tration of lectures—that most important change of emphasis which came to pass in the method of scientific education. Professor Cross has won high place, which he will hold, whether or not in retirement.—*Boston Evening Transcript.*

SCIENTIFIC BOOKS

The Birds of Britain, their Distribution and Habits. By A. H. EVANS, M.A., F.Z.S., M.B.O.U., Cambridge, 1916. 8vo, pp. xii + 275, numerous halftone text-figures.

This concise and rather informal work is stated to be "primarily intended for schools," but is designed also to serve as a "short handbook which includes the results of the most recent observations, and is adapted to modern nomenclature." While this intention may be justified by the character of the main text, the introductory chapter, treating of "The Class Aves, or Birds in General," might have been written a generation ago, and does not include "the results of the most recent observations," as regards especially the subject of migration. Reference is made only to the creditable work of local observers in Britain, which has accumulated interesting facts regarding the movements of birds in England and Wales without furnishing generalized results, while the important work carried on elsewhere is passed without mention, including the researches of the late W. W. Cooke which have so greatly extended our knowledge of this subject.

In the main text, under the general heading "Classification," with subheadings for the higher groups from orders to subfamilies, a paragraph, without special heading, is devoted usually to each species of regular occurrence in Britain, with a nominal list at the end of nearly 200 "occasional visitors" not formally mentioned in the preceding pages. The author manages to give in the half-page notices of the species of regular occurrence a comprehensive statement of their leading traits, distribution and diagnostic features, in a clear and direct way that should render his "little book" attractive and useful to many readers. The nomenclature is strictly modern, being "almost exactly" that of the British Ornithologist's Union's revised Check-list. The illustrations, though said to be "from photographs taken for the most part from nature," are in many cases obviously not from life but from stuffed specimens or from museum groups, and are thus not up to the standard of the text.

J. A. A.

SPECIAL ARTICLES

FACTORS IN THE GROWTH AND STERILITY OF THE MAMMALIAN OVARY

1. THE growth and, to some extent, the structure of the mammalian ovary depend essentially on the development of the ovarian follicles. The maturation of some follicles and the subsequent rupture leads to the formation of the corpus luteum; the retrogression (atresia) of follicles before they have reached maturity and ruptured leads in certain species to the formation of the so-called interstitial gland and in others to the accumulation of atretic follicles in which the theca interna is relatively prominent, without, however, the formation of an interstitial gland.

As we shall see presently, it is possible to inhibit the full development of the follicles experimentally. Under these conditions we find that the atretic follicles with relatively large thecæ internæ, are especially numerous and constitute perhaps the greater part of the ovary. We may therefore conclude that it is the pressure exerted by the developing, expanding follicles which leads to the shrinking and ultimate complete disappearance of the atretic follicles, and that if this pressure is diminished these atretic follicles become relatively prominent. This explains their relative preponderance in the guinea pig during the period following ovulation, when no large follicles are present in the ovaries.

2. Former observations of the writer showed that under certain conditions mitoses in the granulosa cells of the follicles were especially frequent around the ovum. This suggested the possibility that the stimulus for the growth of the granulosa cells which ultimately determines the growth of the whole follicles, depends upon a substance given off by the ovum. Dr. L. S. N. Walsh in our laboratory

has recently shown quantitatively that during the whole course of the development of the follicles definite relations exist between the ovum and the proliferation of the granulosa cells. These relations can hardly be explained in any other way than as dependent upon a growth stimulus emanating from the ovum and determining the proliferation of the granulosa cells and thus indirectly of the whole follicle. It is possible that in addition to this endogenous growth stimulus certain exogenous stimuli, emanating from other organs with internal secretions (hypophysis?) may be operative. This effect of the ovum on the granulosa cells leads to the formation of the cumulus oophorus, and this structure makes possible the escape of the ovum into the Fallopian tube. Thus the ovum is ultimately the seat of the mechanism which makes possible its fertilization and fixation in the uterine wall.

3. In previous investigations[1] we have shown that it is possible to cause a premature atresia of follicles by the burning out of the corpora lutea. While the effect of moderate heat does not directly destroy the follicles, it diminishes their expansive power; they grow up to a certain point and then become prematurely atretic; the heat causes a mild degree of what might be called a "tissue shock." Under those conditions the development not only of mature, but even of moderately sized follicles, does not take place and as long as this condition lasts the animal is sterile.

4. In continuation of these experiments we found that it is possible to produce the same condition not only by means of a local interference with the ovary, but also by affecting the general state of nutrition through underfeeding the animal. In all cases in which the animals (guinea pigs were used in our experiments) had lost 25 per cent. of their initial weight maturation of the follicles ceased, and in the majority of the cases the follicles became atretic before they had reached even medium size. The changes in the ovary were on the whole more pronounced in younger animals weighing between 300 and 400 grams, but in some cases very marked changes were also produced in older animals. A certain minimum time has to elapse before the changes in the ovary become apparent.

The lack of sufficient food affects in the first place the granulosa cells; they prematurely dissolve. Those granulosa cells, however, which at first escape the solution, continue, as Dr. Walsh found, to divide at approximately the normal rate—another proof of the distinctness of proliferative stimuli and foodstuffs.

The connective tissue becomes affected by the underfeeding somewhat later than the granulosa. This apparent difference in the resistance of different tissues to the effects of underfeeding is of interest and will be tested in further experiments. Thus underfeeding, if very marked, will lead to at least temporary sterility in the guinea pig as an expression of what we designated as a "hypotypical" condition of the ovaries.

5. In one case of pronounced loss of weight following thyroidectomy, we found a still further reaching change. Not only were the ovaries hypotypical, but the stroma separating the various follicles had become affected. It was underdeveloped or lacking in places, so that the thecæ internæ of neighboring follicles in places directly adjoined each other. As a result of this condition and of an imperfect separation of primordial ova, due to the same relative inactivity of the connective tissue, many follicles containing two or more ova developed in both ovaries. It could be clearly seen that small follicles were pushed into the cavity of neighboring follicles as a result of the intraovarian pressure, which, while diminished in hypotypical as compared with normal follicles, was still positive and as a result of the lack of development of ovarian stroma. Follicles containing more than one ovum are occasionally found in the ovaries of various species and it would be of interest to determine whether in addition to the factors operative in our case, other factors may be responsible for this condition in other cases.

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[1] Loeb, Leo, *Zentralblatt f. Physiologie*, 1911, XXV., No. 9. *Virchows Archiv*, 1911, CCVI., 218.