known gonadotropic substance. One gram equivalent or more injected into 21-day-old male and female rats daily for 5 days caused no increase in the weights of the ovaries, uteri, testes or seminal vesicles. As much as 5 g of fresh placenta injected intravenously into an estrous rabbit failed to induce ovulation or the formation of hemorrhagic follicles or corpora lutea. These tests establish its dissimilarity to any known gonadotropic substance of pituitary origin and differentiate it from the pregnancy hormones of the human being and the mare. Active extracts tested on 6-week-old pigeons gave negative results. Five grams equivalent in 5 daily subcutaneous injections or one-tenth gram intracutaneously over the crop gland resulted in no proliferation of the crop epithelium.

These experiments indicate that in normal pregnancy in the rat the foetal placenta secretes a substance which is responsible for the maintenance and function of the corpora lutea during the latter half of pregnancy. The functional corpora lutea induced by the act of copulation carry pregnancy to the 10th or 11th day at which time the hormone secreted by the developing chorion acts to maintain and enlarge these corpora whose continued secretion prolongs gestation to term.

In view of these and other considerations together with the available information on the chorionic hormones of the human being and the mare, it is probable that a similar mechanism is active to a greater or lesser extent in maintaining the luteal function of pregnancy in many mammals.

9992 P

Influence of Diet on Gonad Activity of English Sparrow, *Passer domesticus* (Linnaeus).

JAMES C. PERRY. (Introduced by A. G. Wedum.)

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Since the work of Rowan,[1] Bissonnette,[2] and more recently of Kirschbaum and Ringoen,[3] and others, exposure to increased light during the spring months has been considered the predominant factor in inciting the development of the gonads of birds that com-

1 Rowan, W., *The Riddle of Migration*, The Williams and Wilkins Co., 1931.

2 Bissonnette, T. H., *J. Exp. Zool.*, 1931, **58**, 281.

3 Kirschbaum, A., and Ringoen, A. R., *Anat. Rec.*, 1936, **64**, 453.

monly reproduce in the spring. It is believed that the anterior hypophysis is indirectly stimulated by the increased daily light and in turn stimulates the gonads to activity.

The investigators mentioned above have fairly well established the fact that increased exposure to artificial light does cause gonadal activity in such birds as juncos, starlings and English sparrows. Juvenal sparrows (birds hatched during the previous summer) thus treated in our laboratory responded after 60 days' exposure (November 15 to January 15). They were exposed to light for 10 hours daily in excess of the normal light period. The source of the light was a 25-watt Mazda lamp placed approximately one foot from the birds. The males thus treated developed the black beaks characteristic of this species during the breeding season. The testes contained cells in all stages of spermatogenesis, the sperm ducts were enlarged and otherwise functional. Female birds had, at this time, large ovaries containing numerous eggs of various sizes. The ovary had increased approximately 300% in weight and 6 times in volume over the non-treated controls. This is not the extreme increase found in fully developed females in the wild. It is, however, a marked increase, being about one-half that of the wild bird ovary at the height of development. The number of follicles, also, was greatly in excess of that of the controls. In judging the degree of ovarian development this factor is perhaps more important than weight and volume, at least in the early stages. The oviducts of light-treated birds were also greatly developed. Sections reveal the extreme epithelial and glandular development characteristic of breeding females.

In an attempt to determine what factor in the light might be responsible for these effects, birds were subjected to increased exposures of ultraviolet light during December and January. The source of such radiation was the recently developed Sperti bulb manufactured by Science Laboratories, Cincinnati, Ohio. The effects were identical to those obtained when ordinary Mazda bulbs were used. However, the time required was considerably less. The daily exposure to Sperti light was for the same length of time; comparable development of the gonads, however, was obtained in 3 weeks. It would seem, therefore, that ultraviolet radiation in nature is an important stimulating cause of gonadal activity.

