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Further Evidence for a Histolytic Process in the Seasonal
Growth of the Reproductive System in *Hyla aurea*

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Abstract

HERNIATION of the left ovary into the right femoral subcutaneous lymph space through a small perforation in the bladder is attributed to a histolytic activity in the tip of the growing ovary causing the formation of the perforation.

IN the consideration of previous examples of herniation in *Hyla aurea*, attention was drawn to a relatively persistent incidence of this phenomenon in frogs of the Wellington district. This was in the order of 0.3 per cent. The initial reports have not produced records from other areas or other species. This apparent unique occurrence in an introduced animal first suggested a possible environmental factor disturbing the normal pattern of seasonal cyclical change in size of the organs of the reproductive system since only these organs have been involved in the cases seen (Richardson, 1943, 1947). These earlier cases were essentially dorsolumbar herniations which were open to interpretation as consequent from pressure hypertrophy involving a coil of the oviduct, a "cystic" ovary, and a testicular fat-body.

A fourth case (1952) was of an entirely differing order. In this specimen, a large female, an abnormally elongated process of the left fat-body had perforated the linea alba without adhesion to enter the subcutaneous lymph-space terminating there as an enlarged mass of fatty tissue. The perforation was 3.0mm in diameter and thick-rimmed, suggesting a tissue-reaction while the herniated mass was some 10.0mm wide by 15.0mm long. This herniation cannot be classed in any of the usual categories. There is no opportunity for embryological defect, for pressure atrophy, or mechanical rupture. With these and other of the usual considerations unacceptable the circumstance requiring explanation was that of the tip of a rapidly hypertrophying structure freely suspended from the dorsal aspect of the abdomen contacting and perforating the linea alba.

The only possibility lay in the presence of some histolytic activity in this structure involving a substance rapidly transferable to the linea alba where it would produce a tissue breakdown. The existence of histolytic processes during metamorphosis has been recognised as phagocytosis in, for example, the reduction of the tadpole tail. There has been also an acceptance that phagocytosis is active in seasonal reduction of the reproductive system after breeding; but in both, attention has been directed to the phagocytes themselves as the demonstrable visible active agents.

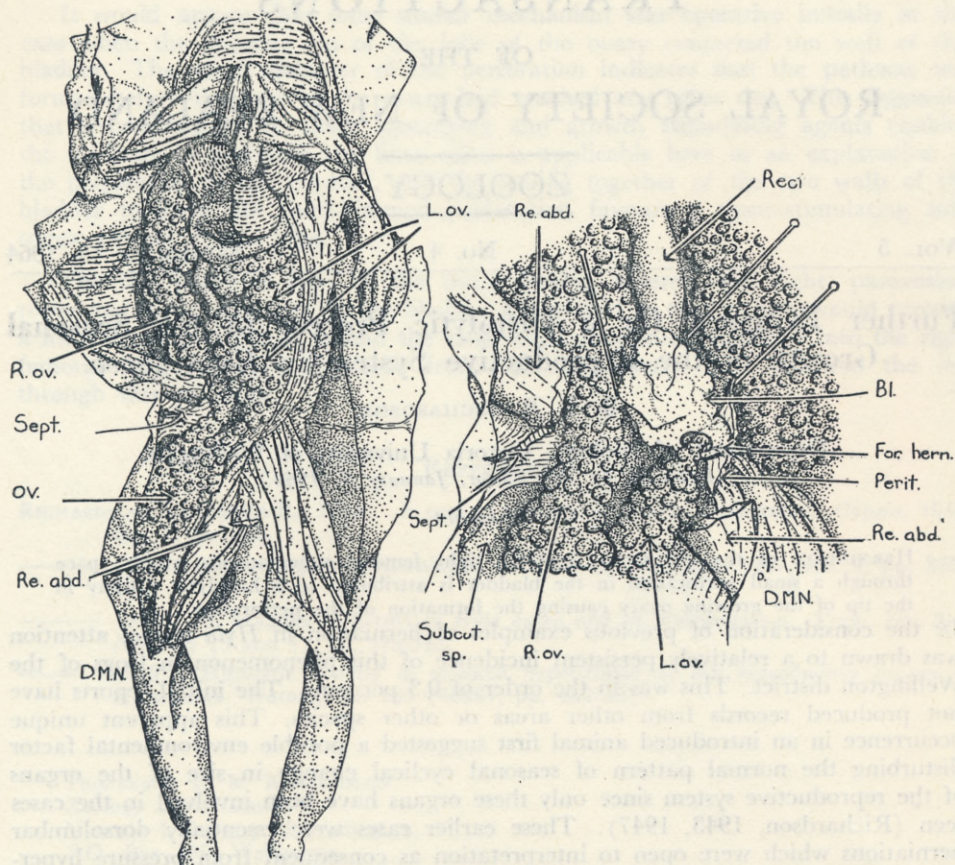


FIG. 1.—Dissection of *Hyla aurea* from the ventral aspect to show hernia of the ovaries into the right femoral lymph-space.

