Catalogue of American Amphibians and Reptiles.

Ernst, Carl H., J. Whitfield Gibbons, and Susan S. Novak. 1988. *Chelydra.*

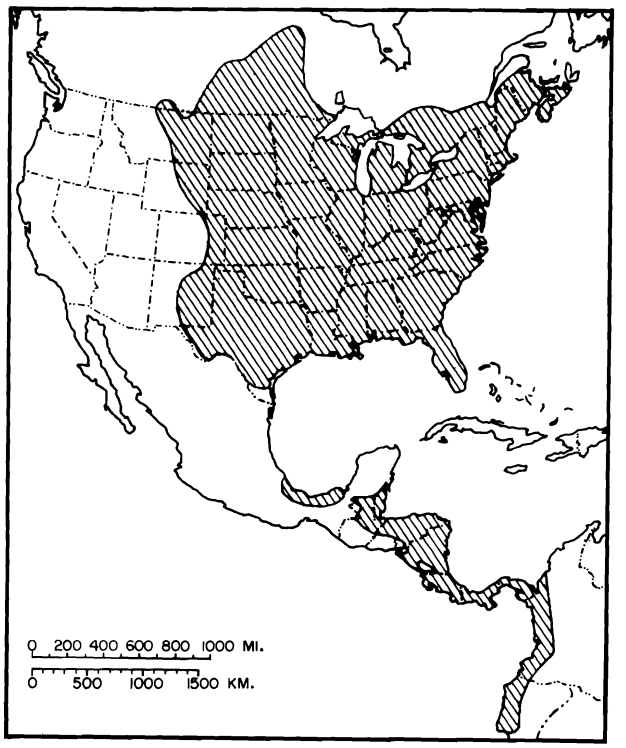
Chelydra Schweigger
Snapping Turtles

Chelydra Schweigger, 1812:292. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by designation (Fitzinger, 1843:29).
Emys: Merrem, 1820:23. In part.
Ophichelone Jarocki, 1822:21. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by monotypy.
Chelonura Fleming, 1822:270. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by monotypy.
Rapara Gray, 1825:210. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by monotypy.
Saurochelys Berthold, 1827:90. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by monotypy. This is the first Latinization of *Saurochelys* Latreille, 1825:92, who only applied the French vernacular.
Chelidra: Bonaparte, 1831:67: *Lapsus calami.*
Cheliurus Rafinesque, 1832:64. Type-species, *Testudo serpentina* Linnaeus, 1758:199, by monotypy.
Hydraspis Fitzinger, 1835:125. In part. Type-species, *Chelydra serpentina* (Linnaeus, 1758:199), by designation.
Emysaurus Duméril and Bibron, 1835:348. Type-species, *Chelydra serpentina* (Linnnaeus 1758:199), by monotypy.
Emysaura: Duméril and Bibron, 1835:350. Emendation.
Emydosaura: Gray, 1844:34: *Lapsus calami.*
Emydosaurus: Gray, 1856:48: *Lapsus calami.*
Chelhydra: Huber, 1896:424: *Lapsus calami.*
Devisia Ogilby, 1905:11. Type-species, *Devisia mythodes* Ogilby, 1905:11 [= *Chelydra serpentina* Linnaeus (1758:199) by monotypy.]
Chyldra: Daniel, 1984:40: *Lapsus calami.*

• **Content**. One species, *Chelydra serpentina*, is recognized.

• **Definition**. Adults are large (to 47 cm carapace length), temperate to tropical turtles frequenting aquatic and semi-aquatic habitats. The cross-shaped bridge and plastron are reduced, hingeless, and not buttressed. A t-shaped entoplastron and a medial plastral fontanelle are present. The abdominal scutes are reduced and confined to the bridge. The flattened carapace is strongly serrated posteriorly, and has three low knobby keels that become smooth with age. Eight quadrilateral to octagonal shaped neurals and two suprapygals are present. Inframarginal scutes occur, but supramarginals do not. The large skull is posteriorly emarginated, and the frontals do not enter the orbit. There is no parietal-squamosal contact, and the maxilla does not touch the quadratojugal. The quadrate completely encloses the stapes. No secondary palate is present, and a medial ridge occurs on the vomer. The maxillae are ridgeless. The blunt snout protrudes slightly, and the upper jaw is strongly hooked. The orbits can be viewed from above. The 10th dorsal vertebra lacks ribs, and there is only one biconvex cervical vertebra (VIII). Cloacal bursae are present. The limbs are well-developed, webbed, and heavily clawed; the tail is long and saw-toothed dorsally.

