

## TONSILS AND OTHER LEUCOCYTOPOIETIC CENTRES IN THE INDIAN FROG *RANA TIGRINA* (DAUD)

HARISH C. NIGAM

Zoology Department, Lucknow Christian College, Lucknow 226 001 (India)

**I**N spite of the fact that frog has been the 'basic' animal in the teaching of biology and hundreds of frogs are dissected every year in the laboratories, not much work has been done on its anatomy and physiology. An attempt was made by this author last year<sup>6</sup> to describe some special features in the heart of Indian frog *Rana tigrina*. The present paper is aimed to describe the lymphoid and leucocytopoietic centres in the same species of frog. Such centres in this frog are several and have been found to play significant roles in the life of frog in different parts of the year.

Freshly narcotized and formaline preserved frogs of the desired species were procured from and around Lucknow. They were dissected throughout the year taking into consideration both active and hibernation periods. Gum was injected<sup>4</sup> into the lymphatic system through the dorsal cutaneous lymph sinus of frogs narcotized with 5 ml of 1% Urethan solution. The injection increased the colloidal osmotic pressure in the tissue spaces; this prevented the back-suck of the fluid into the venules and hence led to the swelling of the lymph sinuses. This technique helped in observing the lymph sinuses and studying the lymphoid centres. The suspected lymphoid organs were then exposed and their relation to the blood vessels traced out. Grafts from the suspected centres were macerated on the microslides and examined for their nature and contents. Leishman's stain was used to identify the leucocytes.

The lymphoid centres of frog appeared as irregular masses of yellow or orangish colour in the preserved as well as in the freshly narcotized frogs collected from September to following January. In the active period from July to September, the colour was however lighter. It was not uncommon, but unaccountable, in some frogs to find some centres having a grayish tinge after preservation.

Various lymphoid centres may be described thus :

1. *Pharyngeal tonsils*.—A pair of these lymphoid centres were exposed by cutting open the roof of the mouth cavity where they appeared as small diffused lymphoid masses of yellow colour just

beneath the bulgings of the eye balls towards the mouth cavity (Fig. 3). These have been suggested to be homologous with the pharyngeal tonsils of mammals<sup>10</sup>. During the active periods of the life of frog these 'tonsils' contained lymphocytes and leucocytes with scattered adipose cells. The blood cells obviously help killing the bacterial and protozoan invaders which might find way into the mouth cavity and lungs with food or air.

2. *Thymus*.—This is no more believed to be an endocrine centre. Variations were found in its size in different frogs. The thymus, one on each side, was found to be located behind the tympanic membrane and under the depressor mandibulae muscle.

3. *Superior and inferior pectoral lymphoid centres*.—These paired and bilaterally symmetrical centres were spotted by their yellow colour in the vicinity of the pectoral girdle, lying between the skin and the muscles. The inferior lymphoid centre was exposed by cutting away the skin from the chest of frog and lifting the pectoral muscles of the girdle to bring in view coracobrachial muscles. This centre consisted of roughly a triangular mass of lymphoid tissue surrounding the junction of the brachial vein with the musculocutaneous vein. For some distance into the fore limb this mass extended around the brachial vein.

The superior lymphoid centre, initially appearing as a large patch of lymphoid tissue in front of the clavicle of each side, was found attached to the skin overlying it. The centre was exposed in full by lifting the pectoral and coracoradial muscles overlying it. This lymphoid mass was associated with the facio-mandibular vein<sup>2</sup> which passes through this centre. The said pectoral lymphoid centres are bathed by the lymph of the large pectoral lymph sinus (Fig. 1).

4. *Deep pectoral lymphoid centres*.—These are located deep in the thoracic cavity close to the sinus venosus on either side and surround the musculocutaneous veins shortly before they join the precavals. The deep centre is reached by removing the coracoid of the pectoral girdle and

tracing it upto the musculocutaneous vein. It is bathed by the large coelomic lymph sinus.

