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Osteological and myological comparisons of the head and thorax regions of *Cnemidophorus tigris septentrionalis* Burger and *Ameiva undulata parva* Barbour and Nobel (Family Teiidae)

Don Lowell Fisher

Wilmer W. Tanner

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OSTEOLGICAL AND MYLOGICAL COMPARISONS
OF THE HEAD AND THORAX REGIONS OF
CNEMIDOPHORUS TIGRIS SEPTENTRIONALIS BURGER
AND AMEIVA UNDULATA PARVA BARBOUR AND NOBLE
(FAMILY TEIIDAE)

by

Don Lowell Fisher

and

Wilmer W. Tanner

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>METHODS AND MATERIALS</td>
<td>2</td>
</tr>
<tr>
<td>OSTEEOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>General Description of the Skull</td>
<td>3</td>
</tr>
<tr>
<td>Description of Skull Elements</td>
<td>4</td>
</tr>
<tr>
<td>Lower Jaw</td>
<td>13</td>
</tr>
<tr>
<td>Foramina of the Skull and Lower Jaw</td>
<td>16</td>
</tr>
<tr>
<td>Teeth</td>
<td>17</td>
</tr>
<tr>
<td>Wrist</td>
<td>19</td>
</tr>
<tr>
<td>MYOLOGY</td>
<td>19</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>30</td>
</tr>
<tr>
<td>CONCLUSIONS AND SUMMARY</td>
<td>37</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>39</td>
</tr>
</tbody>
</table>

# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Ameiva undulata parva.</em> Dorsal view of skull (6.2X)</td>
<td>5</td>
</tr>
<tr>
<td>2. <em>Ameiva undulata parva.</em> Ventral view of skull (6.2X)</td>
<td>6</td>
</tr>
<tr>
<td>3. <em>Ameiva undulata parva.</em> Lateral view. (6.2X)</td>
<td>7</td>
</tr>
<tr>
<td>4. <em>Cnemidophorus tigris septentrionalis.</em> Dorsal view of skull. (8.4X)</td>
<td>8</td>
</tr>
<tr>
<td>5. <em>Cnemidophorus tigris septentrionalis.</em> Ventral view of skull. (8.4X)</td>
<td>9</td>
</tr>
<tr>
<td>6. <em>Cnemidophorus tigris septentrionalis.</em> Lateral view of skull. (8.4X)</td>
<td>10</td>
</tr>
<tr>
<td>B. Medial view. C. Dorsal view. (4.9X) teeth diagramatic, see Fig. 9</td>
<td></td>
</tr>
<tr>
<td>8. <em>Cnemidophorus tigris septentrionalis.</em> Lower Jaw. A. Lateral view. B. Medial view. C. Dorsal view. (7.5X) teeth diagramatic, see Fig. 9</td>
<td>15</td>
</tr>
<tr>
<td>10. <em>Ameiva undulata parva.</em> Musculature dorsal view. A. Superficial depth. B. First depth. (2.9X)</td>
<td>20</td>
</tr>
<tr>
<td>11. <em>Ameiva undulata parva.</em> Musculature dorsal view. A. Second depth. B. Third depth. (2.9X)</td>
<td>21</td>
</tr>
<tr>
<td>12. <em>Ameiva undulata parva.</em> Musculature dorsal view. A. Fourth depth. B. Fifth depth. (2.9X)</td>
<td>22</td>
</tr>
<tr>
<td>13. <em>Ameiva undulata parva.</em> Musculature ventral view. A. Superficial depth. B. First depth. (2.9X)</td>
<td>23</td>
</tr>
</tbody>
</table>
15. *Ameiva undulata parva*. Musculature ventral view. A. Fourth depth. B. Fifth depth. (2.9X) .............................................................. 25
16. *Ameiva undulata parva*. Musculature lateral view. First depth. (2.9X) .......... 26
17. *Ameiva undulata parva*. Musculature lateral view. Second depth. (2.9X) ..... 27
18. *Ameiva undulata parva*. Musculature lateral view. Third depth. (2.9X) ...... 28
19. *Ameiva undulata parva*. Musculature lateral view. Fourth depth. (2.9X) ..... 29
20. *Ameiva undulata parva*. Musculature lateral view. Fifth depth. (2.9X) ...... 30
INTRODUCTION

There has long been a need for a comparative study of the osteological and myological structures of the reptilian family Teiidae. This present study is organized to increase our understanding of the anatomical features of the head and thorax regions of two large genera of this large and diversified family. The two genera discussed are Cnemidophorus and Ameiva.