• **Descriptions and Illustrations**. References to external features are listed in the species account; other selected references with descriptions or illustrations follow. Karyotype: Stock (1972), Killebrew (1977), De Smet (1978), Bickham and Carr (1983). Internal anatomy: Gray (1831). Embryology: Agassiz (1857), Zangerl (1941), Decker (1967), Yntema (1968), Senn (1979), Ewert (1979), Packard (1980). Skeleton: Baur (1886), Williams (1950), Green (1951), Romer (1956), Kilias (1957), Richmond(1964), Ganguly et al. (1966), Hoffstetter and Gasc (1969), Enlow (1969), Gaffney (1972, 1979), Rieppel (1976, 1977), Bellairs and Kamal (1981). Shell seams: Tinkle (1962). Muscles: McDowell (1963), Schumacher (1973). Nerves:



Map. Distribution of the genus *Chelydra.*

Humphrey (1894), Soliman (1964), Kollros and Fu (1957), Riss et al. (1969), Starck (1979), Schwab (1979). Nose: Parsons (1959, 1970). Ear: Heinemann (1877), Baird (1970), Wever (1978), Millller and Kasahara (1979). Eye: Grassé (1970), Underwood (1970). Digestive tract: Parsons and Cameron (1976). Circulation and lymphatics: Stromsten (1910), McDowell (1961), Hutchison and Szarski (1965), Borysenko and Cooper (1972), C. G. Jackson (1979). Urogenital tract: Fox (1976). Penis: Zug (1966). Cloacal bursae: Smith and James (1958). Rostral pores: Winokur and Legler (1974).

• **Distribution.** See map and species account.

• **Fossil Record**. *Chelydra* sp. have been reported from the Pliocene and Pleistocene of North America. Pliocene records include two from Kansas (Galbreath, 1948; Hibbard, 1963). Pleistocene records are from Florida (Hay, 1923; Gehlbach, 1965; Weigel, 1962), Kansas (Galbreath, 1948; Hibbard, 1963; Hibbard and Taylor, 1960), Maryland (Cope 1869a,b), Pennsylvania (Hay, 1923), and Texas (Hibbard and Taylor, 1960; Holman 1964, 1969), and Nevada (VanDevender and Tessman, 1975).

• **Pertinent Literature**. See species account for ecological and behavioral literature; other selected references follow. Systematics: Boulenger (1902), Babcock (1932), Loveridge and Shreve (1947), Richmond (1958), Feuer (1966, 1971), Medem (1977). Evolution: Gaffney (1975a,b), Whetstone (1977). Zoogeography: Darlington (1957), Neill (1958), Savage (1966), Reig (1968). Serology and immunology: Cohen (1954a,b) 1955), Cohen and Stickler (1959), Leone and Wilson (1961), Hildemann (1962), Frair (1963, 1972), Sullivan and Riggs (1967), Jackson and Legendre (1967), Sidky and Auerbach (1968). Endocrinology: Evans (1952), Hebard and Charipper (1955). Metabolism: Baldwin (1926), Lynn and von Brand (1945), Dodge and Folk (1963), Boyer (1963), Lynn (1970), Gilles-Baillien (1974), Gatten (1978, 1980), Packard et al. (1984). Breathing: George and Shah (1959), Gaunt and Gans (1969), D. C. Jackson (1979). Urogenesis: Baze and Horne (1970). Circulation: Schwartz and Kaplan (1962), Lange et al. (1966), Jackson and Legendre (1967), Semple et al. (1970). Vision: Knapp and Kang (1968), Ernst and Hamilton (1969), Senn (1971), Copenhagen and Owen (1976, 1980),

Detwiler et al. (1980). Walking: Zug (1971), Walker (1973), Jayes and Alexander (1980). Longevity: Bowler (1977).

