gests that supramaximal amounts of antidiuretic hormone are continuously secreted by kangaroo rats. This may depend upon a different renal response requiring larger amounts, a different rate of destruction of the hormone elsewhere, an excessive rate of secretion or a combination of more than one factor. The amount of antidiuretic hormone in the pituitary of stock rats was found to increase after a thirst of 72 hours. Thus, an increased rate of secretion of the hormone was associated with the storage of an increased amount of hormone in the gland. These results are difficult to compare with those of Simon(10) who found a decrease in pituitary oxytocic and pressor hormones in rats deprived of water for a much longer period (120-168 hours) than our rats (72 hours). He detected no significant change after 72-96 hours in a few rats; however, in view of the variations to be expected, this is not surprising.

Summary. The kangaroo rat *(Dipodomys merriami)* excretes large amounts of antidiuretic hormone in the urine (up to 50 milliunits per ml). The presence of this high concentration of hormone is believed to be related to the ability of this desert rodent to excrete the most concentrated urine of any mammal and to reflect a correspondingly high rate of secretion of antidiuretic hormone by the posterior pituitary. In 2 other mammals, the dog with powerful osmotic stimulation of the cerebrum, and the laboratory rat (Long-Evans strain) deprived of water for 48-72 hours, the maximum concentration of hormone in the urine is about 6 m.u. per ml. The hormone in kangaroo-rat urine undergoes sedimentation in the ultracentrifuge and thus resembles endogenous antidiuretic hormone in canine urine. The pituitary of kangaroo rats contains more antidiuretic hormone than that of normal laboratory rats although the latter are 5 to 6 times larger. After 72 hours of thirst the laboratory rat's pituitary contains an increased amount of hormone. Each microgram of fresh posterior lobe contains about 0.9 m.u. of antidiuretic hormone in kangaroo rats and about 0.3 m.u. in normal laboratory rats.

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Effect of DDT Ingestion on Total Cholesterol Content of Ovaries Of White Rat.* (18217)

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Fitzhugh(1) observed that DDT, up to 600 p.p.m. in the diet of female rats, did not affect survival of young of the first generation. However, in the second generation of feeding DDT poisoned food, there were few living young at birth. Although the high mortality of young in Fitzhugh's DDT feeding tests may have come about through direct toxicity of the chlorinated hydrocarbon, it is possible that a hormonal disturbance may be involved in the whole problem. There is evidence that cholesterol is a precursor of some hormones exerting their influences in the reproductive cycle of the rat(2). Therefore, it seemed promising to investigate ovarian cholesterol in rats subjected to DDT poisoning. In connection with investigations (3) concerned with accumulation of ingested p,p′ DDT in various internal organs of white rats, additional females were exposed to diets

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TABLE I. Accumulation of DDT and Content of Total Cholesterol in Ovaries of Rats Fed Diets Containing p,p′ DDT.

No. of rats*	Age (days)	DDT in diet (p.p.m.)	Duration of feeding DDT (days)	Organic chloride content, μg/g of tissue	Calculated DDT content, μg/g of tissue†	Total cholesterol, parts/1,000‡
6	90	—	—	594 (558-637)	—	—
3	90	—	—	—	—	6.7 (6.0-7.5)
4,3	90	100	60	—	364 (324-394)	3.9 (3.3-4.3)
3,3	90	300	60	—	1423 (1400-1444)	4.6 (3.7-6.0)
3,3	90	600	60	—	2594 (2570-2620)	4.1 (3.9-4.2)
3,3	41	800	11	—	4599 (4582-4676)	5.2 (5.0-5.3)
3,2	35	1,000	5	—	7492 (7304-7544)	6.2 (5.8-6.6)

* Where 2 figures are given, left hand number indicates sample size of rats for the DDT determinations, and right hand number is sample size of rats for total cholesterol analyses.

† These are "corrected" figures for DDT content, that is, the average normal organic chloride had been subtracted and these figures are the excess chloride presumed to have come from DDT present in the tissue at the time of analysis.

‡ Each of group averages is based on 6 determinations: 2 aliquots from extract of ovaries of each of the 3 rats.

of various levels of DDT. Ovaries of these rats were analysed for total cholesterol.

Materials and methods. Rats of Wistar-Ames stock were weaned at 25 days and placed on regular ration† and water for 5 days. At 30 days of age, female rats were placed on experimental diets, *ad libitum,* containing 100, 300, 600, 800, or 1,000 p.p.m. of pure p,p′ DDT (dichloro-dephenyltrichloroethane).‡ To insure even distribution of DDT throughout the feed, a carefully weighed amount of contaminant was dissolved in enough acetone to moisten 100 g of food, which, in turn, was then thoroughly distributed in 900 g of feed so that the resultant mixture would contain a known amount of DDT. Usually 1,000 g of each level of DDT were made as an experimental diet supply and kept in a covered container for 1 day. Before use for feeding, each supply was spread out on a large glass plate for at least a day, or until all odor of acetone had disappeared.

