Journal of the Arkansas Academy of Science

Volume 35 Article 31

1981

Anomolies of Bobcat Skulls (Felis rufus) in Arkansas

C. Renn Tumlison
Arkansas State University

V. Rick McDaniel
Arkansas State University

LITERATURE CITED

BLOCH, A. 1974. Cytidine 3',5'-monophosphate (cyclic CMP). I. Isolation from extracts of Leukemia L 1210 cells. Biochem. Biophys. Res. Comm. 58:652-659.

BLOCH, A., G. DUTSCHMAN and R. MAUE. 1974. Cytidine 3',5'-monophosphate (cyclic CMP) II. Initiation of Leukemia L 1210 cell growth *in-vitro*. Biochem. Biophys. Res. Comm. 59:955-959.

CAILLA, M. L., D. ROUX, M. A. DeLAAGE and C. GORIDIS. 1978. Radioimmunological identification and measurement of cytidine 3',5'-monophosphate in rat tissues. Biochem. Biophys. Res. Comm. 85:1503-1509.

CECH, Y. S. and L. G. IGNARRO. 1977. Cytidine 3',5'-monophosphate (cyclic CMP) formation in mammalian tissues. Science 198:1063-1065.

CECH, Y. S. and L. G. IGNARRO. 1978. Cytidine 3',5'-monophosphate (cyclic CMP) formation by homogenate of mouse liver. Biochem. Biophys. Res. Comm. 80:119-125.

CONRAD, D. and BLOCH, A. 1980. 3',5' Cyclic pyrimidine and purine phosphodiesterase (PDE) activities in normal and regenerating rat liver. Fed. Proc. 39:1955.

GAION, R. and G. KRISHNA. 1979. Cytidylate cyclase: The product isolated by the method of Cech and Ignarro is not cytidine 3',5'-monophosphate. Biochem. Biophys. Res. Comm. 86:105-111.

HELFMAN, D. M., M. SHOJI and J. F. KUO. 1980. Cytidine 3',5'-monophosphate (cCMP) Phosphodiesterase: Purification to apparent homogeneity from pig liver using affinity chromatography. Fed. Proc. 39:1955.

ISHIYAMA, J. 1975. Isolation of cyclic 3',5'-pyrimidine mononucleotides from bacterial culture fluids. Biochem. Biophys. Res. Comm. 65:286-292.

MURPHY, B. E. and J. E. STONE. 1979. Radioimmunoassay of cytidine 3',5'-monophosphate (cCMP) I. Development of the assay. Biochem. Biophys. Res. Comm. 89:122-128.

MURPHY, B. E. and J. E. STONE. 1980. Changes in concentration of cytidine 3',5'-monophosphate (cyclic CMP) in regenerating rat liver. Proc. Soc. Exper. Biol. 163:302-304.

SCAVENNEC, J., Y. CARCASSONNE, J. GASTAUT, A. BLANC and H. L. CAILLA. 1981. Relationship between the levels of cyclic cytidine 3',5'-monophosphate, cyclic guanosine 3',5'-monophosphate and cyclic adenosine 3',5'-monophosphate in urines and leukocytes and the type of human leukemias. Cancer Res. 58:3222-3227.

SMITH, G. J., G. J. DRUMMONG and H. G. KHORANA. 1961. Cyclic phosphates IV. Ribonucleoside-3',5' cyclic phosphates. A general method of synthesis and some properties. J. Am. Chem. Soc. 83:698-706.

STEINER, A. L., G. W. PARKER and D. M. KIPNIS. 1972. Radioimmunoassay for cyclic nucleotides. I. Preparation of antibodies and iodinated cyclic nucleotides. J. Biol. Chem. 247:1106-1113.

SUTHERLAND, E. W. 1972. Studies on the mechanism of hormone action. Science 177:401-408.

WIKBERG, J. E. S. and G. B. WINGREN. 1981. Investigations on the occurrence of cytidine 3',5'-monophosphate (cCMP) in tissues. Acta Pharmacol. et. Toxicol. 49:52-58.

JOSEPH E. STONE and BRUCE E. MURPHY, Dept. of Pharmacology and Dept. of Medicine, University of Arkansas for Medical Sciences, Little Rock, Ark. 72205.

ANOMALIES OF BOBCAT SKULLS (*FELIS RUFUS*) IN ARKANSAS

Examination of 275 bobcat skulls (*Felis rufus*) from Arkansas, preserved in the Collection of Recent Mammals, Arkansas State University Museum of Zoology (ASUMZ), revealed five anomalous forms which ranged from dental irregularity to supernumerary cranial bones.

Sutural anomalies were found in several skulls. The normal junction of the coronal (C) and sagittal (S) sutures is illustrated in Figure 1, # 6926. This bregmatic junction forms after fontanelle ossification of the frontal and parietal bones. In the fetal skull, cartilagenous "soft spots" or fontanelles exist at the future junctional site, and if ossification among the bones is uneven, waved or otherwise malformed sutures may result. Two of the more pronounced sutural anomalies found in Arkansas bobcats are illustrated in Figure 1, #'s 7706 and 6765. Bregmatic bone formation can also cause abnormal junctions if ankylosis obliterates one or more sutures (Pratt, 1942; Manville, 1959). We did not attempt to distinguish between anomalies caused by these factors.

