

INCUBATION RESEARCH GROUP

MEETING 1980

The following are the abstracts of papers given at the I.R.G. meeting held at the University of Bath, September 1980.

GENERAL DISCUSSION ON THE FUTURE OF THE INCUBATION RESEARCH GROUP Chairman: Dr. S. Tullett

Dr. S. Tullett presented a brief history of the I.R.G., and outlined some of the areas in which discussion was necessary. It was agreed that:-

- (1) The I.R.G. was a viable group, and should hold future meetings.
- (2) The I.R.G. should be an informal group with no rules or elected officers etc., and should be open to both academic and commercial researchers in the field of avian incubation.
- (3) Meetings will be held no more often than once a year.
- (4) Organization of the I.R.G. meetings would be undertaken by a local secretary, who will also organize financing and set registration fees.
- (5) Abstracts of the papers given at the meeting will be prepared by the contributors, and sent to members by the local secretary. A note about the meeting may be placed in Current Notes of Ibis.
- (6) The 1981 meeting will be held at the A.R.C. Poultry Research Centre, Roslin in September. Local secretary will be Dr. S. Tullett. In 1982 the proposed venue will be the Royal Veterinary College, London.
- (7) If possible, a theme for these meetings will be proposed.

THE EFFECTS OF COLD STRESS ON THE RESPIRATORY PATTERNS OF HATCHING BIRDS C.M. Dawes, Royal Veterinary College, London.

The ambient temperature of pipped eggs of the domestic fowl, Japanese quail, and domestic duck was reduced from about 39°C to 20°C. In each species there was a progressive decline in the respiratory frequency of the embryo. But there was often a transient increase in the amplitude of respiration indicating that the embryo attempts to maintain or increase its rate of pulmonary ventilation. It is proposed that the embryo tries to increase its rate of heat production in order to offset heat loss from the egg, and that this response creates a demand for extra oxygen.

GAS TENSIONS WITHIN THE EGG OF THE QUAIL DURING THE CLOSING STAGES OF INCUBATION

G. Nair, The Royal Veterinary College, London

The respiratory status of the embryonic quail during the two days prior to hatching was assessed by measuring the gas tensions within the air space of the egg and of blood collected from the chorioallantois. When the lungs became inflated there was a significant decrease in the PO_2 of the gas in the air space. After pipping, there was a rise in the PO_2 and fall in the PCO_2 within the air space, together with corresponding changes in the blood. The outer shell membrane remained intact until the onset of hatching. These results were compared with those obtained by other workers using the domestic fowl; in this species, the outer shell membrane is often ruptured at the time of pipping and the changes which then occur in the gas tensions of the blood are greater than in the fowl.

THE EFFECTS OF TEMPERATURE ON VOCALIZATION IN THE HATCHING FOWL

M. Hooper, Royal Veterinary College, London

Vocalization in the embryo of the domestic fowl is usually associated with an increase in the amplitude of respiration. The use of recordings of respiratory movements in assessing vocal activity was compared with direct recording. When the ambient temperature of pipped eggs was either increased or decreased from the normal temperature of incubation there was often a marked increase in vocalization and hatching activity. These responses were discussed in relation to the incubation behaviour of the parent.

THE MECHANISM OF YOLK SAC WITHDRAWAL IN CHICK EMBRYOS

G.J. Wishart, ARC Poultry Research Centre, Roslin, Midlothian

During the last few days of incubation, the yolk sac is withdrawn into the abdomen of turkey and fowl embryos. Incomplete withdrawal results in chicks with unhealed navels which are subsequently downgraded, causing financial loss.

With this problem in mind, we have re-examined the mechanism by which the yolk sac is withdrawn in chick embryos. We find that the generally accepted mechanism - that contractions of the abdominal musculature pull the yolk sac into the abdomen - which has been widely quoted since the 1930s seems much less important than shrinkage of extra-embryonic membranes, especially the inner allantoic membrane, around the yolk sac, constricting it and squeezing it through the navel into the abdominal cavity.