• **Etymology**. The name *Chelydra* is from the Greek *Chelydros*, a water serpent. The gender is feminine.

Literature Cited

Agassiz, Louis. 1857. Contributions to the natural history of the United States of America, first monograph. Vol. 2, part 3. Embryology of the Turtle. Little, Brown and Co., Boston. p. 451-643.

Babcock, Harold L. 1932. The American snapping turtles of the genus *Chelydra* in the collection of the Museum of Comparative Zoology, Cambridge, Massachusetts, U.S.A. Proc. Zool. Soc. London (44):873-874.

Baird, Irwin L. 1970. The anatomy of the reptilian ear, Pp.193-275. *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology B, Vol. 2. Academic Press, New York.

Baldwin, Francis M. 1926. Notes on oxygen comsumption in turtles, *Chrysemys marginata belli* and *Chelydra serpentina* Linn. Proc. Iowa Acad. Sci., 33:315-323.

Baur, G. 1886. Osteologische Notizen über Reptilien. Fortsetzung I. Zool. Anz. 9:733-743.

Baze, Wallace B., and Francis R. Horne. 1970. Urogenesis in Chelonia. Comp. Biochem. Physiol. 34(1):91-100.

Bellairs, Angus d'A., and A. M. Kamal. 1981. The chondrocranium and the development of the skull in Recent reptiles, Pp. 1-263. *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology F, Vol. 11, Academic Press, New York.

Berthold, A. A. 1827. Latreilles natürliche Familien des Thierreichs-aus dem Französichen mit Anmerhungen und Zusäten. Weimer. 604 p.

Bickham, John W., and John L. Carr. 1983. Taxonomy and phylogeny of the higher categories of cryptodiran turtles based on a cladistic analysis of chromosomal data. Copeia 1983(4):918-932.

Bonaparte, Carlo Luciano. 1831. Saggio D'una distribuzione metodica degli animali vertebrati. Boulzaler, Rome. 144 p.

Borysenko, M., and E. L. Cooper. 1972. Lymphoid tissue in the snapping turtle, *Chelydra serpentina*. J. Morphol. 138(4):487 498.

Boulenger, George A. 1902. On the southern snapping-turtle, *(Chelydra rossignonii* Bocourt). Ann. Mag. Natur. Hist. Ser. 7, 9(49):49-51.

Bowler, J. Kevin. 1977. Longevity of reptiles and amphibians in North American collections as of 1 November, 1975. Soc. Stud. Amphib. Rept. Misc. Publ., Herpetol. Circ. (6), iv + 32 p.

Boyer, Don R. 1963. Hypoxia: effects on heart rate and respiration in the snapping turtle. Science 140(3568):813-814.

Cohen, Elias. 1954a. A comparison of the total protein and albumin content of the blood sera of some reptiles. Science 119(3081): 98-99.

———. 1954b. A serological study of whole and fractionated sera of some reptiles and amphibians. Serol. Mus. 12:6-7.

———. 1955. Immunological studies of the serum proteins of some reptiles. Biol. Bull. 109:394-403.

———, and G. B. Stickler. 1959. Absence of albumin-like serum proteins in turtles. Science 127(3311):1392.

Cope, Edward D. 1869a. Extinct Batrachia, Reptilia and Aves of North America. Trans. Amer. Phil. Soc. 14:100-122.

———. 1869b. Synopsis of the extinct Mammalia of the cave formations of the United States, with observations of some Myriapoda found in and near the same, and on some extinct mammals of the caves of Anquilla, W. I., and of some other localities. Proc. Amer. Phil. Soc. 11:171-192.

Copenhagen, David R., and W. Geoffrey Owen. 1976. Coupling between rod photoreceptors in a vertebrate retina. Nature 260 (5546):57-59.