Although the entire family is in need of a comparative study, these two genera were chosen because they are, according to Burt (1931b), closely allied and also because a number of study specimens were available. The study is limited to the head and thorax regions inasmuch as this area, according to Patten (1951), seems to be the most plastic region of the body as far as adaptive radiation is concerned. We are aware that other regions of the vertebrate body are also plastic in some groups; however, we believe that in this family the thorax region is of special significance to the study of the phylogenetic development of genera within this family.

Studies dealing with taxonomy, physiology, ecology and general anatomy of the two genera have been made by various workers. Those reports which are pertinent to this study are cited below.

An extensive taxonomic study of the genus Cnemidophorus was made by Burt (1931b) with complete synonymy of the various species and subspecies to that date. A revision of the genus Ameiva was completed by Barbou and Noble (1915). Smith and Laufe (1946) in their summary of the Mexican lizards of the genus Ameiva dealt with the taxonomy of the genus. It will not be necessary, therefore, to give a detailed account in this report of the taxonomy which has been completed to date. We can thus confine ourselves more to the comparative anatomical aspects of the two genera.

The family Teiidae was established by Gray (1825), and today consists of about 40 genera (Smith and Taylor, 1950). The genus Ameiva was established by Meyer (1795) with Lacerta americana Seba = Ameiva ameiva (Linnaeus) being the genotype. According to Smith and Taylor (1950), there are 13 species and 28 subspecies in the genus.

The genus Cnemidophorus was established by Wagler (1830). The genotype is Seps murinus Laurenti. There are about 18 species of Cnemidophorus with about 47 subspecies (Smith and Taylor, 1950). Since 1950 only a few new species and subspecies have been described in each genus.

Ameiva undulata varva was established by Barbou and Noble (1915). The type is MCZ 5831 (with Van Patten as the collector) and the type locality is listed as Guatemala; however, this was later restricted by Smith and Laufe (1946) to Mazatenango. The range is on the Pacific slopes from the Isthmus of Tehuantepec in Oaxaca south to Costa Rica.

Cnemidophorus tigris septentrionalis was established by Burger in 1950. The type is CNCM 38217 and the type locality is Una, Garfield County, Colorado. The range extends over the Colorado Plateau (Maslin, 1959b) and includes the northern half of Arizona, the northwestern quarter of New Mexico, the southeastern half of Utah, and the southwestern quarter of Colorado (Burger, 1950).

A synopsis of the genus Cnemidophorus was first completed by E.D. Cope (1892b) wherein he made a most memorable statement to all individuals who further attempt to resolve the phylogenetic relationships within this genus. He considered the discrimination of the species within Cnemidophorus the most difficult problem in herpetology.

A later work by Burt (1931b) using Ecology, scutellation, and distribution has helped in unravelling some of the problems of the phylogenetic relationships within the genus Cnemidophorus. Other large and comprehensive works on groups within the genus Cnemidophorus also have been recently completed. These include a report by Zweifel (1959) on the distribution and variation of the saki group, a systematic study of the depeei group (Duellman and Wellman, 1960), and a systematic study of the sexlineatus group (Duellman and Zweifel, 1962).

These works all analyze such characters as scutellation, coloration, dorsal patterns, size, and distribution.

The systematic relationships of the genus Ameiva have also been explored by Barbou and Noble (1915), who published an extensive work on the phylogeny and provided a description of the species and subspecies included in the genus. The relationships of the Ameiva undulata group were suggested by Stuart (1942). In this study he included a diagnosis of each species as well as a key to the species.

A summary of the Mexican species of the genus Ameiva was published by Smith and Laufe (1946). Their report is informative, extensive, includes a historical summary and an analysis of characters by means of scutellation. A phylogeny, a key to the Mexican Ameiva, and an account of the subspecies is also included.

Some of the factors relating to behavior and evolution have also been reported. A thorough study for its time by Gadow (1906) on evolution was based on the Mexican species of Cnemidophorus. His report helps us to realize the great variety possible in a genus which has evolved in a land filled with the diversity of bionomic conditions found in Mexico. Other studies include those by Broom (1925), Maslin (1959a, 1961, 1966), Zweifel (1962), Beargie and McCoy (1964),
Pennock (1965), Licht (1966), Lowe and Goldberg (1966), McCoy (1966), and Taylor and Medica (1966).

