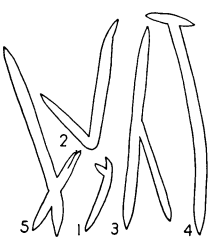
SHULER, E. W. (1918). The geology of Dallas County. *Texas University Bulletin 1818*, 48 pp. 7 figs., 21 pls.
———— (1935). Terraces of the Trinity River, Dallas County, Texas. *Field & Laboratory*, vol. 3, pp. 44-53.
TAFF, J. A. (1893). Report on the Cretaceous area north of the Colorado River. *Geological Survey of Texas*, 4th Ann. Rept. (for 1892), pp. 241-354.
TURNER, W. L., JR. (1950). Geology of the Eagle Ford Quadrangle, Dallas County, Texas. *Field & Laboratory*, vol. 19, pp. 51-65.

UNUSUAL VARIATIONS IN THE SKELETON-SPICULES OF FRESH-WATER SPONGES.——The examination of a series of spicule slides used in the identification of fresh-water sponges has revealed a few interesting variations in skeletal spicules, which to our knowledge have not been mentioned in the literature. Old (*Papers Mich. Acad. Sci., Arts, & Lett., 15*:439-77, 1932) and Potts (*Proc. Acad. Nat. Sci., Phila., 1884*:184-5) have both reported modifications in skeletal spicules, but none of their reports appear to duplicate the variations in spicules shown in this series. **Fig. 1.** The "scissors" type has probably been produced from two scleroblasts, the cells crossed and in close apposition to each other; the result is a fusion of siliceous secretions. The axial canals are distinct, one seemingly superimposed upon the other. **Fig. 2.** The "elbow" type is a complete spicule, but bent. This type might have been caused by the formative cell's having been bent, owing to some obstruction in the dermal layer. **Fig. 3.** The "Y" type. The axial canal which traverses the stem of the Y and continues without interruption into and through one of the arms of the Y. The other arm has probably resulted from a division of the scleroblast, one daughter-cell moving out at an angle from the "mother-stem" and depositing the accessory arm. **Fig. 4.** The "T" type. One plausible explanation of this formation lies in the equal division of the scleroblast; each daughter-cell then extends at right angles at the end of the main axis, thus producing a short spicule which is fused solidly with the central spicule. **Fig. 5.** The "tetraxon" type. The silica has been deposited along four radii which meet each other at the center. One ray is longer than the other three, thus giving the effect of a triaxon-spicule which has been fused to the end of a monaxon-spicule.——*E. P. Cheatum & Joseph P. Harris, Jr.*



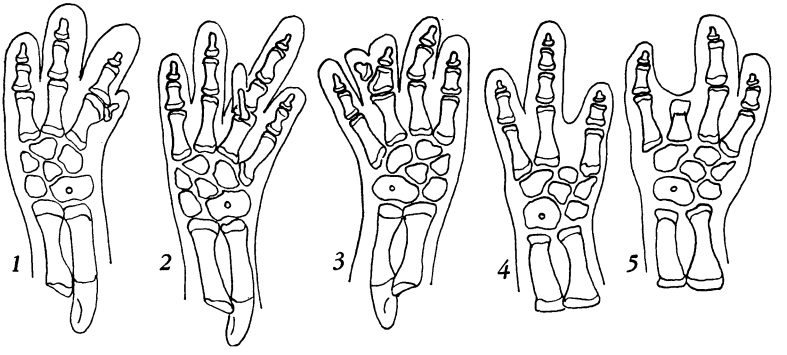
Abnormal Digits in Necturus

Joseph P. Harris, Jr.

Necturus normally has four digits on each limb, but several variations of this basic pattern have been recorded. Necturus with three toes on one or more feet have been reported by Jenness (1942, 1944), Hutt (1945) and Mattox (1944). Individuals with five toes were reported by Jenness (1942, 1946) ; one with eight toes was reported by Mattox. Digits may have one phalanx less than is usual (Mattox) or one phalanx more than is usual (Harris, 1952). Mattox had one specimen in which digit 4 was missing on one leg, and another in which an extra phalanx grew from the side of digit 3 on one forefoot. Jenness (1942) found webbed toes on the hindfoot of one specimen; and in another specimen (1946) found the second and third toes fused at the second

phalanx. Hilton (1948) figured a specimen with two feet on one leg; one foot had four toes, the other foot had three toes.

Five additional digital abnormalities are briefly noted here. Musculature and circulatory channels of each abnormal foot were studied; afterward the foot was cleared in KOH and lightly stained in alizarin red. The following numbered paragraphs refer seriatim to the figures here published, drawn from the palmar or plantar surface.



