Letters to the Editor

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Light and Diet as Factors in Relation to Sexual Periodicity

IN his recent communication regarding light as a factor in causing sexual periodicity in birds and mammals, Dr. F. H. A. Marshall¹ has directed attention to several examples of the induction of sexual activity in birds by prolonged daily light periods, and to the great rarity of animals not exposed to light variations at some time. Even nocturnal animals are subject to twilight. Not all have the same degree of susceptibility to light in this respect. He also cited conditions in tropical regions, such as the Cameroons, "where environmental conditions are similar throughout the year" and "native birds have no restricted breeding season but breed at any time".

That this is true only in a very broad sense was shown by Bates,² who found that some native birds breed there at any time, others only in the dry seasons, twice a year (in May, June, and July, and in November, December, and January), others only through half the year. Sex glands of both sexes often remain in breeding condition and size throughout the year. This suggests that breeding may be controlled by some factor other than light periods in some or all of these birds, even though comparatively long light periods may keep the sex glands actively producing germ cells.

Moreau³ pointed out that, in any district, each species of bird has a rather restricted breeding season of about three months, relatively constant for any locality, but differing in neighbouring localities. He also pointed out that length of day is constant throughout the year only on the equator. It varies 40 min. at 6° N. or S.; 70 min. at 10°; and 3 hr. at 23.5°. In this respect, therefore, the transition from equator to poles is gradual throughout, and differences are those of degree only. Light, in its relation to sexual periodism, is a world problem.

Moreau accepts Rowan's hypothesis⁴ that longer periods of wakefulness or exercise induce sexual activity in many species in addition to juncos and crows; but finds it of doubtful value in the cases of long migrants, wintering beyond the equator, or on both sides of it. He is of the opinion that food is a controlling factor in breeding periodicity of tropical birds, the breeding seasons of which are seldom longer than three months. At Amani and Zanzibar, these seasons differ for species common to both districts. So the sexual activities of tropical birds are subject to seasonal cycles comparable with those of palæarctic birds. For him, this rules out photoperiodism for these birds, and makes climate and food supply more dominant factors in their sexual cycles. Lynes,⁵ Vaughn,⁶ Paget-Wilkes,⁷ and others agree, and even suggest that rains and bush fires are related to the breeding cycles in Nyasaland.

Recent work by Bissonnette,⁸ and Bissonnette and Wadlund,⁹ on the modification of the sexual cycle of starlings in America, shows that testis activity is conditioned by daily period, intensity, and wave-length of light. The long wave red rays stimulate, and the shorter wave green rays inhibit germ cell activity. But, no matter how stimulating the light ration used, sexual regression sets in after a variable period of complete sperm formation. This period is

shorter in animals brought to the climax quickly, and longer in those activated more slowly. An optimum wave-length, somewhere in the red, and an optimum intensity of light, below 185.6 foot candles of white light and nearer 29 foot candles intensity, are indicated. These results with starlings were obtained when birds were fed on a varied diet, rich in proteins, fats, and vitamins.

On the other hand, some unreported recent studies with starlings in Cambridge, using red light of a potency capable of inducing complete sperm formation in about twenty days on the rich diet used previously, indicate that, on a diet restricted to 'middlings' grain mash, the very stimulating red light is prevented from inducing testis activity, even in 22 days. This shows that, even when the daily light ration is adequate to induce sexual activity, the type of food may be a limiting factor and, under such conditions, control the appearance of seasonal activity. This may be the case with tropical birds, as described by Bates, Moreau, and others, and may account for the apparent correlation of diet with reproductive periodicity. Then, too, light intensity varies as between rainy and dry seasons.

Variations of susceptibility, of members of the same or of different species, to changes in light rations, would cause breeding activity to occur at somewhat different dates, even in the same locality, whether species are permanent residents or migrants.

In studies of mammals in this relation, by Bissonnette,¹⁰ Baker and Ranson,¹¹ Marrian and Parkes,¹² and Moore and Samuels,¹³ light ration and food have been found to influence reproductive activity. When either one of these two factors remains constant and adequate for activity, the resulting activity may be varied by changes in the other factor.

It becomes more evident that, while light ration plays a great part in conditioning the periodicity of sexual cycles in many birds and mammals, it is not the only factor operating. Seasonal changes in type or quantity of food must be reckoned with, in analysing the factors effective in any particular case.

We are still far from a general law in this connexion. But all will agree with Dr. Marshall in maintaining the wide application of this principle of photoperiodism in sexual cycles.

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School of Agriculture,
Cambridge, March 30.

¹ Marshall, F. H. A., NATURE, 129, 344, March 5, 1932.

² Bates, G. L., Ibis (9), 2, 8, 558-570; 1908.

³ Moreau, E. R., Ibis (13), 1, 553-570; 1931.

⁴ Rowan, Wm., Proc. Boston Soc. Nat. Hist., 39, 152-208; 1929.

⁵ Lynes, H., Ibis, 1, 757-797; 1925.

⁶ Vaughn, J. H., Ibis, 577-608; 1929, and 1-48; 1930.

⁷ Paget-Wilkes, A. H., Ibis, 690-748; 1928, and 475-490; 1931.

⁸ Bissonnette, T. H., Am. Jour. Anat., 45, 289-305; 1930; Jour. Exptl. Zool., 58, 281-319; 1931 a: Physiol. Zool., 4, 542-574; 1931 b: Science, 74, 18-19; 1932 a: Physiol. Zool., 5, 92-123; 1932 b.

⁹ Bissonnette, T. H., and A. P. R. Wadlund, Jour. Morph., 52, 403-428; 1931.

¹⁰ Bissonnette, T. H., in press.

¹¹ Baker, J. R., and E. M. Ranson, in press.

¹² Marrian, G. F., and A. S. Parkes, Proc. Roy. Soc., B, 105, 248-252; 1929.

¹³ Moore, C. R., and L. T. Samuels, Am. Jour. Physiol., 96, 278-288; 1931.

Albertus Magnus as Chemist

THE article by Dr. Greenwood¹ seems to me to lay too little stress on the point that while Albertus Magnus certainly advanced botanical and zoological science by much valuable original observation, yet in the realm of chemistry he contented himself with repetition and interpretation of earlier writings. The opposite impression given by the article seems to be due to the fact that Dr. Greenwood regards "De Alchimia" as authentic. This book is, of course,