5. *Precardial or median pectoral lymphoid centre*.—This is a prominent bilobed lymphoid mass in front of the heart lying below the omosternum (Fig. 1) and shortly caudal to it. It

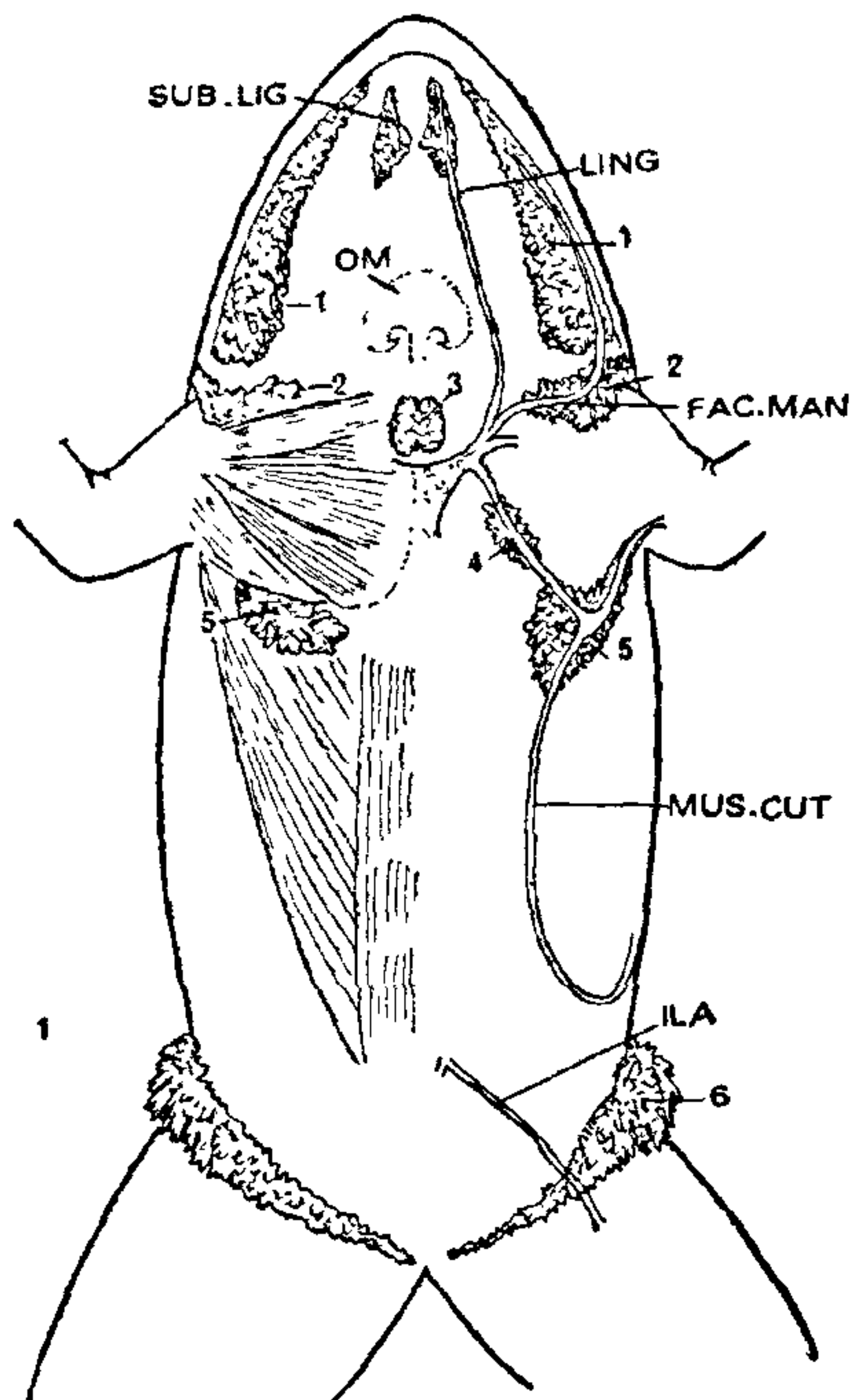


FIG. 1. Diagram of the frog *Rana tigrina* showing the lymphoid centres (ventral) after dissection.