† Ingredients, in %: ground yellow corn, 63.75; soy bean meal, 10.0; wheat middlings, 10.0; linseed oil meal, 8.0; dried skim milk, 5.0; alfalfa meal, 2.0; NaCl, 0.5; fine ground limestone, 0.5; vitamin A and D concentrate, 0.25. This diet was formulated by Dr. E. R. Becker, Iowa State College.

‡ Obtained from E. I. DuPont Co.

Rats were kept on the 100, 300, and 600 p.p.m. diets for 60 days. Those on 800 and 1,000 p.p.m. had to be sacrificed after 11 and 5 days of exposure, respectively, when death was imminent. All rats were killed by overdose of ether. Ovaries were immediately removed and weighed. Tissues for DDT determinations were stored in vials of acetone and analysed by Carter's(4) method of measuring organic chloride. Tissues to be analysed for total cholesterol were transferred to vials containing a mixture of 3 parts ethyl alcohol to 1 part ethyl ether, in which they were stored at about 4°C until analysed by the dichromate-sulfuric acid oxidation method, essentially as described by Boyd(5) and Finkel(6).

Control rats were handled as described above except that their food contained no DDT. Ovaries from control rats were analysed for average normal organic chloride. This average was subtracted from the total organic chloride in ovaries from each experimental rat. The difference in chloride is presumably attributable to accumulation of DDT

4. Carter, R. H., *J. Assn. Official Agri. Chem.,* 1947, v30, 456.

5. Boyd, E. M., *Am. J. Clin. Path.,* 1938, v8, 77.

6. Finkel, A. J., *Physiol. Zool.,* 1948, v21, 111.

chloride. Average normal total cholesterol determinations were also made on ovaries from other control rats.

Results and discussion. Pertinent data are tabulated. Figures in parentheses are ranges in each group of determinations. The average normal organic chloride (594 μg/g of ovary) was used as a "constant" in calculating the chloride presumed to come from DDT. Results for DDT content show a tremendous accumulation of toxicant in the ovaries. Especially surprising is the rapidity of storage at the 2 higher levels of diet, 800 and 1,000 p.p.m. even when duration of exposure was relatively brief: 11 and 5 days, respectively.

The average of 6.7 parts/1,000 of cholesterol (range 6.0-7.5) for control tissues compares favorably with Perlman and Leonard's (2) average of 7.3 parts/1,000 (range 5.0-9.0) based on ovaries from 10 non-pregnant rats. Although samples for each feeding level of the present investigation are small (3 rats, each) the average cholesterol value shows a decided decrease on the 100, 300, and 600 p.p.m. DDT diets. Because cholesterol is believed to have a part in the synthesis of reproductive hormones (probably progesterone, especially) this upset in the sterol picture may be of some consequence.

The deviations in cholesterol content at the 800 and 1,000 p.p.m. levels are likely of no significance, as such, and should not be compared with the results on the lower levels of DDT intake. Probably the short duration of exposure to DDT was not long enough to disrupt radically the sterol relationships in the tissues.

In the present series of experiments, the average weight of the 2 ovaries from 90-day rats was 66.8 mg; for 41-day rats, 44.4 mg; and for 35-day rats, 40.7 mg.

Summary and conclusions. Female albino rats, age 30 days at beginning of the experiments, were fed *ad libitum* ground feed diets containing 100, 300, or 600 p.p.m. of pure p,p′ DDT. After 60 days, at age 90 days, the rats were sacrificed, ovaries were removed, weighed, and analysed either for total cholesterol or for organic chloride. Control females were handled the same way except food was uncontaminated with DDT. Other groups of 30-day females were started on 800 and 1,000 p.p.m. DDT diets but had to be sacrificed after 11 and 5 days, respectively, when death was imminent. Normal average ovarian organic chloride from control rats was 594 μg/g of tissue (range 558-637); average ovarian total cholesterol was 6.7 parts/1,000 (range 6.0-7.5). Average weight of both ovaries from control 90-day rats was 66.8 mg. On 100, 300, and 600 p.p.m. diets, the average calculated DDT contents of the ovaries were 364, 1423, and 2594 μg/g of ovary; the total cholesterol values were 3.9, 4.6 and 4.1 parts/1,000, respectively. Rats on the diet of 800 p.p.m. for 11 days, and on the 1,000 p.p.m. for 5 days showed less change in total cholesterol values (5.2 and 6.2, respectively) than did the 90-day rats, exposed to the DDT diets for 60 days, perhaps because the shorter exposure to the toxicant was not long enough to disrupt the sterol metabolism of the ovaries. On the other hand, the DDT content of ovaries from rats on 800 p.p.m. averaged nearly 4600 μg/g of tissue; and on 1,000 p.p.m., nearly 7500 μg/g. These data indicate a "selective accumulation" of DDT by female gonadal tissue. The disturbance in the sterol balance of the ovary may be significant in view of the opinion that cholesterol may be a precursor of progesterone.

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