Not satisfied, however, that light directly affecting the birds is the determining factor of gonadal activity for the reason that many seasonal breeding vertebrates undergo seasonal gonad activity without receiving additional amounts of light, the writer carried out the

following experiments for which the light-treated birds mentioned above served as controls. Whole wheat grains were exposed to radiations from the same Sperti ultraviolet bulbs and were fed to the sparrows during December, January, and February. These birds received only the ordinary daily amount of light in the laboratory. Controls were fed on a non-irradiated wheat diet. The birds, both experimental and control, were juvenals. Three groups of experimental and control birds, 6 to a group, were used. Thus a total of 36 birds was employed. Guided by a preliminary experiment, birds were sacrificed at weekly intervals after they had received wheat irradiated for 250 hours. As soon as the wheat had been exposed to the ultraviolet light for 24 hours it was fed to the birds. Each subsequent feeding was from wheat that had received a daily increasing amount of ultraviolet light. After this exposure had reached 250 hours the gonadal response of the birds was well advanced. Birds that received wheat irradiated in excess of 300 hours showed a pronounced response. As in the case of light-treated males of both types the beaks became black, complete spermatogenesis ensued, and the sperm ducts developed to a state of functional activity. The ovaries and oviducts of the females likewise developed. Follicles in the ovaries were very numerous. Several in each ovary were more than a millimeter in diameter. Weight and volume increases were equal to or slightly greater than light-treated bird ovaries. The oviducts closely approached the condition found in oviducts of wild laying birds. That the development in both sexes was pronounced cannot be doubted when compared to birds receiving injections of Parke-Davis Antuitrin anterior lobe extract. This latter was kindly supplied by Dr. Oliver Kamm, to whom the writer is indebted. Male and female birds were injected subcutaneously with 0.2 cc of this preparation 3 times a week for 3 weeks. The response of these birds was closely comparable to the results obtained from feeding irradiated wheat. The controls of the wheat-fed birds, as well as the wild birds sacrificed during this experiment in no instance showed development beyond the resting condition of the gonads and ducts.

Conclusion. It seems likely that a chemical substance in the wheat is changed by the ultraviolet radiations. Most probably this substance directly affects the anterior hypophysis, which in turn stimulates gonad activity. If this is the case we have a new explanation of the seasonal sexual activity of the sparrow in the natural state. This interpretation, which merely shifts the emphasis from light affecting the animal to light producing a change in the diet, may

well apply to the seasonal sexual development of other vertebrates as well. The results of the above experiment point to an increase of Vitamin D or some kindred substance as the specific dietary factor. Other experiments, planned to determine the exact mechanism, are in progress.

9993 P

Anomalous Behavior of Isolated Muscle Fibers Toward Certain Chemical Stimuli.

E. W. ASHKENAZ. (Introduced by L. V. Heilbrunn.)

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The rhythmic twitching induced in skeletal muscle by sodium chloride solutions is well known. It has also been known for a long time that the sodium salts of the calcium-precipitating anions induce even stronger twitching and that potassium chloride, citrate and oxalate are also effective, although potassium salts in addition cause a characteristic contracture. It was rather surprising, therefore, to find that the single isolated muscle fiber, when immersed in any of these solutions, did not twitch at all nor did it undergo contracture. The behavior of the isolated fiber was so different from that of the whole muscle that an attempt was made to discover the cause of this paradox.

Single muscle fibers were isolated from the adductor magnus muscle of the frog *(Rana pipiens)* in the usual frog Ringer's solution, buffered with di-sodium phosphate. Ordinarily, no attempt was made to preserve the nerve ending and the fiber was cut at both ends in the process of dissection. The isolated fiber then differs from the fiber in the intact muscle in that its nerve ending may be lacking, that is, it may have been located in a part of the fiber which was discarded; and also in that its ends are cut. This fiber responds quite normally to electrical and ultraviolet stimulation. It twitches in response to a condenser discharge or an induction shock and shortens on faradic stimulation or ultraviolet irradiation. However, its reaction to chemical stimulation is lacking in so far as the chloride, citrate and oxalate of sodium and potassium are concerned. Moreover, it does not respond to acetylcholine in Ringer's solution. In this respect my results corroborate those of Keil and Sichel.[1]

[1] Keil, E. M., and Sichel, F. J. M., *Anat. Rec.*, 1937, **70** (Supplement No. 1), 112.