(s) this development is due. Is it due exclusively to the lengthening of daylight, the presence of a male and a mussel? Or is it primarily brought about by an intrinsic force or impulse inherent in the animal as such?

To answer this question the following combinations were made.

Aquarium I contained two females, one male and one mussel.

Aquarium II contained two females, no males and one mussel.

Aquarium III contained two females, two males and no mussels.

Aquarium IV contained two females only.

The experiment started on the 1st of April in Bloemfontein (South African autumn). The ovipositors were measured in anal fin units once or twice a day. One anal fin unit corresponds with 1/8th part of the stretched proximal anal fin ray. This unit can easily be estimated with the naked eye.

From the experiments, the following facts became apparent:

(1) Ovipositor growth took place in all four combinations. Obviously the presence of a mussel and/or a male is not essential for ovipositor growth under optimal laboratory conditions.

This is in conflict with the results obtained by WUNDER⁴ and MELTZER⁵. According to WUNDER the presence of a mussel only is essential to cause ovipositor growth. According to MELTZER the presence of both a male and a mussel is necessary.

As "oviposition peaks" are produced during the absence of males and/or mussels, and then during decrease in daylight length, without an increase in temperature, the oviposition stage, in our opinion, is primarily brought about by a spontaneous intrinsic force or impulse.

(2) The qualitative intrinsic ability to produce spontaneous oviposition peaks is, however, secondarily as well as quantitatively assisted by extrinsic agents. This is shown by the observation that in combination III the frequency of the ovipositor growth cycle was halved as compared with that in combination I. In combination IV the frequency was even reduced to a quarter of that in combination I.

(3) Combination II represents a remarkable case, because one of the females assumed the male mode of behaviour. She established a territory around the mussel and on ovulation days of her partner she wagtailed

around her, eventually accompanying (but not leading) her to the mussel. She imitated all the phases of male behaviour with the exception of the quivering and fertilisation movements.

The female, which retained her female mode of behaviour, produced a similar ovipositor growth cycle as the fishes in combination I. Obviously, as regards her cyclic ovipositor lengthening, it is immaterial to the female bitterling whether the male mode of behaviour which affects the frequency of the cycle, is exhibited by a male or a female provided a mussel is present.

(4) Finally the intensity of the periodical rapid increase and decrease in ovipositor length appeared to be strongly influenced by the presence of a male and a mussel. In other words: as conditions become unfavourable for the normal oviposition process, there is a tendency to retend the oviposition stage.

An extensive publication of these investigations will be published elsewhere.

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Zusammenfassung

Das Wachstum der Legeröhre hängt im weiblichen Bitterling vorherrschend von einem spontanen, inneren Vorgang ab. Hierauf ist er sekundär und quantitativ von äusseren Faktoren beeinflusst, unter welchen die Gegenwart eines männlichen Bitterlings und einer Teichmuschel das Wichtigste ist.

Pregnenolone and Δ^{16} -Dehydropregnenolone in Work with Oestrogen-induced Abdominal Fibroids

Contrary to progesterone, MIESCHER's Δ^{16} -dehydroprogesterone has been shown to be void of antifibromatogenic potency (LIPSCHUTZ, BRUZZONE, and FUENZALIDA, 1944)¹. Since the Δ^{16} -compound is not progestational it was originally thought that loss of antifibromatogenic potency is concomitant with the loss of progestational activity (LIPSCHUTZ, 1944). But subsequently evidence was given that increase of progestational activity of testosterone by substitution with a side chain of 2 carbons at C₁₇ is not concomitant with an increase of antifibromatogenic potency (IGLESIAS and LIPSCHUTZ, 1946; summary LIPSCHUTZ, 1950, Ch. 13). It now seems an established fact that antifibromatogenic potency and most probably antitumoral potency in general is an independent faculty of certain steroids (LIPSCHUTZ, 1946, 1947; LIPSCHUTZ, IGLESIAS, and MARDONES³, IGLESIAS, LIPSCHUTZ, and MARDONES⁴).

Antifibromatogenic steroids are, like progesterone, 3-ketosteroids (desoxycorticosterone, testosterone, dihydrotestosterone). However, against all expectation, pregnenolone has been found to be antifibromatogenic

¹ L. H. BRETSCHNEIDER and J. J. DUYVENÉ DE WIT, *Sexual Endocrinology of Non-Mammalian Vertebrates* (Elsevier Publ. Comp. Inc., New York and Amsterdam, 1947).

² B. J. DE GROOT and J. J. DUYVENÉ DE WIT, *Acta Endocr.* 3, 129 (1949).

³ J. MELTZER, *Proc. Kon. Ned. Akad. Wetensch.* 50, 6 (1947).

⁴ W. WUNDER, *Verh. dtsch. Zool. Ges.* (1934).

⁵ J. MELTZER, *Proc. Kon. Ned. Akad. Wetensch.* 50, 6 (1947).

¹ References before 1950: see LIPSCHUTZ, 1950².

² A. LIPSCHUTZ, *Steroid Hormones and Tumors* (Williams & Wilkins, Baltimore, 1950).

³ A. LIPSCHUTZ, R. IGLESIAS, and E. MARDONES, *Bull. Cancer* 38, 394 (1951).