———, and ———. 1980. Current-voltage relations in the rod photoreceptor network of the turtle retina. J. Physiol. 308:159-184.

Daniel, Paul M. 1984. The herpetofauna of Adams County, Ohio. Ohio J. Sci. 84(1):35-43.

Darlington, Philip Jackson, Jr. 1957. Zoogeography: The geographical distribution of animals. John Wiley & Sons, New York. xiii + 675 p.

Decker, John D. 1967. Motility of the turtle embryo, *Chelydra serpentina* (Linné). Science 157(3791):952-954.

De Smet, Willem H. O. 1978. The chromosomes of 11 species of Chelonia (Reptilia). Acta Zoo. Pathol. Antverp. (70):15-34.

Detwiler, P. B., A. L. Hodgkin, and P. A. McNaughton. 1980. Temporal and spatial characteristics of the voltage response of rods in the retina of the snapping turtle. J. Physiol. 300:213-250.

Dodge, Christopher H., and G. Edgar Folk, Jr. 1963. Notes on comparative tolerance of some Iowa turtles to oxygen deficiency (hypoxia). Proc. Iowa Acad. Sci. 70:438-441.

Duméril, André Marie Constant, and Gabriel Bibron. 1835. Erpétologie génèrale ou histoire naturelle complete des reptiles. Vol. 2. Librairie Encyclopedique de Roret, Paris. iv + 682 p.

Enlow, Donald H. 1969. The bone of reptiles. Pp. 45-80. *In* Carl Gans, Angus d'A. Bellairs, and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology A, Vol. 1. Academic Press, New York.

Ernst, Carl H., and Helen F. Hamilton. 1969. Color preferences of some North American turtles. J. Herpetol. 3(3-4):176-180.

Evans, Llewellyn T. 1952. Endocrine relationships in turtles. III. Some effects of male hormones in turtles. Herpetologica 8(1): 11-14.

Ewert, Michael A. 1979. The embryo and its egg: development and natural history. Pp. 333-413 *In* Marion Harless and Henry Morlock (eds.), Turtles: perspectives and research. Wiley-Interscience, New York.

Feuer, Robert C. 1966. Variation in snapping turtles, *Chelydra serpentina* Linnaeus: a study in quantitative systematics. Ph.D. thesis, Univ. Utah, Salt Lake City. iv + 264 p.

———. 1971. Intergradation of the snapping turtles *Chelydra serpentina serpentina* (Linnaeus, 1758) and *Chelydra serpentina osceola* Stejneger, 1918. Herpetologica 27(4):379-384.

Fitzinger, Leopold J. 1835. Entwurgeiner systematischen Anordung der Schildkröten nach den Grundsatzen der natürlichen Methode. Ann. Mus. Wien 1:103-128.

———. 1843. Systema Reptilium. Braumuller et Seidel, Vienna. vi + 106 p.

Fleming, John. 1822. The philosophy of zoology; or a general view of the structure, functions, and classification of animals. 2 vols. Constable, London.

Fox, Harold. 1976. The urinogenital system of reptiles. Pp. 1-157 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology E, Vol. 6. Academic Press, New York.

Frair, Wayne. 1963. Blood group studies with turtles. Science 140(3574):1412-1414.

———. 1972. Taxonomic relations among chelydrid and kinosternid turtles elucidated by serological tests. Copeia 1972(1):97-108.

Gaffney, Eugene S. 1972. An illustrated glossary of turtle skull nomenclature. Amer. Mus. Novitates (2486):1-33.

———. 1975a. A phylogeny and classification of the higher categories of turtles. Bull. Amer. Mus. Natur. Hist. 155(5): 387-436.

———. 1975b. A phylogeny of the chelydrid turtles: a study of shared derived characters in the skull. Fieldiana: Geol. 33(9): 157-178.

———. 1979. Comparative cranial morphology of Recent and fossil turtles. Bull. Amer. Mus. Natur. Hist. 164(2):65-376.

Galbreath, Edwin C. 1948. Pliocene and Pleistocene records of fossil turtles from western Kansas and Oklahoma. Univ. Kansas Publ., Mus. Nat. Hist. 1(17):281-284.