FIG. 2.—Perforation of the bladder by the posterior lobe of the left ovary.

Bl., bladder; For. hern., hernial foramen through bladder; ov., ovarian mass in right femoral lymph space; L. ov., R. ov., left and right ovaries; Perit., peritoneum; Re. abd., rectus abdominus; Rect., rectum; Sept., septum of lymph space; Subcut. sp., femoral subcutaneous lymph space. Figures prepared by Miss D. M. Norris.

Metchnikoff had established by 1892 phagocytic activity as a response to a stimulus such as tissue injury, microbial activity, etc. The perforation of the linea alba may have been brought about by the transfer of either a directly histolytic substance or alternatively a substance stimulating localised phagocytic activity. The existence of such a substance can be postulated in an actively growing organ where in order to permit interstitial growth the tissue framework requires alteration to allow hypertrophy of the essential tissue under hormonal influence.

It can be suggested then that the tissue at the tip of the fat-body manifests a growth involving tissue break-down as well as tissue elaboration. The peritoneum covering the fat-body restrains the tissue-elaborating mechanism but can pass the histolytic agent.

A fifth specimen showing perforation of the bladder by an hypertrophying lobe of the ovary supports in full the above interpretation. It gives evidence that

growth of the ovary involves the production of an histolytic agent and even permits of a suggestion that the histolytic process might play some part in ovulation. This example and interpretation was briefly notified (1959) and this full account delayed in the hope of further material which has not eventuated.

The specimen is a fully grown female measuring 68.0mm from the tip of the head to the end of the urostyle. Externally, the presence of a hernia is not marked. Seen from the ventral aspect, the right thigh is swollen along the ventral face, and in the preserved specimen is firmer to the touch than the opposite thigh. On reflecting the skin along the ventral aspect of the thigh, a large ovarian mass 26.0mm long, generally cylindrical and of 9.0mm diameter, is seen filling the right femoral lymph space and extending from the posterior margin of the mm. abdominales to the knee so that none of the ventral muscles of the thigh are visible but those of the medial aspect are not hidden. The ovarian mass extends into the abdomen through a foramen bounded ventro-medially by the posterior border of the mm. abdominales externus and internus.

With these muscles reflected, the mass is seen to be constricted to a neck about 3.0mm in diameter which divides in the abdomen. One portion continues simply to the posterior lobe of the right ovary. The other portion crosses the paravesical recess for about 3.0mm to reach the midline where it constricts to 1.0mm and passes without adhesion through a thick-rimmed perforation in the ventral portion of the bladder. The two sides of the bladder are fused to form the margin of this perforation so that the lumen of the bladder is sealed off from the coelom. To the left of the bladder the neck expands rapidly into the posterior lobe of the left ovary. All this is without adhesion to the body wall or other structures.

The sequence of events in the development of hernia in this specimen was most probably initiated by the entry of the end of the posterior lobe of the left ovary into the left paravesical recess. This recess is walled laterally by the abdominal muscles, dorsally by the expanded ends of the oviduct (often referred to as uterus), medially by the bladder and rectum. The recess opens widely into the abdomen. All aspects are covered with peritoneum. The perforation in the bladder is in the posterior portion, the ventral third of that organ, a region secured to the abdominal wall by a short, low, well-formed ventral mesentery. In the normal posture there is no structural mechanism which would prevent return of the developing lobe of the ovary. Having in mind the thin, distensible, yielding nature of the bladder and the ease with which the end of the ovary could return to the general body cavity, sustained simple mechanical causes leading to pressure atrophy can hardly be considered as an effective factor in the opening of the perforation through the bladder, nor equally can there be seen an opportunity for perforation to have resulted from sudden gross mechanical pressure of brief duration.

In the previously reported case of perforation of the linea alba by the tip of an abnormally hypertrophying fat-body, the only acceptable explanation required a mechanism operative during a brief contact between the two structures. For this reason, it was suggested that since a structure undergoing rapid growth had made contact with a structure in a state of normal metabolism, there existed an opportunity for the transfer of substances from the first structure to the second. The contacting surface being each peritoneum, these would form no barrier to the transfer, and as the substances induce growth in the peritoneum covering the fat-body, it is reasonable to accept that these would stimulate growth in the peritoneum of the body-wall, but it is difficult to see how this would weaken the linea alba unless a histolytic process was also present.

It would appear that some similar mechanism was operative initially in this case when the growing tip of the lobe of the ovary contacted the wall of the bladder. The small diameter of the perforation indicates that the pathway was formed before the lobe of the ovary had reached any great size. The suggestion that a combination of tissue destroying and growth stimulating agents enabled the fat-body to perforate the linea alba, is applicable here as an explanation of the perforation of the bladder, and the sealing together of the two walls of the bladder to form the thick-rimmed perforation favours a tissue-stimulating substance present at this time.

The left posterior lobe of the ovary having entered the right paravesical recess and being anchored by the bladder was placed so that growth would provide a mechanical pressure to extend the established anatomical pathway into the right femoral lymph space. The lobe from the right ovary then followed the left through this pathway.

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