Much of the literature available on the family Teiidae deals with old and new collecting localities and taxonomy. Some such papers are those by Gray (1825), Boulenger (1884, 1899), Nopcsa (1928), Burt (1929, 1931a, 1931c), Beebe (1945), Smith and Burger (1949), Burger (1950), Smith and Taylor (1950), Maslin, Beidleman and Lowe (1958), Maslin (1963), Peters (1964), Zweifel (1965), and Stebbins (1966).

Fossil teedids have been reported by Brattstrom (1954), Etheridge (1960), Gehiabch (1965), and Romer (1966).

A number of anatomical works are of importance to those working in herpetology in the areas of osteology and myology. Among these are Boulenger (1891), Cope (1892a), Howes (1902), Bradley (1903), Broom (1903), Huntington (1903), Kingsley (1905), Kesteven (1919), Camp (1923), Reese (1923), Romer (1924), Sinsitsin (1928), Edgeworth (1931), Broom (1935), Davis (1936), Howell (1936), Gnanamuthu (1937), Dubois (1942, 1943), George (1948), Adams (1953), Poglayen-Neuwall (1954), Snyder (1954), Dervich (1956), Romer (1956), Hofer (1960), Jollie (1960), Robison and Tanner (1962), Avery and Tanner (1964), and Romer (1946, 1966).

Although most of the anatomical works mentioned above do not consider extensively the family Teiidae, some are of special importance to a study of this family. Camp (1923) compares anatomically the families of reptiles and emphasized the genus Tupinambis as a member of the family Teiidae. Two other works of osteological import for the genus Tupinambis are those by Reese (1923) and Hofer (1960). To date, only one work has been published on the complete cranial osteology of Cnemidophorus, on C. sexlineatus and C. guttus by Dubois (1943). A major osteological report on Ameiva has not appeared to date. Taylor (1940) was one of the first to establish the presence of parietal teeth in Cnemidophorus. His study included nine species. Edmunds (1960) presented the tooth replacement phenomena in lower vertebrates.

The myology of the family Teiidae has been studied only to a limited extent. Camp (1923) and Poglayen-Neuwall (1954) included work on Tupinambis, with a few references to the deep skull musculature of Ameiva. No comparative or descriptive study of the myology of Cnemidophorus or Ameiva has yet appeared. Perhaps the most extensive treatment of vertebrate cranial muscles is the work of Edgeworth (1935).

The position of the family Teiidae is unique in its phylogeny among the other saurians. This was observed by Stokely (1950) in his report on the occurrence of an intermediate in certain lizards. He found the intermediate present in several species of Cnemidophorus, but absent in Ameiva ameiva praesignis. Camp (1923) considered the presence of this wrist bone an indication of an older position in phylogeny. The apparent differences within the family Teiidae on this structure warrant a more detailed investigation. There is reason to believe that further osteological and myological studies of the family Teiidae should include comparisons with members of the family Lacertidae. The work of Uzzell (1959) and others suggest a parallelism that may be fruitful in phylogeny as well as anatomy.

The purpose of this paper, therefore, is to present a report on the anterior osteology and myology of a species of the genus Ameiva and to compare it with a species of the closely allied genus Cnemidophorus. It may thereby be possible to develop other criteria to be used in determining the phylogenetic relationships between Cnemidophorus and Ameiva within the family Teiidae.

We are grateful to Dr. Bertrand F. Harrison for his suggestions in preparing the manuscript and to Mr. Lee F. Braithwaite for his aid in the preparation of the illustrations. Dr. Robert T. Swenson and the X-ray technicians at the Utah Valley Hospital prepared the X-ray photographs of the wrist elements. We extend our thanks to the above and others who have aided us in this project.

**MATERIALS AND METHODS**

Cnemidophorus tigris septentrionalis Burger and Ameiva undulata parva Barbour and Noble are the principal species and subspecies used in this study. In the body of the text they will be designated as C. t. septentrionalis and A. u. parva respectively. Specimens of Cnemidophorus tigris tigris Baird and Girard and Cnemidophorus tigris gracilis Baird and Girard were also dissected for comparative purposes.