Ganguly, D. N., Kamal Krishna Singh- Roy, and Biswanath Mitra. 1966. A study on the cranio-vertebral joint in the vertebrates. III. In reptiles as illustrated by its structure in the *Hemidactylus flaviviridis* and development in both *Hemidactylus* and *Chelydra* sp. Anat. Anz. 118:122-131.

Gatten, Robert, Jr. 1978. Aerobic metabolism in snapping turtles, *Chelydra serpentina*, after thermal acclimation. Comp. Biochem. Physiol. 61A(2):325-337.

———. 1980. Aerial and aquatic oxygen uptake by freely-diving snapping turtles *(Chelydra serpentina)*. Oecologia (Berl.)

46(2):266-271.

Gaunt, Abbot S., and Carl Gans. 1969. Mechanics of respiration in the snapping turtles, *Chelydra serpentina* (Linné). J. Morphol. 128(2):195-228.

Gelbach, Frederick R. 1965. Amphibians and reptiles from the Pliocene and Pleistocene of North America: a chronological summary and selected bibliography. Texas J. Sci. 17:56-70.

George, J. C., and R. V. Shah. 1959. The structural basis of the evolution of the respiratory mechanism in Chelonia. J. Anim. Morph. Physiol. 6(1):1-9.

Gilles-Baillien, M. 1974. Seasonal variation in reptiles, p. 353-376. *In* Marcel Florkin and Bradley T. Scheer (eds.), Chemical Zoology, Vol. 9, Amphibia and Reptilia, Academic Press, New York.

Grassé, P.-P. 1970. Traité de Zoologie. XIV. Reptiles: Charactéres et Anatomie (II). Masson, Paris. 681-1428.

Gray, John E. 1825. A synopsis of the genera of reptiles and Amphibia, with a description of some new species. Ann. Philos. (n.s.) 10:193-217.

———. 1831. On the anatomy of the alligator tortoise (*Chelydra serpentina* Schweig.). Proc. Zool. Soc. London 1831:129-131.

———. 1844. Catalogue of the tortoises, crocodiles, and amphisbaenians in the collection of the British Museum. London. viii +80 p.

———. 1856. Catalogue of the shield reptiles in the collection of the British Museum. Part 1. Testudinata (tortoises). Taylor and Francis, London. 79 p.

Green, John Davis. 1951. The comparative anatomy of the hypophysis with special reference to its blood supply and innervation. Amer. J. Anat. 88(2):225-311.

Hay, O. P. 1923. The Pleistocene of North America and its vertebrated animals from the states east of the Mississippi River and from the Canadian provinces east of Longitude 95°. Carnegie Inst. Washington Publ. (322):viii + 499 p.

Hebard, William B., and Harry A. Charipper. 1955. A comparative study of the morphology and histochemistry of the reptilian adrenal gland. Zoologica, N.Y. 40(3):101-123.

Heinemann, Carl. 1877. Beiträge zur Anatomie der Retina. Arch. Mikrosk. Anat., Bonn 14:409-441.

Hibbard, Claude W. 1963. The presence of *Macroclemys* and *Chelydra* in the Rexroad fauna from the Upper Pliocene of Kansas. Copeia 1963(4):708-709.

———, and D. W. Taylor. 1960. Two late Pleistocene faunas from Southwestern Kansas. Contrib. Mus. Paleo. Univ. Mich. 16:1-223.

Hildemann, W. H. 1962. Immunogenetic studies of amphibians and reptiles. Ann. New York Acad. Sci. 97:139-152.

Hoffstetter, Robert, and Jean-Pierre Gasc. 1969. Vertebrae and ribs of modern reptiles. Pp. 201-310 *In* Carl Gans, Angus d'A. Bellairs, and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology A, Vol. 1. Academic Press, New York.

Holman, J. Alan. 1964. Pleistocene amphibians and reptiles from Texas. Herpetologica 20(2):73-83.

