containing five *Rotifer vulgaris*. All the rotifers were dead at the end of four minutes. In one specimen observed, addition of 0·01 c.c. of the filtrate caused retraction of the ciliary wreath, and some slowing of bodily movement, though the jaws remained active. Addition of the remainder caused the jaws to slow, and the body gradually contracted, without convulsions, into a double mass with a central constriction. The other four rotifers presented the same post-mortem appearance. Small monads also present in the water showed no diminution of activity after fifteen minutes.

ERNEST GRAY.

Veterinary Research Laboratories,
Pakenham,
Bury St. Edmunds. Sept. 2.

Epidermal Papillæ and Dermal Bones of the Chick Sclerotic

THE article in NATURE by Moy-Thomas[1] and Westoll's comments[2] discuss the interesting relation existing, in fish, between certain structures of ectodermal origin and certain dermal bones. It seems appropriate to report briefly upon a similar relation which I have recently studied in the embryonic chick. A more complete account will be published elsewhere. It is well known that the fowl has fourteen dermal bones in its sclerotic, forming a ring round the pupil, and that the same number of epidermal papillæ develop in the conjunctiva at about seven days of incubation but disappear before hatching. Nussbaum[3] and Dabelow[4] both studied the papillæ, but as their descriptions are in several respects unsatisfactory, I have examined these structures, and especially their relation to the dermal bones, afresh.

The papillæ first appear as flat thickenings of the epidermis. Later, on the eighth and ninth days, the central part of each thickening increases greatly and projects downwards as a conical mass of epithelial cells into the underlying mesenchyme, against which it is bounded by a basement membrane. I call this downward projection the 'tongue'. The papilla also projects slightly above the general epidermal level. There is a condensation of mesenchyme cells below and around the tongue; these cells are the *Anlage* of the future scleral bone. Careful study shows, in sections stained with azan, that very delicate blue-staining collagen fibres run off from the basement membrane of the papilla, and especially from its tongue, among these mesenchyme cells. Even while it is forming, degeneration sets in among the epithelial cells at the base of the tongue and in its substance. This continues during the ninth and tenth days, and the result is the liquefaction of the greater part of the cells forming the tongue, which gradually retracts and finally disappears. At the same time the elevation of the papilla above the general level of the epidermal surface increases and the papilla is transformed from a solid mass projecting principally downward into the mesenchyme, into a hollow, more or less filiform structure, projecting upwards from the epidermis and joined to it by a rather narrow neck. Its cavity is open to the mesenchyme below, and contains mesenchyme cells.

Meanwhile, the cells of the mesenchyme condensation, originally grouped round the 'tongue', stream from this position downwards and outwards, and become arranged as a flat sheet of cells below the papilla and separated from it by mesenchyme which at last shows little or no condensation. The first collagen fibrils of the developing bone are now deposited among these cells, which take the histological character of osteoblasts. A connexion with the papilla is, however, maintained. The delicate collagen fibrils, mentioned above as running from the papilla among the mesenchyme cells around the tongue, have increased in number and thickness, and when the histological differentiation of the bone is beginning they form a very obvious strand of fibres running from the cavity of the hollow papilla, down through the intervening unspecialized mesenchyme, to the bone, with the developing collagen fibrils of which they are continuous.

The papillæ disappear completely before hatching, and it is difficult to imagine what function they can serve if it is not concerned with the development of the scleral bones with which they are so closely connected. Experimentation must wait until eggs once again become available for purposes other than food; but it will be as surprising as Moy-Thomas's results if the relationship proves to be without morphogenic significance.

P. D. F. MURRAY.

Department of Biology,
St. Bartholomew's Hospital Medical College,
at the Zoological Laboratory,
Cambridge.
Sept. 5.

[1] NATURE, **147**, 681 (1941).
[2] NATURE, **148**, 168 (1941).
[3] *Arch. mikr. Anat.*, **57**, 676 (1901).
[4] *Z. Morph. u. Anthrop.*, **26**, 305 (1927).

Poultry as Food Converters

THE article by Mr. E. T. Halnan in NATURE of September 20 threw an interesting light on the problem of achieving the maximum efficiency in live-stock farming from the point of view of war-time food production. He made out a good case for giving prior right to the hen in the distribution of available feeding-stuffs, over meat-producing animals. The milk-cow easily takes first place as an efficient food converter, and its performance is still more amazing when one considers that, besides utilizing concentrated feeding-stuffs such as hens and pigs need, it also utilizes cheap, home-produced foods such as grass, hay, straw, etc.

This question of the kind of material an animal can utilize is, of course, practically as important as the efficiency of conversion. Grass is by far the cheapest and most plentiful feeding-stuff in Great Britain. There is one egg-producing animal which can utilize grass, namely, the goose. Would it not therefore be worth while making an effort to increase its efficiency as an egg-producer by systematic trap-nesting and selection, as has been done in the case of the hen and the duck? It did not take a very long period of systematic selection to increase the egg-production of ducks from a few dozen a year to the level of that of the most high-yielding hens, and the same thing would probably prove true of geese. At the same time, a smaller strain, producing an egg of a smaller, more convenient size, could be evolved by selection.

If, by these methods, geese could be made to replace hens largely as egg-producers in Britain, I think it would be an achievement of very great national importance.

E. E. JONES.

3 Canterbury Way,
Rickmansworth, Herts.