The specimens of C. t. septentrionalis were collected from southeastern Utah. Five came from North Wash near Hog Spring (BYU 31903-07); two from Star Spring (BYU 31908-09); one from Bullfrog Basin (BYU 31910); three from North Wash along highway U95 between Star Spring and Hanksville (BYU 31911-13) and nine from Snow's Canyon, west of Saint George, Utah (BYU 31914-22).

The specimens of C. t. tigris were collected in western Utah. Six specimens came from Lake Moun-
tains west of Utah Lake (BYU 31923-28), and one from Milford, Utah (BYU 31929).

The specimens of C. t. gracilis Baird and Girard examined were taken 11 miles east of Bowie, Cochise Co., Arizona (BYU 13555-61).

A. u. parva were collected at Finca Tinajas, Panzos, Alta Verapaz, Guatemala (BYU 14389, 14895-96, 14398, 14444, 14448-51, and 14453).

The specimens used for X-ray analysis of the wrist elements were the following: C. t. septentrionalis (BYU 31904); C. t. gracilis (BYU 13560); C. t. canus VanDenburgh and Slevin (BYU 30159); C. t. aethiops Cope (BYU 30196); C. t. tigris Baird and Girard (BYU 30552); C. s. communis Cope (BYU 24017); C. s. gularis Baird and Girard (BYU 12876); C. d. deppei Wiegmann (BYU 22541); C. l. lineatissimus (Linnaeus) Cope (BYU 24018); C. l. lemniscatus (Linnaeus) (BYU 22599); C. exsanguis Lowe (BYU 14158); A. u. hartwegi Smith (BYU 22523); A. u. sinistra Smith and Laufe (BYU 24013); A. u. parva (BYU 14398) and A. auberi Cocteau (BYU 30326).

Radiographs were taken with an X-ray machine using eleven milliamperes at one and one-half seconds with a medium KVP. X-ray negatives were then enlarged in a slide projector and examined.

Skulls were cleaned by various methods. One specimen of A. u. parva (BYU 144451, snout-vent length 100 mm.) was skinned and placed in 35 percent ammonium hydroxide for two months, boiled for two hours and then cleaned by hand. It was then treated with Clorox bleach at full strength for 15 minutes with excellent results. Another specimen of A. u. parva (BYU 14450, snout-vent 86 mm.) as well as two C. t. septentrionalis (BYU 31924 and 31926, snout-vent length both 84 mm.), and two C. t. gracilis (BYU 13559 and 13561, snout-vent length 70 and 71 mm. respectively) were skinned, hand cleaned of muscle tissue and then boiled for two hours. The skulls were then soaked in Clorox bleach at full strength for 35 minutes with adequate results. Care must be taken not to leave a skull too long in the bleach solution. If not properly attended, disarticulation occurs after a certain length of time depending on the size and thickness of the skull bones.

Myological studies were made on C. t. septentrionalis (BYU 31906-8, 31910, 31024 and 31925 with snout-vent lengths of 77, 84, 74, 92, 84 mm. respectively) and A. u. parva (BYU 14396, 14444, 14448-9 and 14453 with snout-vent lengths of 111, 108, 91, 75, and 127 mm. respectively). All specimens were carefully skinned and muscles dissected using small pieces of a new razor blade held securely in an x-acto knife handle. All specimens studied had been preserved in 10 percent formalin.

All drawings were made on Clearprint "fade-out" paper. The specimens were examined under a 10X-40X binocular dissecting scope and then drawn in pencil using a micrometer eyepiece for exactness. The drawings were then enlarged by use of an opaque projector and inked using a L 4 Koh-I-Noor drawing pen. Stippling and line-shading methods described by Zweifel (1965) were adopted, using a #00 Koh-I-Noor drawing pen. Lettering was made with Prestype futura demi 18 and 36 point.

Photographs of all work accomplished were made for comparison purposes using an Exacta camera with an f22 aperture at 1/25 of a second and a double flash attachment. Expansion rings were used to obtain a 4:1 ratio enlargement. Kodak plus-X ASA 125 pan film was used.

