

AXIAL DESIGNATIONS FOR THE LIMBS OF AMBYSTOMA AND NOTOPHTHALMUS

Warren F. Fox

Developmental Biology Center, University of California, Irvine, CA 92717

---

Many experiments on amphibians have involved manipulations of mature limb or blastema tissue. Most authors have reported the location of the area manipulated and the position of the new structures formed by the following designations: dorsal, ventral, anterior, posterior, or combinations of these. Unfortunately, the designations used by various authors do not always correspond to the same underlying tissues. At least two systems exist in current literature and these are 90° out of phase with each other.

These differences can lead to misinterpretation when comparing results. A "dorsal" supernumerary in one system is a "posterior" supernumerary in the other. A "double dorsal" limb in one system contains two extensor muscle masses, but would be a combination of extensor and flexor in the other.

It would be very helpful if, in future publications, authors would correlate their designations to the underlying muscle masses. In this way, much of the confusion will be eliminated. In addition, when the position of new structures, such as supernumerary outgrowths, is reported, it would be helpful if the initial location was correlated to the underlying muscle masses.

Figure 1 shows the approximate positions of the axial designations used by the authors listed and was prepared by personal communication with all the authors listed and examination of current papers. Although most authors state that the upper hindlimb of larval Ambystoma is rotated approximately 90° with respect to the forelimb, they would correspond their axial designations to the same muscle masses as in the forelimb (see Fig. 1). This means that when the animal is viewed from above with the limbs extended, dorsal (light lettering system) in the upper forelimb and posterior (light lettering system) in the upper hindlimb would be up. Two external markers not shown on Figure 1 are also used. In Notophthalmus, the pigmented surface is dorsal (light lettering system) and extends from anterior to posterior. In Ambystoma, there are furrows in the skin at anterior and posterior (light lettering system) in the upper limb.

References on Amphibian Anatomy

- Francis, E.T.B. The Anatomy of the Salamander, Oxford University Press (London and New York, 1934).
- Grim, M. & B.M. Carlson. "A Comparison of Morphogenesis of Muscles of the Forearm and Hand during Ontogenesis and Regeneration in the Axolotl (Ambystoma mexicanum). I. Anatomical description of the muscles of the forearm and hand. Z. Entwickl.-Gesch. 145, 137-148 (1974).
- Noble, G.K. The Biology of the Amphibian, McGraw-Hill Book Co., Inc., 1931; reprinted by Dover Publ. (New York, 1954).
- Romer, A.S. The Vertebrate Body, 4th Ed., W.B. Saunders Co. (Philadelphia, 1970).

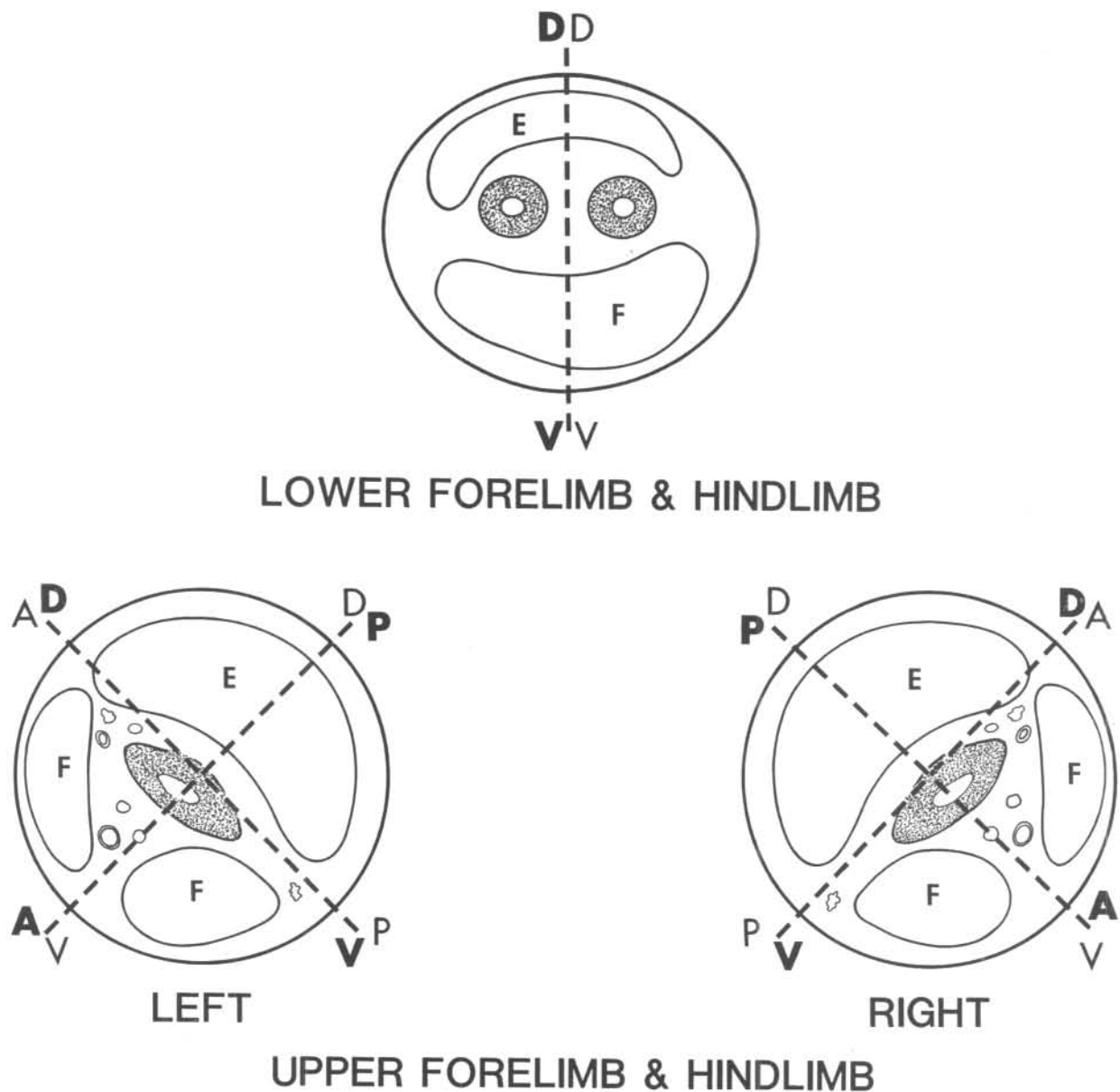


Figure 1. Diagrammatic cross sections of amphibian limbs at approximately mid-stylopodium and approximately mid-zeugopodium. The axial designations correspond to internal limb tissues and no attempt has been made to show how these relate to the axes of the flank. Dorsal (D), ventral (V), anterior (A), and posterior (P) are labelled in light and bold letters for each system as follows:

Light lettering: S. Bryant, N. Holder, P. Tank (*Notophthalmus*); M. Maden, J. Slack, D. Stocum, N. Turner (*Ambystoma*).

Bold lettering: B. Carlson, N. Holder, P. Tank (*Ambystoma* forelimb).

⊕ ≡ arteries; ⊕ ≡ veins; ○ ≡ nerves; ⊕ ≡ bone;

F ≡ flexor muscle mass; E ≡ extensor muscle mass.