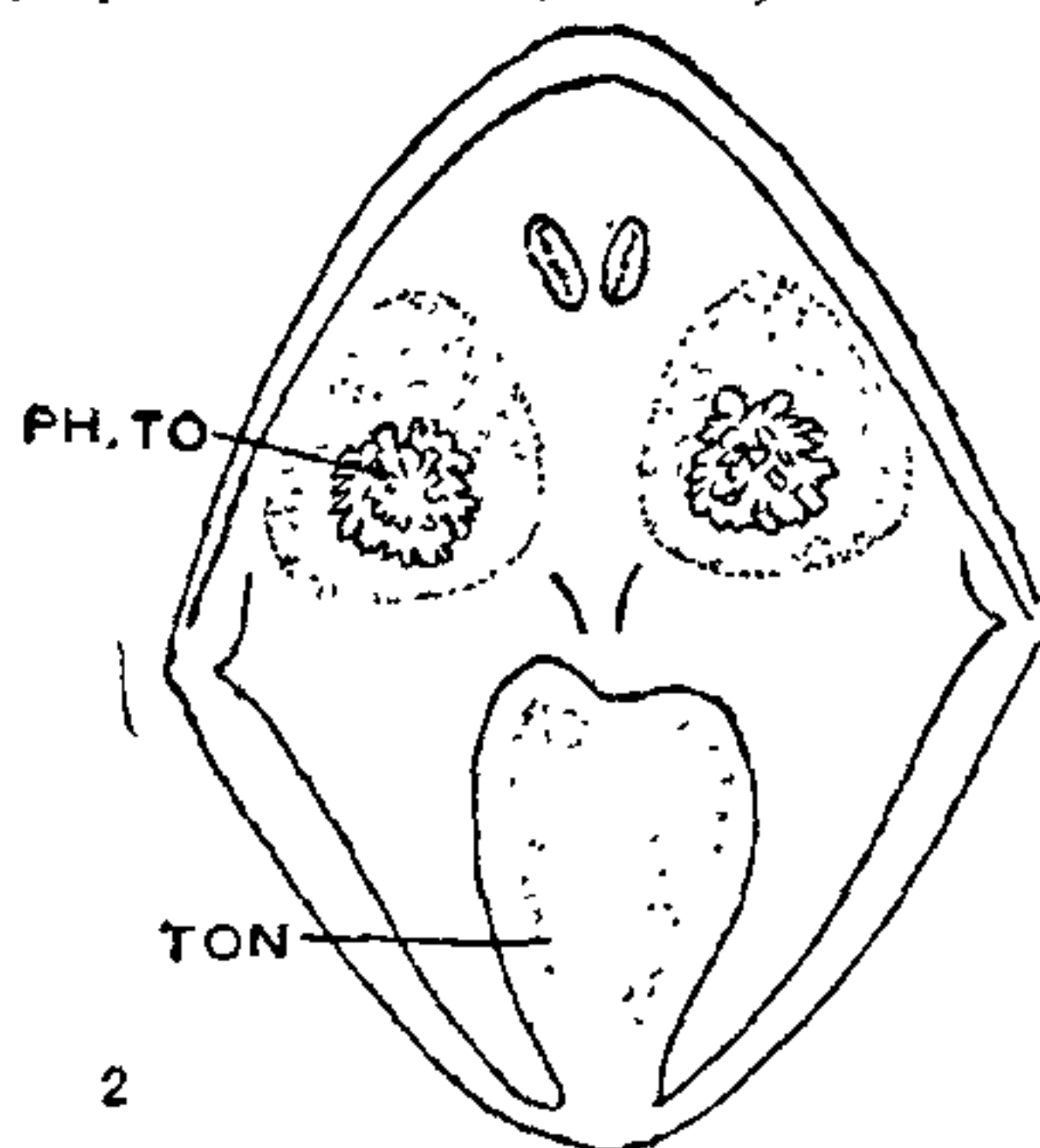


FIG. 2. Diagram of the mouth cavity of *Rana tigrina* showing the pharyngeal tonsils.

appeared to be associated directly with the sinus venosus.

6. *Internal mandibular lymphoid centre*.—This paired centre is approached by first cutting away the skin of the throat thereby exposing the large mylohyoid muscles below the floor of the mouth cavity, and further by pulling out the mylohyoid muscles. The internal mandibular centre lies below the mandibular ramus as a long yellowish mass all along the course of the internal mandibular vein. The centre is bathed by the submaxillary lymph sinus.