OSTEOLEGY

An extensive study of all the skeletal elements of the body is not the primary purpose of this report. The discussion, therefore, is limited to the skull, wrist bones, and a comparison of the teeth. In each case, a full description of A. u. parva is given under each element using two skulls to determine all structures and listed as "A". This is followed by only the comparative differences noted in skulls of C. t. septentrionalis under each element and listed as "C". Two skulls each of C. t. tigris and C. t. gracilis were also examined for comparative purposes. If not otherwise stated, items not listed in "C" are essentially the same as those in "A".

General Description of the Skull

A. Generally, the skull can be considered heavily ossified for members of the family Teiidae having the dorsal surface rather rugose with prominent indentations present indicating positioning of overlying scutellation. Prominent dorsolateral orbital fenestrae dominate the middle portion of the skull. Posteriorly, two prominent fenestrae are present: a posterdorsal supratemporal fenestra and a posteroventral infra-temporal fenestra separated by a temporal arch composed of the fused postorbital-postfrontal and the squamosal bones. Such a condition is termed diapsid and is typical of the condition seen in the fossil ancestors of modern lizards (Romer, 1966).

The foramina of the ventral surface anteriorly are those for the vomeronasal organs of Jacobson followed by the elongate internal nares. The floor of the orbit in the central portion of the skull is opened by the infraorbital foramen.

The occipital portion of the skull forms a posterior union for dorsal and ventral segments to enclose the brain. The occipital bones are highly fused and relatively difficult to differentiate. The brain case is composed of ventral projections of the parietal, anterior projections of the supraoccipital, exoccipital, and the basioccipital. The foramen magnum poster-
ocentrally is bordered by the supraoccipital dorsally, the basioccipital ventrally and the exoccipitals laterally. The occipital condyle is tripartite and is located on the posterior end of the basioccipital and the medioventral projections of the exoccipitals.

The large quadrate bones of the posterolateral portion of the ventral surface are loosely attached to the occipital processes and thus appear to allow for greater expansion of the lower jaw.

C. Generally, the skull is lighter, that is the bones are thinner and the dorsal surface is relatively glabrous. There is little indication of indentations for scutellation on the dorsal surface. The anteromedial border of the orbit is cartilaginous and the occipital portion of the skull is not highly fused, permitting most elements to be more easily distinguished.

More specifically, the differences between the two genera are considered with each of the individual skull elements.

Description of Skull Elements

All elements, for the sake of clarity, are discussed in alphabetical order. Only bones which are paired are indicated as such.

Basioccipital. (Fig. 2, 3, 5, and 6)

A. This bone is partially fused into the occipital complex. It forms the posteroverentral border of the foramen magnum and extends anteriorly to articulate with the basisphenoid. It is bounded laterally by the exoccipitals and forms the floor of the brain case having fused anterolaterally with a pair of processes from the basisphenoid. Posteriorly, a pair of strongly developed basioccipital tuberosities can be seen which extend ventrally and slightly laterally. A slight median ridge extends along the suture line between the basioccipital and the exoccipitals.

C. The bone is thin on the ventral surface and the suture lines between it and the exoccipital are prominent.

Basisphenoid. (fig. 2, 3, 5, and 6)

A. This is the main bone of the floor of the cranium. It is bordered posteriorly by the basioccipital and anteriorly forms a forward projection which proceeds along the base of the brain called the rostral paraphenoid which we considered a separate element. Ventrally, articulation is with the pterygoid bone by means of two ventral foot-shaped basi-pterygoid processes. Lateral extensions form an irregular suture with the basioccipitals. The dorsomedial portion forms the sella turcica.

C. Relatively little difference is noted.

Ectopterygoid.—paired bones (Fig. 1, 2, 3, 4, 5, and 6)

A. Posteriorly, it articulates with the anterolateral projection of the pterygoids. A prominent ectopterygoid process is noted as a ventral projection. Laterally, articulation is with the maxilla, jugal, and pterygoids, but a complete separation of jugal from the pterygoid or separation of maxilla from the jugal is made. Anteriorly, articulation is with the palatine bones. The medial border forms the lateral margin of the infratrochial foramen. Dorsally, it forms the posterolateral floor of the orbit.

C. The ectopterygoid process is pronounced and a separation of it from the pterygoid is complete, thus forming a small anterior border of the infratemporal fenestra.

Epipterygoid.—paired bones (Fig. 3 and 6)

A. This pillar-shaped bone forms the anterolateral wall of the brain case. Articulation is with the pterygoid ventrally by means of a small depression and dorsally with an anteroverentral projection of the parietal. A prominent lateral ridge is visible for its entire length.

