interesting result was that for induction of the latter type, the ABA-coupled spleen cells were required to share certain class II molecules with the recipient — that is, the induction event was MHC-restricted. Thus, even in a non-ontogenic model, for at least one limb of the tolerance-inducing process, the cells involved must recognize antigen in association with MHC-encoded gene products.

This suggests that the distinction of self from nonself is not mediated by any event in ontogony involving the expression or recognition of only a part of the T-cell receptor, for example only one of its two polypeptide chains[12]. If the two-chain molecule forms a single combining site, similar to that of heavy and light chains for immunoglobulin, one can postulate that the ability to distinguish between self and nonself might in some cases result solely from the interactions between the antigen and the histocompatibility molecule. A recent example which seems to fulfill this prediction is the T-cell proliferative response to pigeon cytochrome *c* in the B10.A mouse[13,14].

Structural studies using synthetic peptide analogues have suggested that a lysine at position 99 of cytochrome *c* is a contact residue for the T-cell receptor whereas a C-terminal lysine at position 103 or 104 is important for interaction with the class II histocompatibility molecule. A comparison of pigeon and mouse cytochrome *c* sequences reveals that both possess a lysine at 99 but that whereas the pigeon has Ala 103, Lys 104, the mouse has Asn 103, Glu 104. Thus mouse cytochrome *c* fails to stimulate T-cell clones from B10.A mice specific for pigeon cytochrome *c* solely on the basis of sequence differences that affect its interaction with the class II molecule. T-cell clones specific for mouse cytochrome *c* in association with B10.A class II molecules are presumably deleted or suppressed by the self-tolerance mechanism.

Overall, these experiments involving *in vitro* and *in vivo* experimental models of helper, cytotoxic and delayed-type hypersensitivity T-cell function have led to one and the same conclusion: that the induction of T-cell tolerance is MHC-restricted. This directly refutes a major prediction of the Cohn–Epstein model of T-cell activation and suggests that independent recognition of antigen without histocompatibility molecules does not occur even during ontogeny. These results do not, however, eliminate the application to T cells of the Bretcher–Cohn two-signal model of descrimination between self and nonself. Thus it is possible that engagement of the T-cell receptor by both antigen and histocompatibility molecule delivers signal one which, by itself, induces tolerance, but if coupled with a second signal (for example interleukin 1), transduced through a separate receptor on the T-cell membrane, induces activation. Such models are currently being tested in several laboratories using anti-receptor antibodies and T-cell clones[15,16]. □

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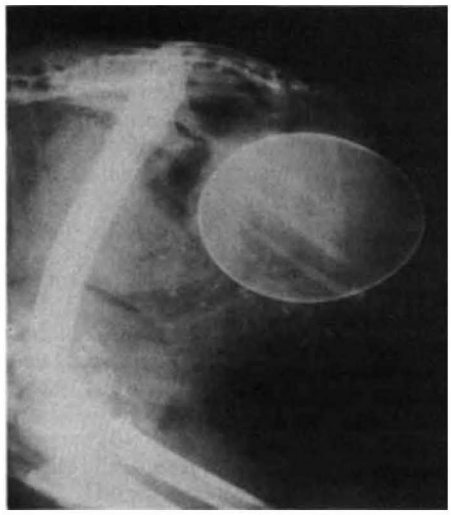

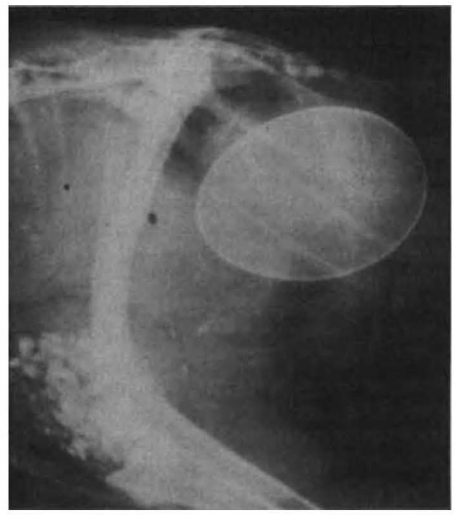

AVIAN eggs are laid blunt end first. For many years it was taken for granted that birds form eggs that way, perhaps first creating soft spheroids and then gradually deforming them into ovoids by the peristaltic movement of their uterine muscles. Although several physiologists, starting with Fabricius of Padua in the 17th century, realized that the egg rotates *in utero*, thereby confuting the peristaltic theory, confusion abounded until J.R.G. Bradfield, in the Department of Zoology at Cambridge, asked J.A.F. Fozzard, an experienced radiographer at the School of Anatomy, to X-ray hens at successive stages of their incubation cycle. In April 1946, Fozzard photographed a Rhode Island Leghorn with a Coolidge X-ray tube at 60 kV placed 1 m away and obtained the radiograms shown here with exposures of 0.05 s.

The faint outline of an egg in production becomes discernable about a quarter of the way through the 26-hour cycle of production and by half way though the cycle it is unmistakably oval. Until 23.5 hours (above left) the sharp end points towards the cloaca but by 25.5 hours (above right) rotation of the egg has directed the blunt end towards the cloacal exit. In between, the brooding hen rises to her feet to enable the egg to rotate and drop to a deeper position.

So the ingenious explanation offered for the egg's form by D'Arcy Thompson in his famous work *On Growth and Form* — that muscular contractions propelling an egg down the oviduct account for its shape — was radiographically refuted.

Why should birds behave in this extraordinary fashion? Obviously there must be some natural advantage to the blunt-laid egg, and in an article in the *British Medical Journal*, 1st vol, p.585 (1948), entitled "De formatioine ovi et pulli" in imitation of Fabricius and William Croone, H.A. Harris advanced one theory. The peristaltic uterine contractions of a hen are surprisingly forceful, he argued, and the blunt-end-foremost arrangement is favoured to avoid rupture of either egg or uterus. However, Bradfield found the alleged peristalsis to be without foundation (*J. exp. Biol.* **28**, 125, 1951). Instead, the shell gland holding the egg is extruded through the cloaca where the egg is deposited before the gland retracts. Is there some other reason why hen eggs are ovoid? If the ovoid form has such exceptional tensile strength, why are some birds' eggs spherical? Are all birds equipped with an internal rotation system to guarantee their eggs a blunt exit? And why is the egg not formed the 'right' way round in the first place?

In the decades since Bradfield's study, various papers have referred to his analysis of the rate of calcium deposition in eggshell formation, but none has accounted satisfactorily for the purpose and mechanism of rotation. Could this long-standing problem be met with a seasonal solution from an Easter reader of the last of this series of historic scientific photographs? **Jon Darius**

Taken from Beyond Vision, *an exhibition just opened at the Science Museum, London and a book of the same title just published by Oxford University Press. Reproduced by kind permission of J.A. Fairfax Fozzard.*