# Egg production - 20/5/25

Research by DBCP volunteer – Gareth Wallis

The return of breeding behaviour in early Spring is triggered by an increase in infrared light from the lengthening days. This penetrates the birds' skulls and is detected by special cells in the hypothalamus, part of the primitive brain. The signals from these cells are relayed to the pituitary gland which sends out hormones (gonadotrophins) to stimulate the production of sex hormones by the males' testicles and the females' ovaries.

As the breeding season progresses, other environmental factors such as ambient temperature and food supplies also come into play to alter the birds' hormones and drive the changes in behaviour seen during the breeding season.

The increased testosterone level in males drives the territorial aggression and defence against predation which are behaviours seen only during the breeding season. Hormonal changes in females are more complex and drive both changes in behaviour and the production of eggs.

Although the bonding behaviours observed in the field are triggered by the underlying hormonal changes, they also feedback through the same hypothalamic-pituitary axis to provide the fine tuning of hormones that coordinates the behaviours of the pair. For example, the behaviours of the male prior to nesting: clearing the nest field of predators, initiating nest site selection and mating, have to be synchronised with the production of eggs by the female and this is achieved through the bonding activity.

Two recurring questions about mating are: 'Does it indicate the nest field?' and 'How long does it happen before nesting?'

From observations, it is clear that the field in which mating occurs is not necessarily the future nest field. The timing of mating before nesting is more difficult to answer.

The research on the reproductive biology of birds has been carried out in domestic fowl that naturally produce large clutches of eggs. In these species, sperm can be stored for some time; turkeys can store sperm which remains viable for 30 days or more.

Curlew are likely to be different but can probably store sperm for a few days. Full mating seems to take place during nest site selection. The tete-a-tete between the birds that precedes both nest site selection and mating can be observed to lead to either event. However, nest site selection can take some days, so curlew need some sperm storage capacity in case egg laying is delayed for lack of a suitable nest site due, for example, to disturbance by livestock etc.

A critical part of ovum development is yolk formation. This may take anything from 4-30 days depending on the species and female birds produce the exact number of yolked ova that correspond to the number of eggs that they will normally lay. In curlews, four yolked ova are stored in sequence in the ovary to be released at 24hr intervals, to be fertilised.

If the first clutch is lost, the female can lay a second clutch, usually of only 3 eggs, within a few days by accelerating the process of yolk formation.

The sperm needs to be released from the storage tubules, which are situated at the bottom of the oviduct near the cloaca a few days before ovulation so they have time to travel

up to the infundibulum. Here, they must meet the ovum within 15 minute of its release from the ovary, before it acquires a coating which prevents fertilisation by the sperm.

Unlike mammals, the ovum in birds needs to be fertilised by a number of sperm. Only one sperm contributes to the genetics of the chick; the others are necessary to trigger the development of the egg.

From ovulation it takes about 24 hours for the entire egg to form as it travels down the oviduct; therefore, it takes 4 days for a curlew to complete its clutch.

The shape of the egg, which in the curlew is unusually conical, is determined by the shell membrane, made in the isthmus. The shell is then added to the membrane after it leaves the isthmus, in a more vascularised section of the oviduct called the shell gland. Specialised cells in the shell gland deposit blobs of calcium carbonate on the shell membrane (mammillary cores) in a process that takes a few hours.

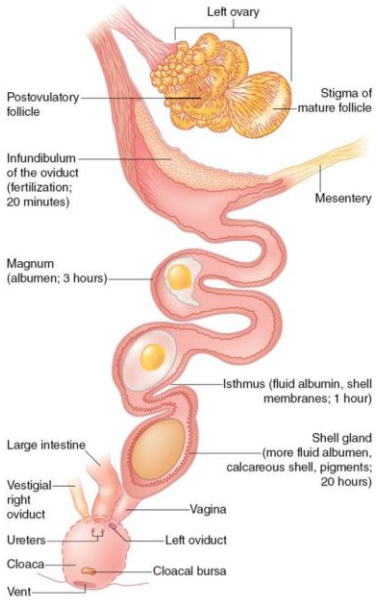


**Fig. 6.43 Ovulation and the passage of an ovum through the reproductive tract.** Most female birds only have one functional ovary. To initiate ovulation, the infundibulum temporarily opens to permit the entry of an ovum. From there, it travels to the magnum, where albumen (egg white) is secreted around the yolky ovum. In the isthmus, more watery albumen and shell membranes are deposited. The shell forms as the ovum passes through a short isthmus and into the uterus, where the shell and pigments are added. The ovum then typically rotates 180 degrees in the vagina to be laid with the blunt end first, via the cloaca. (© Cornell Lab of Ornithology.)

*Handbook of Bird Biology*, Third Edition. Edited by Irby J. Lovette and John W. Fitzpatrick.

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The egg then moves down into a less vascularised part of the shell gland where water is added to the egg to plump it up to its final shape.

Further specialised cells then add more calcium carbonate to the cores creating a series of microscopic columns that make up the egg shell. The small spaces between the overlapping columns lead to the formation of pores in the shell allowing gas transfer for the developing embryo.

In the last few hours pigments are added giving the egg its base colour and then its markings and finally a waxy protein coating.

In summary, it takes about 20 hours for the shell to form and it is very demanding on dietary calcium for the bird.

Finally, why would a curlew's egg be so conical? Guillemots and, presumably other cliff nesting birds have conical eggs to reduce the risk of their eggs rolling off the nest ledge. Curlew have no such excuse.  Gareth's investigations have revealed two probable reasons:-

The conical shape permits an 8% larger yolk which means a faster start in the growth of their precocious, nidifugous chicks.

Secondly, the eggs can pack tightly under the birds' brood patch and, by lying close together, keep each other warm when the bird leaves the nest.

Gareth also recommends Tim Birkhead's book, *The Most Perfect Thing: Inside (and Outside) a Bird's Egg* as a fantastic source of information on everything egg related.