C. Relatively little difference is noted.

Exoccipital.—paired bones (Fig. 1, 2, 3, 4, 5, and 6)

A. The limits of this bone are difficult to determine as there has been an extensive amount of fusion. Articulation sutures with the opisthotic were not located. The opisthotic, therefore, has been included in this description. Jollie (1960) concurred that sutures were not observable and Dubois (1943) called a part of this bone the otocipital in Ctenidophorus. An extreme posterior projection of the exoccipital forms the lateral portion of the occipital condyle. Medially, it forms the posterolateral wall of the brain case. A large posterolateral paroccipital process extends to articulate with the tabular, parietal and quadrate. Ventral to the paroccipital process a portion of the membranous labyrinth is housed. The sutures separating the exoccipital from the prootic are not definite, but appear to be along the anterior margin of the paroccipital process. No young specimens were available in the collection to determine if this is but a function of age. The suture for articulation with the supraoccipital is lightly marked by a posterodorosulateral ridge extending from the foramen magnum anteriorly to the base of the parietal. Several foramina can also be noted on the posterolateral walls which include the foramen rotundum, two small hypoglossal foramina and the posterior border of the fenestra ovalis.

C. The paroccipital process articulates by means of a small cartilaginous projection with the post-romedial portion of the squamosal bone as well as articulating with the tabular, parietal, and quadrate. The suture lines for articulation with both the prootic and the supraoccipital bones are more distinct. The ridges denoting position of the semicircular canals are not as definite.
Fig. 1. *Ameiva undulata parva*. Dorsal view of skull. (6.2X)
Fig. 2. *Ameiva undulata parva*. Ventral view of skull. (6.2X)
Skull Bones

BO. ...... Basioccipital
BS. ...... Basisphenoid
EC. ...... Ectopterygoid
EO. ...... Exoccipital
EP. ...... Epipterygoid
FR. ...... Frontal
JU. ...... Jugal
LA. ...... Lacrimal
M. ...... Maxilla
N. ...... Nasal
OSP. ...... Os Palpabrae

PAL. ...... Palatine
PAR. ...... Parietal
PF. ...... Prefrontal
PM. ...... Premaxilla
PO. ...... Postorbital
POF. ...... Postorbital-postfrontal
PR. ...... Prootic
PT. ...... Pterygoid
QU. ...... Quadratojugal
RPS. ...... Rostral parasphenoid
S. ...... Squamosal
SM. ...... Septomaxilla
VO. ...... Vomer

Foramina of the Skull

EXN. ...... External nares
IN. ...... Internal nares
IOF. ...... Infraorbital foramen
ITF. ...... Infratemporal fenestra
NF. ...... Nasal foramen
OR. ...... Orbital fenestra
SIF. ...... Supraorbital foramen
STF. ...... Supratemporal fenestra
VOJ. ...... Vomero-nasal organ of Jacobson foramen

Fig. 3. *Ameiva undulata parva*. Lateral view of skull. (6.2X)
Fig. 4. *Cnemidophorus tigris septentrionalis*. Dorsal view of skull. (8.4X)
Fig. 5. *Cnemidophorus tigris septentrionalis*. Ventral view of skull. (8.4X)
Skull Bones

BO. . . . . . . . . . . . Basioccipital
BS. . . . . . . . . . . . Basisphenoid
EC. . . . . . . . . . . . Ectopterygoid
EO. . . . . . . . . . . . Exoccipital
EP. . . . . . . . . . . . Epipterygoid
FR. . . . . . . . . . . . Frontal
JU. . . . . . . . . . . . Jugal
LA. . . . . . . . . . . . Lacrimal
M. . . . . . . . . . . . . Maxilla
N. . . . . . . . . . . . . Nasal
OSP. . . . . . . . . . Os Palpabrae

PAL. . . . . . . . . . . . Palatine
PAR. . . . . . . . . . . . Parietal
PF. . . . . . . . . . . . . Prefrontal
PM. . . . . . . . . . . . . Premaxilla
PO. - POF. . . . . . . . Postorbital-postfrontal
PR. . . . . . . . . . . . . Prootic
PT. . . . . . . . . . . . . Pterygoid
QU. . . . . . . . . . . . . Quadratojugal
RPS. . . . . . . . . . . . . Rostral parasphenoid
S. . . . . . . . . . . . . Squamosal
SM. . . . . . . . . . . . . Septomaxilla
VO. . . . . . . . . . . . . Vomer

