An Example of Hernia in *Hyla aurea*, and Its Interpretation

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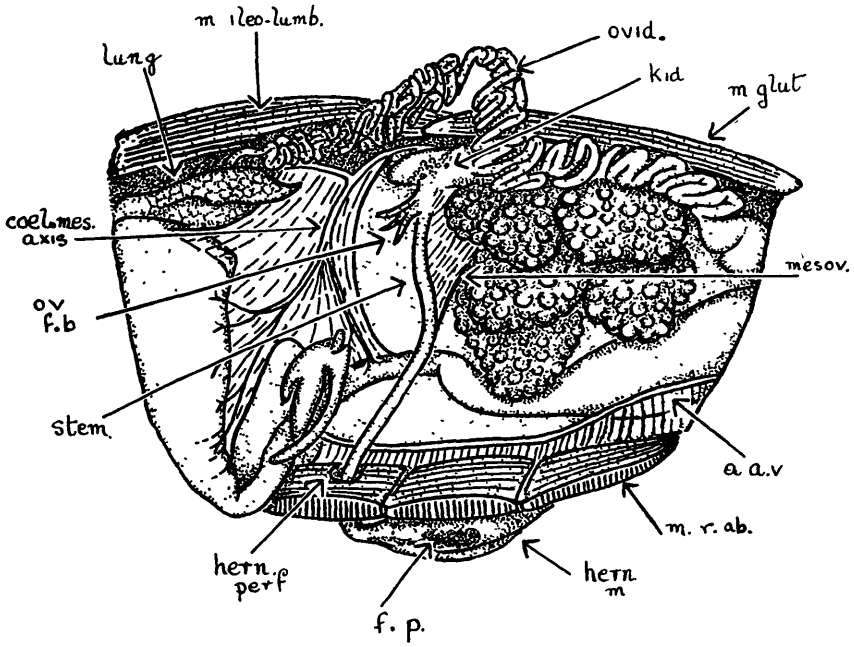
Abstract

An example of hernia in *Hyla aurea* is described in which the ovarian fat-body extends across the abdominal cavity without adhesion to or involvement of other viscera to perforate the linea alba and expand in the ventral lymph-space. In the absence of a reasonable opportunity for the action of local pressure and subsequent pressure atrophy, it is suggested that tissue-stimulating factors present in the hypertrophying fat-body induce at least the initial pathway through the body-wall.

Hernia are apparently rare in Amphibia. The records to date include only those of Hoheisal (1932), who describes hernia in *Necturus*, and three cases of hernia in *Hyla aurea* (Richardson, 1943, 1947). This paper adds a fourth record to the list of *H. aurea*. During the past eleven years over 1,200 frogs of this species have been dissected in the zoology laboratories in this College. Although the incidence of hernia is very low, it is still remarkable in view of the lack of records for the several species of *Rana*, of which many hundreds of thousands are handled and dissected each year, and in the absence of records for *H. aurea*, of which at least 4,000 must be examined yearly in other centres. The four specimens showing hernia have all been taken in the Wellington area. All are mature. In each the hernia involves a portion of the reproductive system and the hernia are not minor but gross, such as could not escape notice.

The present specimen is a female measuring 76 mm. from the anterior tip of the head to the free end of the urostyle. There is no obvious external indication of a hernia. Posterior to the xiphisternum there is a very minor subcircular swelling on the venter. Reflecting the skin from the venter reveals a flat, rather pyriform mass 10 mm. wide by 15 mm. long, tapering abruptly anteriorly, but nowhere over 3 mm. thick, and occupying the greater part of the area between the posterior two-thirds of the origin of the Mm. pectorales abdominis. The mass is firmly attached to the body-wall by a thin membrane continuous with the serosa and internal to this a layer of fibrous connective tissue which is not obviously continuous with the muscular sheaths. Separation of these coats from the body-wall frees the mass as a whole, since it is not attached on its inner aspect to the body-wall, revealing that the mass is continuous with a stem which is 1·5 mm. in diameter and emerges from the abdominal cavity through a thick-rimmed subcircular perforation 3·0 mm. in diameter in the linea alba and situated 4·0 mm. posterior to the xiphisternum. The stem is completely free from the margin of the perforation, and dissection through the left lateral aspect of the abdomen shows that the stem passes to the left of the anterior abdominal vein and its mesentery without

involving either of these structures, traverses the abdomen, passing between the anterior margin of the ovary and the cardiac limb of the stomach, then along the anterior margin of the mesovarium to lose its identity in taking origin from the ventral margin of the ovarian fat-body and its mesentery.



The origin, path and relationships of the hernia from the left lateral aspect with the stomach turned anteriorly, the oviduct displaced: a.a.v., anterior abdominal vein; coel. mes. axis, coeliaco-mesenteric axis; f.p., fat patches; hern.m., hernial mass; h. perf., hernial perforation; kid., kidney; M. glut., M. gluteus; M. ileo-lumb., M. ileo-lumbaris; M. r. ab., M. rectus abdominis; mesov., mesovarium, ovid., oviduct; ov.f.b., ovarian fat-body; stem, hernial stem.