1. The fourth finger, left hand, appeared as a short projection on the post-axial side of the third finger. Muscles of the extensor surface normal except for the absence of muscles to the abnormal fourth digit. On the flexor surface, the palmar aponeurosis attached to the third metacarpal and the common base of digits 3 and 4. Digit 3 had only 2 phalanges, digit four consisted of a single phalanx; both digits 3 and 4 articulated with metacarpal 3. There was no fourth metacarpal. Specimen was female, length 31 cms.

2. Left hand had 5 fingers, but fifth finger extended from the palmar surface of the third finger. Hand between 2nd and 3rd finger was split nearly to the wrist. Musculature was normal except for a split in the palmar aponeurosis to the base of the metacarpals. The extra digit consisted of one partially ossified phalanx with a single basal epiphysis. It articulated with the ventral surface of the distal epiphysis of the third metacarpal. Specimen was female, length 30 cms.

3. The third finger of the right hand was partially doubled. Musculature was normal. Basal phalanx of third finger supported two terminal phalanges. The pattern of ossification in the basal phalanx was peculiar, but the terminal phalanges appeared normal. Specimen was male, length 29.5 cms.

4. Right foot had only three toes. Musculature was normal, except for the missing finger. From the positions of the digits with relation to the carpal elements, as well as the number of phalanges in the digits, it is assumed that digit two was absent. There was no external sign of injury; skin between first and third digits was normally pigmented. Specimen was female, length 30.5 cms.

5. Right hind leg had three toes; the third toe was missing. Dissection disclosed obvious evidence of injury to account for this abnormality. The third metacarpal was broken, and the broken end capped with cartilage. External pigmentation of skin was normal. Specimen was male, length 31.5 cms.

When amphibians are found with fewer than the normal number of digits, there is always the suspicion that the reduction in number may be due to their having been bitten off by some aquatic animal. But the digit or limb may not have to be bitten off; bruising or other injury may produce regression. O'Brien (1948) exposed adult *Triturus viridescens* to X-rays, and found that regression proceeded from distal regions proximad, but not beyond the area of exposure. Puckett (1936) by X-ray exposure at critical stages in the development of *Ambystoma* produced 2- and 3-digit forelimbs as he chose.

That many amphibia possess powers of regeneration of lost limbs and other parts is well known. Regeneration in large forms is slower than in the smaller (Hilton, 1948); in *Necturus,* more than a year may be required to produce a new limb (Morgan, 1901).

Hilton (1948) studied the regeneration of carpus and tarsus in *Triturus torosus, Pseudotriton ruber* and *P. vioscai, Plethodon glutinosus,* and *Ambystoma tigrinum.* He listed the following steps in regeneration: "(a) First-step healing of the wound. (b) The cut end rounds off and becomes covered with epidermis. (c) Pigmentation of the regenerated end may come before digits are evident, but usually later. (d) Separation of the end regenerated into toes, three is an early number, possibly two in some cases. (e) Internal differentiation of the hand or foot element, the first indication of the skeletal elements in precartilage." Hilton further observed that "regeneration is similar to embryonic development in some respects." Puckett (1936) found that the regenerating limb of *Ambystoma* follows a fairly normal course of development. Chen (1935) found that in *Necturus* the primordia of limb parts take on the essential characteristics of the adult organs as soon as they become discernible; but in regenerating limbs, Hilton found that more tarsal or carpal elements than normal may be produced.

LITERATURE CITED

CHEN, HSIN KUO. 1935. Development of the pectoral limb of Necturus maculosus. Illinois Biol. Monographs 32:1-71.

HARRIS, JOSEPH P., JR. 1952. The skeleton of the arm of Necturus. Field & Laboratory 20:78-82.

HILTON, W. A. 1947. Abnormal double foot of Necturus. Jour. Ent. & Zool. 39:73.
———— 1948. Regeneration of the carpus and tarsus of salamanders. Trans. Amer. Micr. Soc. 67:143-148.
HUTT, F. B. 1945. Complete albinism in the mud-puppy, Necturus. Jour. Heredity 36:145-147.
JENNESS, B. F. 1942. Anatomical abnormalities in Necturus. Turtox News 20:20.
———— 1946. Anatomical abnormalities in Necturus. Ibid. 24:143.
MATTOX, N. T. 1944. Partial hermaphroditism and digital anomalies in Necturus maculosus. Amer. Nat. 78:477-480.
MORGAN, THOMAS HUNT. 1901. *Regeneration.* MacMillan, pp. 1-316.
O'BRIEN, J. P. 1948. Regression of adult urodele limbs following exposure to X-rays. Anat. Rec. 101:711.
PUCKETT, WILLIAM O. The effects of X-radiation on limb development and regeneration in Amblystoma. Jour. Morph. 59:173-214.