We have subsequently found that such a mechanism has been previously described, but only in literature of the last century and the first decade of this century.

We believe that the mechanism of yolk sac withdrawal requires further examination and that its clarification will lead to an understanding of the problem of unhealed navels.

WATER LOSS IN WILDFOWL EGGS.

N.A. French

Measurements of water loss were obtained from infertile eggs of 21 species of wildfowl, and the calculated water vapour conductances (G_{H_2O} , in units of $\text{mg.day}^{-1}.\text{torr}^{-1}$) for these species were reported. The mean G_{H_2O} for all 21 species is $14.53 \pm 9.82 \text{ mg.day}^{-1}.\text{torr}^{-1}$. The observed G_{H_2O} , coefficient of conductance (K) and the allometric relationship between G_{H_2O} and fresh egg weight did not differ significantly from previous studies.

The humidity of the nest was estimated from measurements of G_{H_2O} in the literature of 54 species of wildfowl, assuming a 15% weight loss during incubation. Nest relative humidities (%) at 37°C were found to vary between 0% to 60%, with a mean of 38%

RESEARCH PROSPECTUS.

Dr. S. Tullett

Steve Tullett discussed the research prospectus at the Poultry Research Centre for work on incubation. Three projects are involved:

Factors influencing hatchability in commercial hatcheries.

Effects of genotype, pre-incubation storage and incubation environment on embryonic heart rate.

A new remit is to study the effects of genotype, storage and incubator conditions on post-hatching performance.

A brief description of current interests and experiments was given and it is hoped that some of these will be completed and ready for discussion at the next meeting.

WATER LOSS DURING INCUBATION: POST PIPPING DRYING

A.H.J. Visschedijk

Water vapour conductance is not actually influenced by air movement. However, determinations made in still air are often too low, depending on the number of eggs used. It is shown that some air movement in the desiccator is required to avoid a certain back-pressure of water vapour being built up around the eggs. Otherwise G-determinations are affected by egg number (amount of water produced), surface area of desiccant and temperature. It is proposed to develop a device for practical use in which G could be determined, for instance, 30 eggs at a time.

It is generally accepted that 15% of the initial weight of the avian egg must be lost as water vapour during incubation. It is furthermore assumed that, in chicken eggs, 12% must be lost prior to pipping on the 20th day. Hence 3% should be lost after pipping until the newborn chicken is just dry. It was shown indeed that average postpipping weight loss was 3.1% (± 0.7 , SD, $n = 67$). Dry chicken weight appeared to be highly dependent on prepipping weight loss.

SOME ASPECTS OF SHELL STRUCTURE AND PERFORMANCE IN RELATION TO INCUBATION
AND HATCHING.

G. Bond

A model was suggested to explain the possible adaptive significance of the presence of the mammillary and surface crystal layers in the eggshell. The mammillary layer is seen as serving a useful function in reducing the sensitivity of the shell to inner-surface damage and, in particular, in minimizing the strength changes that occur during incubation. The surface crystal layer is seen as protecting the egg from the effects of abrasion and other surface damage to the outside of the shell; a similar role is attributed to the inorganic covers found on the eggshells of some cliff-nesting seabirds.

The results of a series of tests on the effects of moisture content on the mechanical behaviour of the integument were then described. For both the brittle hen egg integument and the tougher quail egg integument, an increase in water content decreased the breaking load and the area under the load-displacement curve in pipping simulations on shells with membranes present but had little effect if the membranes had been removed. Simulations of the "pushing" phase of hatching climax revealed a decrease in the breaking load for the shells with membranes (but a small increase for shells alone) with increasing water content for both species. However, while the area under the load-displacement curve was unaffected by water content for hen eggs, it increased markedly with increasing water content for quail eggs, particularly when the shell membranes were present. These results were discussed in the context of the different hatching strategies adopted by the two species.