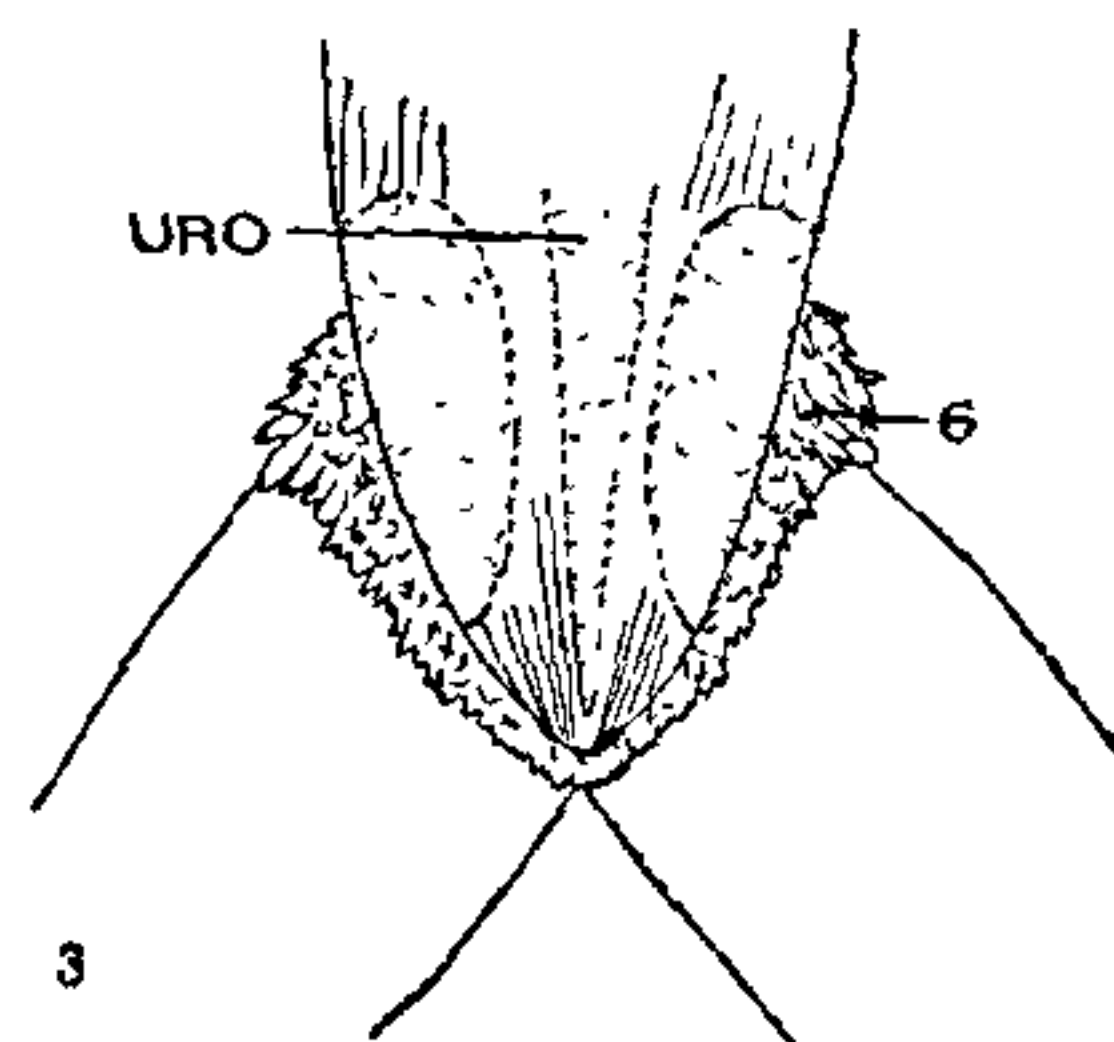


FIG. 3. Diagram of *Rana tigrina* (dorsal) showing the iliac lymphoid centres.

All diagrams in natural sizes.

SUB. LIG. Sublingual tonsils; LING, Lingual vein; OM, Omosternum, FAC. MAN, Faciomandibular vein; MUS. CUT, Musculocutaneous vein, ILA, Iliac vein; PH. To, Pharyngeal tonsils, TON, Tongue, URO, Urostyle; 1, Internal mandibular lymphoid centre; 2, Superior pectoral centre; 3, Median pectoral centre; 4, Deep pectoral centre; 5, Inferior centre; and 6, Iliac lymphoid centre.

7. *Sublingual lymphoid centre*.—This was exposed without much effort while exposing the internal mandibular centre. Like other centres this too was paired. It appeared as a pair of yellowish elongated masses near the median line and tucked just below the attachment of the tongue. These have been described as sublingual tonsils<sup>5,9</sup>.