Bregmatic bones (those formed at the anterior fontanelle) occur commonly in the beaver (*Castor*) and porcupine (*Erethizon*) (Schultz, 1923) and result from one or more ossification centers developing in the anterior fontanelle, thereby forming additional bones as the parietals and frontals complete ossification around them. Occurrences of bregmatic bones in bobcats are discussed in the literature (Pratt, 1942; Manville, 1959; Mahan, 1980). Hall and Kelson (1959) (probably unknowingly) depicted a bregmatic bone in their illustration of a bobcat skull. Bregmatic fontanelle bones were found in 41 of 275 (14.9%) Arkansas bobcat skulls examined, and varied in size, shape, and number. Representatives of variations seen in Arkansas skulls are illustrated in Figure 2. The nature of these bones in Arkansas bobcats is similar to reports from other areas: 14.7% in Nebraska (Mahan, 1980); 16.8% in Oregon, 14.6% in Nevada, 15.5% nationally (as represented in the U. S. National Museum) (Manville, 1959). Manville also pointed out deviations from this apparent trend: 37.5% of 32 specimens from West Virginia, 44.0% of nine from Mississippi and 7.0% of 158 from Texas. Pratt (1942) found anomalous bones in 17.5% of his museum study material, and Progulske (1952) found 15 of 72 (20.8%) skulls from Virginia and North Carolina to have anomalous bones. Usually, only a single extra bone occurs; however, in the Arkansas material examined, one skull (Fig. 2, # 7471) exhibited two additional bones (0.4% of sample). Similarly, Mahan (1980) found only one such pair of bones (0.9%) in Nebraska and Pratt (1942) reported two (0.12% of his sample). Furthermore, Pratt reported only one incidence involving three anomalous bones in a sample of 2154 skulls. ASUMZ 7734 (Fig. 2) illustrates an Arkansas specimen exhibiting this trinity of extra bones (0.4% of sample), representing the second documented record. No correlation was found between sex or geographic location and presence of anomalous bones in Arkansas bobcats.

Wormian bones are those which are sutural in origin, as contrasted with bregmatic bones which are fontanellic in origin. It is sometimes

impossible to distinguish between these, as they are often closely associated (Schultz, 1923). One Arkansas bobcat skull demonstrated a distinguishable wormian bone, illustrated in Figure 2, # 6784.

Two dental anomalies were discovered, neither of which have been reported previously. The only previous dental anomaly reported involved the occurrence of double incisors (Rollings, 1945; Pollack, 1949). One skull from Arkansas was found to have a misdirected right upper first premolar. Instead of replacing the lacteal tooth which had been lost, the permanent premolar appeared on the lingual side of the second premolar (Fig. 3).

An additional dental anomaly found during this study involved misalignment of the lower incisors. Normally, these incisors lie in a straight line (Fig. 4A). Due to crowding or other factors, incisors in some jaws occurred out of line, resulting in a wavy appearance of the incisor row (Fig. 4B). The most extreme example of this anomaly consisted of the outer incisors (those adjoining the canines) having been forced completely anterior to the other incisors, which maintained a straight line formation (Fig. 4C).

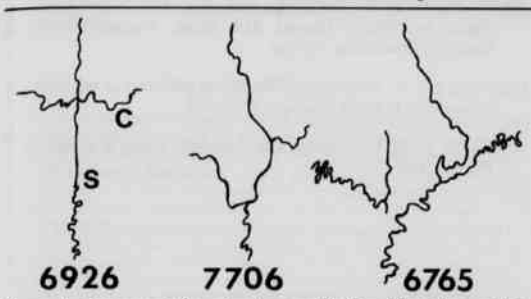

Figure 1. Representative sutural anomalies found in Arkansas bobcat skulls. Normal sutural junction indicated in ASUMZ 6926 (S-sagittal suture, C-coronal suture).

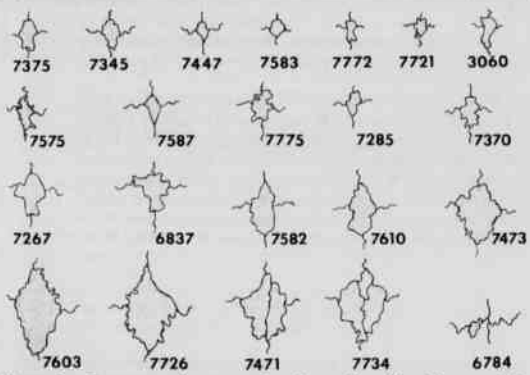

Figure 2. Representative anomalous bones found in Arkansas bobcat skulls (numbers indicate ASUMZ catalog references).

