The Brush-Turkey and "Turning"

By W. MARSHALL, Cambridge, England.

Few birds, apart from those in the service of man, can have been observed so closely and written-up so critically as the Australian Brush-Turkey (*Alectura lathami* Gray). It was perhaps inevitable that a bird with wit enough to sidestep the irksome toils of sitting, by constructing an incubator to do the work for it, should be favoured with special attention. Observers have, amongst them, laid bare most of the secrets of the Brush-Turkey, but there remains at least one problem which has not been cleared up: indeed, so far as I am aware, it has not even been formulated by observers. I refer to the "turning" of the eggs during the process of incubation. How does the bird get to the eggs to turn them once they are buried within the mound?

Alternatively, if they are *not* turned, how do the eggs contrive to hatch while contravening so fundamental a law of incubation? For it is a fundamental law that bird eggs must be turned frequently if they are to hatch successfully. This applies equally whether the eggs are incubated naturally or artificially.

Turning consists in rotating the egg through one of its axes and has the effect, in the initial stages, of presenting a new face of albumen to the germinal disc on the up-thrusting yolk. Later, turning has the effect of preventing adhesions between the various embryonic membranes, a fruitful cause of malformation and malposition of the embryo.

The eggs of *Gallus domesticus* are turned by the hen far more frequently than is found necessary under artificial conditions of incubation. According to Olsen (1930), the hen turns her eggs on an average 96 times every 24 hours.

Under artificial incubation the eggs are turned from two to five times daily, but research has shown that better results may be expected from more frequent turning—Chattock (1925), Insko and Martin (1933). The high turning rate by the hen may be explained by the fact that the average temperature difference between the top and bottom of the egg is 17° during the early stages of development, and 10° to 12° in the later stages—Burke (1925). But, under artificial conditions, as, for example, in a cabinet incubator with forced draught circulation, or in the mound of the Turkey, where the temperature is equable and where there is no temperature gradient throughout the egg, eggs still have to be turned to prevent adhesions.

In a recent experiment in the Incubation Research Department, Papworth Industries, Cambridge, two groups of eggs of *Gallus domesticus* were set in a cabinet incubator and subjected to similar conditions of temperature and

moisture. One group, the control, was placed in the turning compartment and turned five times in each 24 hours. The second or experimental group was set in the hatching chamber in an upright position, with the small end down, and left untouched throughout the whole 21 days. The result emphasized the necessity of turning.

The control group hatched 87 per cent., while the experimental group hatched but 14 per cent., several of which were malformed.

Examination of the dead in shell showed that failure to hatch was attributable in every case to malpositioning of the embryo brought about by adhesions of yolk-sac and allantois. In many cases the adhesions were severe enough to have brought about rupture of the yolk-sac—Marshall (1937).

It may be accepted, then, that turning is one of the fundamental requirements for the successful incubation of bird eggs. But that being so, how does it come about that the eggs of the Brush-Turkey escape a requirement so general amongst birds? That they do so escape will be evident from a brief study of the mound. The eggs are set in the mound at depths varying from 1 foot to 2 feet. Moreover, they are placed carefully in the hole in an upright position with the small end down and fixed thus by earth and other organic matter being tamped into the hole—Fleay (1937) et al.

It is obvious that the eggs could not be reached for subsequent turning without a very considerable dismantling of the nest, and such dismantling has not been recorded. It is true that the bird, according to weather conditions, rakes on to, or removes, a top coating of matter, and generally keeps the crust friable, but such activity never assumes proportions sufficient to make the eggs accessible. Indeed, the care with which the eggs are positioned would seem to indicate an optimum position and therefore an undisturbed incubation period. Fleay (1937) indirectly bears this out when he records that unhatched eggs in a worked-out mound were found to have departed from their original vertical position.

The evidence, then, would seem to point to non-turning, and yet the eggs hatch normally. How can that fact be explained? Is the egg constructed differently from the generality of bird eggs? Has it some form of compensatory mechanism which obviates the need for turning?

There is the possibility, of course, that Brush-Turkey eggs hatch no better than did the experimental group mentioned above (14 per cent.); but that is not borne out by Fleay, who records 13 chicks from 18 to 24 eggs. Even at the higher estimate of 24 eggs, that would represent a hatch of 54 per cent., and at the lower estimate 72 per cent., and this of all eggs set, not of known fertiles only.

It would thus appear reasonable to expect the presence of some factor in the Turkey egg, either as a variant of construction or of function, which is lacking from the eggs of other birds.

Perhaps the factor will be found to be a simple one such as a variation from the normal yolk-albumen-density ratio. Such would have the effect of lessening the upward thrust of the yolk in the early stages of incubation. Or perhaps the explanation will be found to lie in a higher amniotic pulse rate. That would minimize the risk of adhesions between membranes in the later stages. A combination of the yolk-albumen and pulse theories might prove the solution.

But there remains another explanation, though disturbing in its implications. It is that the factor which operates for the Turtle and for some snakes, the eggs of which do not hatch if moved during incubation, operates also for the Brush-Turkey.

Is it possible that the Brush-Turkey embryo, whilst following the developmental curve ultimately leading to bird, has, owing to peculiarities of incubation, not so much adapted itself as clung tenaciously to the ancestral factors of non-turning? Lack of material has prevented further investigation by this department. Perhaps those more fortunately placed may eventually find an answer to what is perhaps the greatest enigma of all connected with the Brush-Turkey.

REFERENCES:
Fleay, D. H.: *Emu*, vol. XXXVI, 1937.
Olsen, M. W., and Byerly: *Poultry Sci.* 15, 1936.
Chattock, A. P.: *Phil. Trans. Roy. Soc. London*, 1925.
Insko, W. M., Martin, J. H.: *Poul. Sci.*, 1933.
Burke, E. D.: *Montana Agric. Exp. Stat. Bul.*, 1925.
Landauer, W.: *Storrs Agric. Exp. Bul.*, 1937.
Le Souëf, D: *Ibis*, 1899, vol. 5 (7).
Dove, W. F.: *Journal Agric. Res.*, 1935.
Marshall, W.: "Eggs," Dec. 8, 1937.

Cuckoos in Queensland and Tasmania.—In Mr. E. A. R. Lord's interesting notes on Queensland migrants in *The Emu* for January, he mentions (p. 375) that, although Pallid Cuckoos were plentiful, and suitable foster-parents were nesting freely, no young Cuckoos were seen. If the species breeds in the northern portion of its range (Queensland) as prolifically as in the southern (Tasmania), the non-appearance of young birds in the summer of 1937 may have some connection with the scarcity of Pallids here during the summer of 1938-39, for I have never known so few to arrive as during the present season.—H. STUART DOVE, Devonport, Tas., 3/2/39.