———. 1969. The Pleistocene amphibians and reptiles of Texas. Publ. Mus. Michigan State Univ. Biol. Ser. 4:163-192.

Huber, G. C. 1896. The spinal ganglia of Amphibia. Anat. Anz. (Jena) 12(18):417-425.

Humphrey, O. D. 1894. On the brain of the snapping turtle *(Chelydra serpentina)*. J. Comp. Neurol. 4:73-116.

Hutchison, Victor H., and Henryk Szarski. 1965. Numbers of erythrocytes in some amphibians and reptiles. Copeia 1965(3): 373-375.

Jackson, Crawford G., Jr. 1979. Cardiovascular system. Pp. 155-164 *In* Marion Harless and Henry Morlock (eds.), Turtles: perspectives and research. Wiley-Interscience, New York.

———, and R. C. Lengendre. 1967. Blood serum cholesterol levels in turtles. Comp. Biochem. Physiol. 20(1):311-312.

Jackson, Donald C. 1979. Respiration. Pp. 165-191 *In* Marion Harless and Henry Morlock (eds.), Turtles: Perspectives and research. Wiley-Interscience, New York.

Jarocki, F. P. 1822. Zoology or a general description of animals according to the most recent system. Vol. III. Reptiles and amphibians [in Polish]. Latkiewicz, Warsaw. 6, 184, 11p.

Jayes, A. S., and R. McN. Alexander. 1980. The gaits of chelonians: walking techniques for very low speeds. J. Zoology 191(3):353-378.

Kilias, Rudolf. 1957. Die funktionell-anatomische und systematische Bedeutung der Schläfenreduktion bei Schildkröten. M. H. Zool. Mus. Berlin 33(2):307-354.

Killebrew, Flavius C. 1977. Mitotic chromosomes of turtles. 5. The Chelydridae. Southwest. Natur. 21(4):547-548.

Knapp, H., and Dai Soo Kang. 1968. The visual pathways of the snapping turtle (*Chelydra serpentina*). Brain Behav. Evol. 1:19-42.

Kollros, Jerry J., and Yu-Ying Fu. 1957. The mesencephalic nucleus of the trigeminal nerve in young snapping turtles. Proc. Iowa Acad. Sci. 64:643-647.

Lange, Gertrude, Hsin-Hsiang, Lu, Y. Tsumuraya, and Chandler McC. Brooks. 1966. Pacemaker actions in the turtle heart. Amer. J. Physiol. 210:1375-1382.

Latreille, Pierre André. 1825. Families naturelles du Règne Animal, exposées succinctement et dans un ordre analytique, avec l'indication de leurs genres. Baillière, Paris. 570 p.

Leone, Charles A., and Fred E. Wilson. 1961. Studies of turtle sera. I. The nature of the fastest-moving electrophoretic component in the sera of nine species. Physiol. Zool. 34(4):297-305.

Linnaeus, Carolus. 1758. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis, locis. 10th ed. Vol. 1. L. Salvius, Stockholm. iv + 826 p.

Loveridge, Arthur and Benjamin Shreve. 1947. The "New Guinea" snapping turtle *(Chelydra serpentina)*. Copeia 1947(2):120-123.

Lynn, W. Gardner. 1970. The thyroid. Pp.201-234 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology C, Vol. 3. Academic Press, New York.

———, and Theodor von Brand. 1945. Studies on the oxygen consumption and water metabolism of turtle embryos. Biol. Bull. 88(2):112-125.

McDowell, Samuel B. 1961. On the major arterial canals in the ear-region of testudinoid turtles and the classification of the Testudinoidea. Bull. Mus. Comp. Zool. 125(2):23-39.

———. 1963. Muscles in the region of the eustachian tube of turtles: two corrections. Copeia 1963(1):153-154.

Medem, Federico. 1977. Contribución al conocimiento sobre la taxonomía, distribución geográfica y ecológica de la tortuga "Bache" *(Chelydra serpentina acutirostris)*. Caldasia 12(56): 41-98.