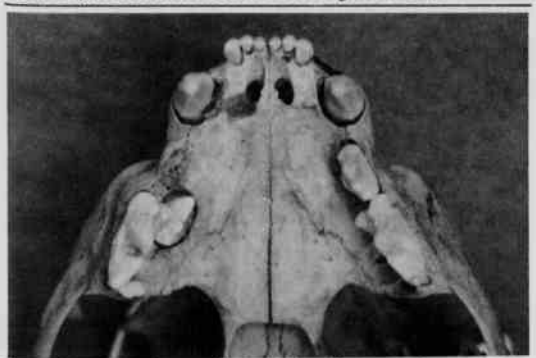

Figure 3. Anomalous position of the right upper first premolar. Note the left jaw maintained the normal arrangement.

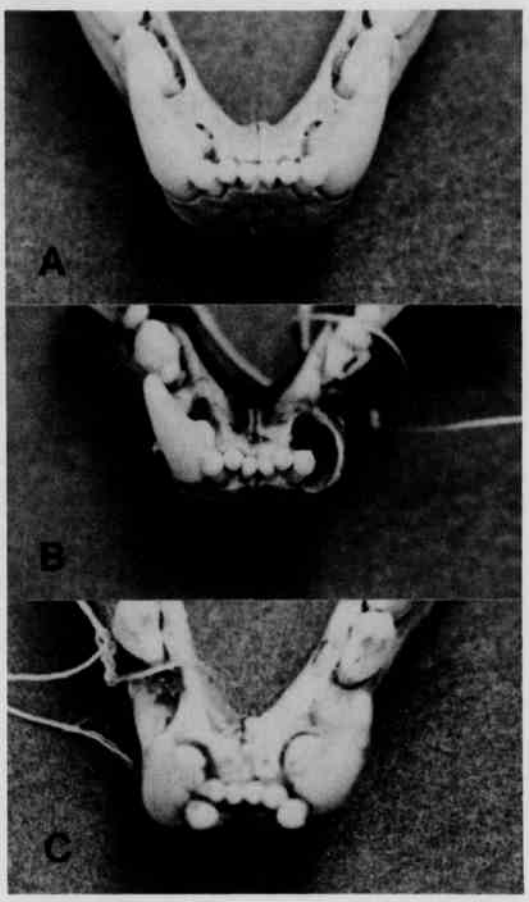

Figure 4. Misaligned incisors of Arkansas bobcats. A - normal linear arrangement. B - misalignment producing wavy appearance. C - misalignment forcing third incisor completely anterior to other incisors.

The authors wish to thank Mr. Lew Johnston of the Arkansas Game and Fish Commission for providing many of the skulls examined.

LITERATURE CITED

HALL, E. R. and K. R. KELSON. 1959. The mammals of North America. Ronald Press, New York. 2 vols. 1083 pp.

MAHAN, C. J. 1980. Occurrence of bregmatic bones in bobcats (*Lynx rufus*) from Nebraska. Trans. Kansas Acad. Sci. 83:95-97.

MANVILLE, R. H. 1959. Bregmatic bones in North American *Lynx*. Science 130:1254.

POLLACK, E. M. 1949. The ecology of the bobcat (*Lynx rufus rufus* Schreber) in the New England states. Unpubl. M.S. thesis, Univ. of Mass., Amherst. 120 pp.

PRATT, L. W. 1942. Bregmatic fontanelle bones in the genus *Lynx*. J. Mamm. 23:411-416.

PROGULSKE, D. R. 1952. The bobcat and its relation to prey species in Virginia. Unpubl. M.S. thesis, Virginia Polytechnic Institute, Blacksburg. 135 pp.

ROLLINGS, C. T. 1945. Habits, foods and parasites of the bobcat in Minnesota. J. Wildl. Manage. 9:131-145.

SCHULTZ, A. H. 1923. Bregmatic fontanelle bones in mammals. J. Mamm. 4:65-77.

C. RENN TUMLISON and V. RICK McDANIEL, Dept. of Biological Science, Arkansas State University, State University, Arkansas 72467.

ERRATUM

The sixth paragraph of the paper, *"Immune responses of rats to antigens of Moloney leukemia virus,"* by Frances B. Soderberg, Susan G. Tai and Joe M. Jones, *Proc. Ark. Acad. Sci.*, 34:133-34, has an incorrect sentence. The corrected paragraph, in its entirety, is published below:

Table 2 shows that when immunized with oncogenic virus (MuLV) or with tumor cells (MST), BN rats exhibit high antibody responses and LEW low responses. LEW-1n congenics with RT1n of BN bred on a LEW background exhibited responses similar to LEW. TO rats, which differ genetically from all of the other three strains, exhibited responses similar to BN to p30 and responses lower than BN to gp70. This shows that higher responders to p30 are not automatically higher responders to other viral polypeptides. Table 3 shows that the phenomenon observed with LEW-1n was not confined to the p30 antigen. Although AS2 rats exhibited significant responses to p15 of MuLZ, LEW-1f congenics carrying the RT1f of AS2 on a LEW background were low or non-responders to p15. LEW-1f were also low responders to gp70 when immunized with MuLV (% precipitation 3.8 $\pm$ 2.6), and LEW rats were low responders to p15, p30 and gp70 in all tests when immunized with MuLV.