Foramina of the Skull

EXN. . . . . . . . . . . . External nares
IN. . . . . . . . . . . . . Internal nares
IOF. . . . . . . . . . . . . Infraorbital foramen
ITF. . . . . . . . . . . . . Infratemporal fenestra
NF. . . . . . . . . . . . . Nasal foramen
OR. . . . . . . . . . . . . Orbital fenestra
SLF. . . . . . . . . . . . . Supraorbital foramen
STF. . . . . . . . . . . . . Supratemporal fenestra
VOJ. . . . . . . . . . . . . Vomero-nasal organs of Jacobson

Fig. 6. *Cnemidophorus tigris septentrionalis*. Lateral view of skull. (8.4X)
C. The middle portion is much narrower with the entire infraorbital foramina appearing visible in a dorsal view. The ventral portion of the frontal is deeply grooved, with prominent anterior arches noted. Of the three anterior processes, the lateral two are slightly longer than the central median process.

Frontal. (Fig. 1 and 3)
A. The dorsal surface of this bone is very rugose, possessing deep indentations for overlying scutellation. The posterior margin is buttressed by the parietal and postero-laterally articulation occurs with the anterior projections of the postorbital-postfrontal. The ventral surface is convex medially, tending to flatten posteriorly when seen in cross section. When viewed dorsally, the middle portion appears to extend laterally to cover the medial borders of the infraorbital foramina. Laterally, the dorsal margin of the orbit is formed. In the anterior aspect, three processes are produced of which the middle is the longest and inserts between the two nasal bones. The lateral processes insert between the nasals and the prefrontals. Ventrally, the anterior portion is arched into ventral columns to allow passage for the olfactory tracts. No pineal foramen is present.

Jugal.—Paired bones (Fig. 1, 2, 3, 4, 5, and 6)
A. A long curved bone forming the ventrolateral margin of the orbit and the anterior margin of the infratemporal fenestra. Articulation posteriorly is with the ventral surface of the postorbital-postfrontal and ventrally a small projection articulates with the pterygoid posteriorly and the ectopterygoid anteriorly. The anterior-most border articulates with the lacrimal dorsally and the maxilla ventrally. A small spur is noted on the posterior margin of its ventral surface.
C. Ventrally, articulation is completely with the ectopterygoid and not with a portion of the pterygoid. No spur is noted on the posterior margin of the ventral surface.

Lacrimal.—Paired bones (Fig. 3, 4, and 6)
A. Found in the anteroventral portion of the orbit, this bone articulates posteriorly with the jugal, ventrally with the maxilla and dorsally with the prefrontal. In the anteromedial aspect the lacrimal duct is found, but no part of the palatine canal is formed.
C. The dorsal-most portion of the palatine canal is formed by the lacrimal.

Nasal.—Paired bones (Fig. 1, 3, 4, and 6)
A. The nasals form the anterodorsal portion of the rostrum and enter the extreme posterior border of the external nares. Posteriorly, separation is by the central process of the frontal. They then meet in the center for a short distance only to be separated anter-
iorly by the posterior projection of the premaxilla. Posterolaterally, articulation is with the prefrontal, being separated from it on the extreme posterior margin by the lateral process of the frontal. Ventrally the dorsal surface of the nasal canal is formed and the dorsal surface is perforated by several irregularly spaced nasal foramina.

C. The central union of the two nasals is much longer and the nasal foramina seemingly are more regularly placed as well as having a larger posterior border where the external nares are formed.

Os palpebrae.—Paired bones (Fig. 1 and 3)
A. This is a small triangular ossified bone in the anterodorsal border of the orbit which articulates entirely with the prefrontal.
C. The os palpebrae is not present as an ossified structure.

Palatine.—Paired bones (Fig. 2 and 5)
A. The palatine articulates posteriorly with the pterygoid and anteriorly with the ectopterygoid and maxilla. The anterior-most articulation is with the vomer and then a central union is formed beneath two strong ridges of the primary palate with the other palatine. A strongly developed depression marks the dorsal and lateral surfaces of the nasal canal and internal nares. The medial border of the palatine canal is also formed.
C. The anterior medial processes are also joined beneath two strong ridges of the primary palate contrary to the findings of Dubois (1943).