Merrem, Blasius. 1820. Tentamen Systematis Amphiborum (Versuch eines Systems der Amphibien). Johann Christian Krieger, Marburg. xv + 191 p.

Miller, Malcomb R., and Michiko Kasahara. 1979. The cochlear nuclei of some turtles. J. Comp. Neurol. 185(2):221-236.

Mlynarski, Marian. 1969. Fossile Schildkröten. Ziemsen. Wittenberg. p. 71-72.

Neill, Wilfred T. 1958. The occurrence of amphibians and reptiles in salt-water areas, and a bibliography. Bull. Mar. Sci. Gulf Carib. 8(1):1-97.

Ogilby, J. Douglas. 1905. Catalogue of emydosaurian and testudinian reptiles of New Guinea. Proc. Roy. Soc. Queensland 19(1):1-31.

Packard, David S. Jr., 1980. Somite formation in cultured embryos of the snapping turtle, *Chelydra serpentina*. J. Embryol.-Exp. Morph. 59:113-130.

Packard, Gary C., Mary J. Packard, and Thomas J. Boardman. 1984. Influence of hydration of the environment on the pattern of nitrogen excretion by embryonic snapping turtles *(Chelydra serpentina)*. J. Exp. Biol. 108:195-204.

Parsons, Thomas S. 1859. Studies on the comparative embryology of the reptilian nose. Bull. Mus. Comp. Zool. 123(4):113-127.

———. 1970. The nose and Jacobson's Organ. Pp. 99-191 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology B, vol. 2, Academic Press, New York.

———, and John E. Cameron. 1976. Internal relief of the digestive tract. Pp.159-223. *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology E, Vol. 6, academic Press, New York.

