STUDIES ON THE INDIAN GHARIAL GAVIALIS GANGETICUS
(GMELIN) (REPTILIA, CROCODILIA) IX. OBSERVATIONS
ON THE DEVELOPMENT AND FATE OF EGG TOOTH

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ABSTRACT

The egg tooth of the Indian gharial Gavialis gangeticus (Gmelin) develops as a small papilla at the extreme tip of the snout on the upper jaw. As embryogenesis proceeds the papilla sinks down to the ventral surface of the upper jaw, but it simultaneously gives rise to a minute hard structure, the egg tooth, that projects out from the surface. The tooth punctures the shell membranes, making a passage for the young for liberating itself out of the egg. Within thirty-five days of post-hatching period the egg tooth disappears due to wear off and cell overgrowth around it. In blind individuals the tooth is non-functional.

INTRODUCTION

The Indian gharial Gavialis gangeticus (Gmelin) lays eggs of calcareous nature. Underneath the shell, covering the albumen, are two membranes, an outer thick membrane of leathery texture and a fine inner membrane intimately applied to the outer membrane. As the process of incubation proceeds, due to imbibition of moisture and increase in size of the developing embryo, the egg swells up and develops cracks on the shell surface. Swelling up of the egg and the development of cracks are therefore, the characteristics of fertile eggs. An unfertile egg may however, on very rare occasions, show these characteristics probably due to water imbibition alone.

The incubation period for the gharial egg varies from eleven to thirteen weeks. Towards the end of seventh week of development, portions of the egg-shell fall off, a process called shell-fluffing (Dustard and Singh, MS) due to further swelling up of the egg coupled with the formation of more cracks on the shell. At this time the shell-membrane system may develop one or two micro-punctures through which albumen may be seen to ooze out as tiny droplets as a result

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In embryos less than 17cm long, the snout is soft. The snout possesses two minute but distinct papillae—one the 'nasal papilla' surrounding the nostrils (non functional at this stage), and the other, a soft 'egg tooth papilla', projected anteriorly from the extreme tip of the snout on the upper jaw. Fig. 4A shows the basic design.

![Diagram](image)

**Fig. 4.** A. Basic design of the tip of the snout in gharial. At the tip the premaxilla is three lobed, a frontal lobe (2), and two lateral lobes (3). The nasal opening is situated over a papilla (3) between the lateral lobes. The lateral margin of the premaxilla bear the dental papillae (4).

B. The head of an early embryo of gharial. The snout (4) at this stage shows the various dental papillae (3), nasal papilla (3) and the egg tooth papilla (1).

C. The head of a gharial hatchling just after hatching. The snout (4) at this stage bears the dental papillae (3), the nasal papilla (3) and the egg tooth (1).
of the snout at its tip and Fig. 4B shows the head of an embryo showing the various papillae. At this stage the snout measures between 0.95cm and 1.5cm and egg tooth papilla about 0.5mm.

In larger embryos the snout is comparatively a hard structure, the hardness increasing with increase in size of the developing young. In these specimens the papilla is replaced by a minute, hard and pointed projection, the egg tooth proper which is detectable by close observation and by touching it.

At the time of hatching, when the body length is 37.4cm on an average and the snout is 3.4cm on average, the egg tooth measures about 0.3mm. The egg tooth is detectable in all the hatchlings upto 20th day of post-hatching period. After hatching, the egg tooth disappears within twenty to thirtyfive days. After 35th day, when the hatchlings are on an average 40cm long, the tooth is no more detectable in any of the hatchlings.

Curiously enough, it was noticed that in embryos more than 20cm long, a distinct, hard papilla was present on the ventral side of the upper jaw at the tip, just underneath the externally sited egg tooth. This structure was found to persist in juveniles of even 1.7 metre long. Larger individuals have not been examined.

The experimental sample also consisted of four blind gharials including one live individual 95cm long. One of the preserved embryos, measuring 10.6cm, had the egg tooth at its papilla stage and two others, measuring 22.7cm and 33.2cm, had it at the definite tooth stage with the usual ventral papilla. The measurements of the egg tooth papilla and the egg tooth proper were concurrent with the measurements made for normal-eyed individuals.

DISCUSSION

From the foregoing account the following pattern for the development of egg tooth in Gavialis gangeticus is well envisaged.

The snout, during the course of its very early stage of development, differentiates its various finer armaments. These armaments include all papillae that are to develop into teeth, the papilla-like elevation bearing the nasal opening, and the egg tooth papilla (Fig. 4D). At this stage the egg tooth papilla is soft and anteriorly projected
Fig. 1. (Top) - Protrusion of snout after puncturing the shell membrane.
Fig. 2. (Bottom) - The emergence of the head.
Fig 3—Hatching in *Gaudiella gaurjica* (Dalmia)—liberation of the body.
from the tip of the snout on the upper jaw. As development proceeds
the papilla sinks into the tissue at the snout tip, assumes a harder
texture and ventrally remains as a persistent structure. However,
on the surface, at the previous position of the papilla, a minute
tooth-like hard pointed structure develops from the papilla itself
(Fig. 4C).

The disappearance of the tooth is due to rapid growth of
the snout, adding cells around the base of the tooth. During this
period the growth of the the snout is extremely rapid (Singh, MS).
Furthermore, the disappearance of the tooth may also be due to gradual
wear off.

Observations made during handling of the juveniles at the time
of hatching suggest that blind gillials are incapable of liberating
themselves from the egg. For liberation they have to be helped out
by operation. It is presumed that either the egg tooth is not strong
enough at the base to puncture the shell membranes as a result of some
effect due to interaction between the determinant factors responsible
for the development of the eyes and the snout (Singh, MS),
or because of blindness, the subject, in absence of any photo-stimulus,
does not get initiated to manœuvre the tooth for puncturing the
membranes. These hypotheses will be explored in future work.

The presence of a pointed calcareous projection, the "caruncle"
on the snout is reported in the hatching of many chelonian species
(Muller, 1921; Einem, 1956; Allard, 1935; Legler, 1960; Booth, 1958; Cahn,
1937; Caldwell et al., 1959; Cagle, 1950 and Moll and Legler, 1971).
But the caruncle is not a true tooth and it is not always used for
puncturing the egg shell membrane. The prime function of the caruncle,
therefore, is suggested to be for rupturing the extra-embryonic membranes,
amnion, chorion, yolk sac and allantois (Moll and Legler, 1971). The
caruncle is reported to be lost within ten to sixty days after hatching.
However, whatever may be the nature and fate of the caruncle in
cheloniens, it is analogous to the egg tooth in the gillial.

The egg tooth in birds is of two types—deciduous type,
where it is quickly lost after hatching of the young, and disappearing
type, where it does not fall off but gradually loses its identity (Clark,
The function and fate of the egg tooth is known for the American alligator, *Alligator mississippiensis* (Daudin) and the Nile crocodile, *Crocodylus niloticus* Laurenti. The two most widely mentioned species. The tooth is reported to be deciduous, falling off immediately after the embryo hatches out (Guggisberg, 1972). But as described above the gharial never drops off the egg tooth; rather the latter gradually disappears. Thus the current investigation demonstrates that the Order Crocodylia is characterized by both deciduous and disappearing types of egg tooth.

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