⁴ R. IGLESIAS, A. LIPSCHUTZ, and E. MARDONES, *Nature* 167, 235 (1951).

Group	No. of animals	Oestradiol per day μg	Pregnenolone or Δ^{16} -dehydropregnen- olone per day μg	F.T.E.*	Q_{2-3} **	Weight of uterus g
Pregnenolone***	6	42–82	395–570	1.6 ± 0.3	0.17	3.3 (2.5–4.3)
Pregnenolone	7	36–61	229–270	2.3 ± 0.6	0.43	2.9 (1.4–4.2)
Δ^{16} -dehydropregnenolone***	13	33–60	495–844	4.6 ± 0.7	1.4	4.1 (2.0–8.5)

* Medium Fibrous Tumoral Effect. The effect in an animal is characterised by a mark between 0 and 12. See LIPSCHUTZ, VARGAS, *et. al.* (1941).
** Number of tumoral marks 2 and 3 in the group, divided by number of animals. See LIPSCHUTZ and MAASS (1944).
*** Absorption: pregnenolone 0.63 μg per mm^2/day ; Δ^{16} -dehydropregnenolone 0.65 μg .

only with quantities about 25 times those of the antifibromatogenic threshold quantity of progesterone (IGLESIAS and BRUZZONE, 1948; BRUZZONE *et al.*¹.) The unexpected phenomenon may be explained by the transformation pregnenolone undergoes in the suprarenal, progesterone being one of the first steps of oxydation, as is known from the outstanding work of the Pincus group (HECHTER *et al.*².)

It seemed of interest to examine the question whether the antifibromatogenic potency of pregnenolone will be diminished by the double bond Δ^{16} as was to be expected from our comparative work with progesterone and Δ^{16} -dehydropregesterone.

Experiments. A group of 13 castrated female guinea-pigs were given a subcutaneous implantation of half an oestradiol tablet and simultaneously 6 to 12 tablets of pregnenolone. Another group of 13 animals was given, besides the oestradiol tablet, 12 to 18 tablets of Δ^{16} -dehydropregnenolone. Results are summarized in the Table.

Notwithstanding all the variations met with in similar work, there is full evidence that Δ^{16} -dehydropregnenolone is not equal to pregnenolone as to antifibromatogenic potency. With oestrogen alone (control animals) the medium fibrous tumoral effect (F.T.E.) is about 4; by adding 400 to 600 μg of pregnenolone per day F.T.E.

is considerably diminished and reaches a level such as is found in animals receiving 20 μg of progesterone per day. Antifibromatogenic activity was still evident, though less pronounced, with 230 to 270 μg of pregnenolone per day. The behaviour in the Δ^{16} -dehydropregnenolone group was quite different. F.T.E. with 495 to 845 μg of the Δ^{16} -comp. was not different from F.T.E. in control animals. Oestrogen-induced uterine growth was also counteracted to a certain degree by pregnenolone, whereas no such action was patent with the Δ^{16} -compound.

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Zusammenfassung

Während grosse Dosen von Pregnenolon die Ausbildung abdomineller Fibroide unter der Einwirkung von Östrogenen zu verhindern vermögen (antifibromatogener Effekt), war mit Δ^{16} -Dehydropregnenolon kein solcher Effekt zu erzielen. Die mangelnde Wirksamkeit der letzteren Verbindung lässt sich vielleicht mit ihrer Umwandlung durch die Nebenniere in das bekannterweise unwirksame Δ^{16} -Dehydropregesteron erklären, vielleicht mit der Annahme einer Unvereinbarkeit der Δ^{16} -Doppelbindung mit antifibromatogener Wirkung.

¹ S. BRUZZONE, F. FUENZALIDA, R. IGLESIAS, and A. LIPSCHUTZ, *Symposium on Steroids* (The Blakiston Co., New York, 1951), p. 72.
² O. HECHTER, A. ZAFFARONI, R. P. JACOBSEN, H. LEVY, R. W. JEANLOZ, V. SCHENKER, and G. PINCUS, *Rec. Progr. Horm. Res.* 6, 215 (1951).

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Symmetry

By HERMANN WEYL

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Es erscheint auf den ersten Blick paradox, dass es unmöglich ist, die Mathematik zu popularisieren, während sie doch jeder exakten Wissenschaft übergeordnet ist und diese Wissenschaften alle populär dargestellt werden können. Der Grund liegt aber im Wesen der Mathematik: sie ist Methode; die Ergebnisse interessieren erst in zweiter Linie.

Wenn sich ein Mathematiker an ein breiteres Publikum wendet, wird man erwarten, dass er an einfachen Beispielen die Fruchtbarkeit einer einheitlichen Methode zeigt. Das ist hier in glänzender Weise geschehen.

Der Gesichtspunkt, unter dem die verschiedensten Erscheinungen betrachtet werden, ist der der Symmetrien. Dieses Wort ist allerdings etwas irreführend, indem für den normal gebildeten Leser der Begriff der Symmetrie bereits durch Axial- und Zentralsymmetrie ausgefüllt ist, während der Begriff der Transformationsgruppen, der hier zugrunde liegt, bedeutend weiter ist.

Wenn nun KLEIN eine Geometrie durch die in ihr enthaltenen Transformationsgruppen definierte, be-