8. *Iliac lymphoid centre*.—This is a paired centre lying in the abdominal lymph sinus and extending into the dorsal lymph sinus, and by far the biggest. The centres are immediately exposed by cutting away the skin from the pelvic region and the thighs and also the back. Each centre is a frill-like half-girdle around the waist. It begins close to the rectus abdominis muscle on the ventral side and continues towards the back on the side of the coccygeo-iliacus muscle. The iliac centres are associated with the iliac veins.



9. *Dorsal cutaneous lymphoid centres*.—These appear as long and thin yellowish lines on the undersurface of the dorsal body wall and are associated with dorsal cutaneous veins and have direct access to dorsal cutaneous lymph sinus.

#### DISCUSSION AND CONCLUSION

It is a known fact<sup>7</sup> that there are various masses of lymphoidal tissue in the bodies of amphibia, the more conspicuous are located anterior to the clavicles of frogs or between skin and muscles near the girdles of burrowing species. No such information is in the records for the Indian species of frogs.

From the location of various lymphoid centres described in this paper, it is clear that majority of them are associated with some vein and are placed inside the subcutaneous lymph sinuses. Earlier it was confirmed<sup>1</sup> that during the spring these lymphoid masses produce both lymphocytes and leucocytes but appear to store fat at other seasons. From the fact that lymphocytes are accumulated in the lymphoid centres during active periods of the lives of frogs, some workers<sup>5-9</sup> went to the extent of naming at least some centres, chiefly in the lingual regions as 'tonsils'.

The present author after studying the macerated preparations of all the lymphoid centres, described above throughout the year, found that the findings of workers<sup>5-9</sup> are true for this species of frog as well. During July and August these lymphoid centres showed a marked leucocytopoiesis and were full of leucocytes; the adipose cells were few. At other times of the year when this species of frog hibernates, the adipose cells gained prominence over the leucocytes and the latter were almost lacking.

Association of lymphoid centres with the veins indicates that the leucocytes produced in the lymphoid centres must be passing on into the blood stream by diapedesis, thus strengthening the body's defence system during the active periods of life of the frog. Since a majority of lymphoid centres are subcutaneous and are bathed by the lymph in the underlying sinuses, their role in the defence of the body from attacks through the skin is quite understandable. Skin being the main

source of water during the active periods of frog's life, is liable to bacterial invasion.

It is therefore concluded that the lymphoid centres including the thymus and the tonsils are defence stations from which hosts of phagocytising cells may be mobilized for attack against bacterial and protozoan invaders with food and air reaching the mouth and the lungs, and also those coming with water diffusing into the subcutaneous lymph sinuses during the months of July to September when the frog is most exposed to the aquatic and terrestrial environments. In fact the lymphatic system of this frog could not exist without these lymphoid centres.

The author is grateful to the management of Lucknow Christian College and specially to its President, for the facilities and encouragement.

1. Braunmuhl, A., von. "Über einige myelo-lymphoide und lympho-epitheliale Organe der Anuren," *Zeitschr. Mikr. Anat. Forsch.*, 1926, 4, 635.
2. Bhaduri, I. L., Biswas, B. and Das, S. K., "Observations on the course of facial vein and the formation of extrajugular in some Indian frogs and toads," *Jour. As. Soc. Bengal*, 1933.
3. Keynes, G., 'Thymus,' *Ann. Roy. Coll. Surg. Engl.*, 1953, 12, 88.
4. Knower, H. McE., *A Resurvey of the Development of lymphatics and Associated Blood Vessels in Anuron Amphibian Method of Injection*, Wistar Inst. Philadel., 1939, p. 125.
5. Kingsbury, B. F., "Amphibian tonsils," *Anat. Anz.* 1912, 42, 593.
6. Nigam, H. C., *Zoology of Chordates*, 6th Edn. S. Nagin and Co., Jullundur, India, 1973.
- , *Curr. Sci.*, 1975, 44, 810.
7. Noble, G. K., *The Biology of the Amphibia*, Dover Publ., 1954.
8. Moore, J. A., *Physiology of the Amphibia*, Academic Press, 1964.
9. Myers, M. A., *Jour Morph. Physiol.*, 1928, 45, 399.
10. Weichert, C. K., *Anatomy of Chordates*, McGraw-Hill, Co., 1958, p. 233.