The left fat-body is small compared with the right one. The latter consists as is usual of a mesenteric sheet rising from the anterior margin of the mesovarium. The sheet divides distally into two plates each again divided into some ten thin elongate finger-like processes, some of which are forked distally. These processes are 12 mm. to 14 mm. in length and extend freely in the abdominal cavity. The left fat-body rises as a sheet from the root of the anterior margin of the mesovarium. This sheet supports only a single plate carrying three processes, all less than 5·0 mm. in length. The stem of the hernia forms at the site corresponding to the second basal plate of the right fat-body. Unfortunately, the vascular supply of the stem cannot be completely traced, but the arterial supply and venous drainage open from and into the vessels of the recognisable fat-body. These features and the presence of small patches of fat in the external mass adequately confirm that the hernia originates in the left ovarian fat-body.

Hernia are commonly regarded as having an anatomical basis, some local weakness usually congenital, and a physiological basis in

the nature of a localised pressure. The earlier records for *H. aurea* include a female in which the normal hypertrophy of the one oviduct had led to extrusion of a mass consisting of the oviduct covered by mesentery and peritoneum through an aperture passing lateral to the ilium between the tip of the transverse process of the sacral vertebra, the origin of the M. gluteus and the posterior border of the M. obliquus externus, so that the hernia expanded beneath the dorsal aponeurosis. In the second specimen, a female, the right ovary was "cystic". The anterior lobe of the ovary perforated the body-wall behind the border of the M. obliquus externus, actually perforated both the M. obliquus internus and the M. transversus abdominis to enter and expand in the lateral subcutaneous lymph-space. The third specimen was a male in which portion of the testicular fat-body in hypertrophy had split its supporting mesentery to the base and dissected a passage through the intermuscular fascia to expand in the dorsal lymph-space as a bean-shaped fat-laden body.

The fourth example resembles the previous cases since the reproductive system is involved, and is related to the hernia in the male since in both it is the fat-body which is herniated; but the present example is distinct from the others. In the first three, hypertrophy extending structures in an abnormal direction can be appreciated as producing local pressure which is relieved by dissection along an established anatomical pathway, the intermuscular fascia, or by pressure atrophy and the creation of a new pathway, the perforation of the muscles of the body-wall.

In this present specimen, there is no indication of an embryological origin for the hernia. It is clear, since there is no involvement of the alimentary canal or other structure, that hypertrophy of the fat-body brought this portion of the fat-body into contact with the ventral body-wall; but in the absence of adhesions to the body-wall or adjacent viscera, it is most difficult to conceive of any way by which simple pressure could be created sufficient to produce a pathway through the linea alba since any initial pressure could be readily relieved by expansion of the fat-body within the abdominal cavity. In this example there is so little opportunity for the initiation of pressure atrophy, there is no indication of initial involvement interfering with the nutrition of the area which has yielded passage, that some other primary process must be assumed.

The problem in this example centres on the establishment of the initial pathway in the linea alba. The situation in the first instance was that a structure, the fat-body, in a phase of active growth, contacted and established entry into a second structure, the linea alba, which was in a state of normal metabolism. It is reasonable to assume the presence of growth-stimulating substances in the fat-body influencing both the supporting tissues and the peritoneum. There is no indication whether this process of hypertrophy involves phagocytosis and replacement, or simple multiplication, but with contact between the fat-body and the linea alba, an agent of either type if transferable could induce change in the latter of a nature suitable for the establishment of an initial pathway by erosion or localised adhesion. Certainly, if hypertrophy of the fat-body involves phagocytosis, the

induced accumulation of phagocytes and their activity in the tissues of the linea alba is more acceptable as a mechanism for the rapid provision of a pathway, than any attempt to interpret the present hernia in terms of congenital weakness and local pressure.

This interpretation is equally applicable to the other examples of hernia described in *Hyla*. In these it can be seen that essentially the same problems existed, but in view of the loci of those hernia the possibility of pressure and its consequences could not be dismissed.

It is clear that in herniation, the initial establishment of the pathway is of overall significance. To what extent the interpretation of the mechanism in the above example can be more generally applied to the understanding of the mechanism of herniation cannot be discussed here. The examples from *Hyla* form a peculiar group in that they entail hernia of a system undergoing a normal seasonal hypertrophy in the adult animal. In the two cases of hernia of the fat-body there is no real indication that the hernia are of recent development. In the examples of hernia of the oviduct and of the ovary, both were gross, interfering with normal oviposition, and from all indications of recent development. The suggestion that the pathway is cleared by the induction of tissue change through the transfer of stimulating agents from the hypertrophic structure to adjacent tissues is certainly compatible with the rapid formation indicated in two of the hernia.

Literature Cited

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