Rafinesque, C. S. 1832. Description of two new genera of softshell

turtles of North America. Atlantic J. Friend Knowledge, Philadelphia 1(2):64-65.
Reig, Osvaldo. 1968. Peuplement en vertébrés tetrapodes de l'Amerique du Sud. Biol. Am. Aust. 4:215-260.
Richmond, Neil D. 1958. The status of the Florida snapping turtle, *Chelydra osceola* Stejneger. Copeia 1958(1):41-43.
———. 1964. The mechanical functions of the testudinate plastron. Amer. Midland. Natur. 72(1):50-56.
Rieppel, Olivier. 1976. Die orbitotemporale region im Schüdel von *Chelydra serpentina* Linnaeus (Chelonia) und *Lacerta sicula* Rafinesque (Lacertilia). Acta Anat. 96(3):309-320.
———. 1977. Über die entwicklung des Basicranium bei *Chelydra serpentina* Linnaeus (Chelonia) und *Lacerta sicula* Rafinesque (Lacertilia). Verh. Naturf. Ges. Basel (1975) 86(1):152-170.
Riss, Walter, M. Halpern, and Frank Scalia. 1969. The quest for clues to forebrain evolution - the study of reptiles. Brain Behav. Evol. 2:1-50.
Romer, Alfred S. 1956. Osteology of the reptiles. Univ. Chicago Press, Chicago. xxi + 772 p.
Savage, Jay M. 1966. The origins and history of the Central American herpetofauna. Copeià 1966(4):719-766.
Schumacher, Gert-Horst. 1973. The head muscles and hyolaryngeal skeleton of turtles and crocodilians. Pp. 101-199 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology D, Vol. 4, Academic Press, New York.
Schwab, Martin Ernst. 1979. Variation in the rhombencephelon. Pp. 201-246 *In* Carl Gans, R. Glenn Northcutt, and Philip Ulinski (eds.), Biology of the Reptilia, Neurology B, Vol. 10, Academic Press, New York.
Schwartz, Clyde, and Harold M. Kaplan. 1962. The electrical activity of the turtle heart. Amer. Zool. 2(4):556-557.
Schweigger, F. 1812. Prodromus monographiae cheloniorum. Konigsberger Archiv. Naturwiss. Math. 1:271-368, 406-468.
Semple, Robert E., Dale Sigsworth, and John T. Stitt. 1970. Seasonal observations on the plasma, red cell, and blood volumes of two turtle species native to Ontario. Can. J. Physiol. Pharmacol. 48 (5):282-290.
Senn, David G. 1971. Structure and development of the optic tectum of the snapping turtle *(Chelydra serpentina* L.). Acta Anat. 80(1):46-57.
———. 1979. Embryonic development of the central nervous system. Pp. 173-244 *In* Carl Gans, R. Glenn Northcutt, and Philip Ulinski (eds.), Biology of the Reptilia, Neurology A, Vol. 9, Academic Press, New York.
Sidky, Younan A., and Robert Auerbach. 1968. Tissue culture analysis of immunological capacity of snapping turtles. J. Exp. Zool. 167(2):187-196.
Smith, Hobart M., and Louis F. James. 1958. The taxonomic significance of cloacal bursae in turtles. Trans. Kansas Acad. Sci. 61(1):86-96.
Soliman, M. A. 1964. Die Kopfnerven de Schildkröten. Z. Wiss. Zool. 169:216-312.
Starck, D. 1979. Cranio-cerebral relations in Recent reptiles. Pp. 1-38 *In* Carl Gans, R. Glenn Northcutt, and Philip Ulinski (eds.), Biology of the Reptilia, Neurology A, vol. 9, Academic Press, New York.
Stock, A. Dean. 1972. Karyological relationships in turtles (Reptilia: Chelonia). Can. J. Genet. Cyto.. 14(4):859-868.
Stromsten, Frank A. 1910. A contribution to the anatomy and development of the posterior lymphatic heart of turtles. Publ. Carnegie Inst. (132): 3-77.
Sullivan, Bolling, and Austen Riggs. 1967. Structure, function and evolution of turtle hemoglobins. I. Distribution of heavy hemoglobins. II. Electrophoretic studies. III. Oxygenation properties. Comp. Biochem. Physiol. 23(2):437-474.
Tinkle, Donald W. 1962. Variation in shell morphology of North American turtles. 1. The carapacial seam arrangements. Tulane Stud. Zool. 9(5):331-349.
Underwood, Garth L. 1970. The eye. Pp. 1-97 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology B, Vol. 2, Academic Press, New York.
Van Devender, Thomas R., and Norman T. Tessman. 1975. Late Pleistocene snapping turtles *(Chelydra serpentina)* from southern Nevada. Copeia 1975(2):249-253.
Walker, Warren F., Jr. 1973. The locomotor apparatus of Testudines. Pp. 1-100 *In* Carl Gans and Thomas S. Parsons (eds.), Biology of the Reptilia, Morphology D, Vol. 4. Academic Press, New York.
Weigel, Robert D. 1962. Fossil vertebrates of Vero, Florida. Florida Geol. Surv. Special Publ. 10, vii + 59 p.
Wever, Ernst Glen. 1978. The reptile ear. Princeton Univ. Press, Princeton, New Jersey. xii + 1024 P.
Whetsone, Kenneth N. 1977. *Platysternon* and the evolution of chelydrid turtles. Herpetol. Rev. 8(3): suppl. 20.
Williams, Ernest E. 1950. Variation and selection in the cervical central articulations of living turtles. Bull. Amer. Mus. Nat. Hist. 94(9):505-562.
Winokur, Robert M., John M. Legler. 1974. Rostral pores in turtles. J. Morphol. 143(1):107-119.
Yntema, C. L. 1968. A series of stages in the embryonic development of *Chelydra serpentina.* J. Morphol. 125(2):219-252.
Zangerl, Rainer. 1941. A series of lateral organs found in embryos of the snapping turtle *(Chelydra serpentina)*. Pap. Michigan Acad. Sci. Arts Lett. 26:339-341.
Zug, George R. 1966. The penial morphology and the relationships of cryptodiran turtles. Occ. Pap. Mus. Zool. Univ. Michigan (647):1-24.
———. 1971. Buoyancy, locomotion, morphology of the pelvic girdle and hindlimb, and systematics of cryptodiran turtles. Misc. Publ. Mus. Zool. Univ. Michigan (142):1-98.

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