Parietal. (Fig. 1, 3, 4, and 6)
A. The parietal is a rugose bone with deep indentations indicating overlying scutellation and is roughly rectangular in shape. Two large posterior projections form the parietal arch and articulate with the tabular, squamosal, and the paroccipital processes of the exoccipital. Anterolaterally, articulation is with the postorbital-postfrontal and the remainder of the anterior border buttresses the frontal. Large ventrolateral flanges deflect downward to enclose the postero-dorsal portion of the brain and articulate with the supraoccipital, exoccipital, and the epityporygoid. Ventrally, there is no central ridge, but the posterior central margin contains a deep indentation which may hold a remnant of the syntotic tectum of the chondrocranium.

C. A small median ridge is present on the ventral aspect of this bone which may partially fill the area of the central fissure of the brain. The dorsal surface is only lightly rugose posteriorly with the anterior portion essentially glabrous.

Postorbital-postfrontal.—Paired bones (Fig. 1, 2, 3, 4, 5, and 6)
A. The postorbital and postfrontal of most
saurians appear to have fused into one bone, although there is a light fusion line marked on the dorsal median surface. This bone divides the orbit from the supratemporal fenestra and also has a posterior projection which forms part of the temporal arch dividing the supratemporal fenestra from the infratemporal fenestra. Dorsally, articulation is anteriorly with the frontal and posteriorly with the parietal. Ventrally, articulation is anteriorly with the jugal and posteriorly with the squamosal. A small flange is observable in the anterior central position.

C. The postorbital and postfrontal are completely fused with no evidence of suture lines. No small flange is observable in the anterior central position.

Prefrontal.—paired bones (Fig. 1, 3, 4, and 6)

A. The prefrontal lies anterolateral to the frontal and articulates with its posterodorsal surface. Anteromedially, articulation is with the nasals and laterally with the maxilla. Posterodorsally, articulation is with the os palpebrae. A small posteroventral projection contacts the lacrimal and ventrally this projection then articulates with the palate. The posteroventral aspect forms a portion of the lacrimal duct.

C. A small posteroventral projection forms the dorsal portion of the palatine canal. There is no os palpebrae to articulate with the posterodorsal border.

Premaxilla. (Fig. 1, 2, 3, 4, 5, and 6)

A. The anterior-most bone of the skull, the premaxilla, inserts dorsally between the nasals for a short distance posteriorly. Medially it is broad and ventrally articulation is with the vomer and with the maxilla ventrolaterally. The dorsolateral margins form the medial border of the external nare and the nasal canal. The ventral surface bears 10 peglike pleurodont teeth.

C. The posterior projection extends a shorter distance between the nasals. On the ventral surface, 8 peglike pleurodont teeth are borne. Medially the bone is rather narrow and less massive than in A.

Prootic.—paired bones (Fig. 3 and 6)

A. The position of the prootic is highly indeterminate since most of the suture lines are indefinite. This bone forms part of the posteroventral lateral wall of the brain case and encloses the area of the anterior semicircular canal. Posteriorly, the anterior border of the fenestra ovalis is formed and anterodorsally a well developed ridge then proceeds to the base of the basipterygoid process. Dorsally and anteriorly articulation is with the parietal and posteriorly with the supraoccipital and exoccipitals. Ventrally and posteriorly the basiocipital and anteriorly the basiaphyseal meet. The central portion is dominated by a lateral flange anterior to the fenestra ovalis.

C. The suture lines are more readily definable, but the positioning of the semicircular canals is more difficult to determine because the external ridges are less pronounced in the bone.

Pterygoid.—paired bones (Fig. 1, 2, 3, 4, 5, and 6)

A. A “Y” shaped bone on the ventral surface of the skull, the pterygoid articulates posteriorly with the quadrate and anteriorly with the palatine medially and the ektpterygoid laterally. The central portion forms the posterior border of the infraorbital foramen. Ventrally, articulation is with the basipterygoid process which fits into an oblique groove on the ventral surface; on the dorsal surface directly opposite the basipterygoid process, the epipterygoid articulates in a small depression. The posteromedial margin is expanded into a knifelike ridge extending horizontally to the posterior end. Teeth are not present on the anteromedial portion. The lateral border, along most of its length, forms the medial edge of the infratemporal fenestra. The rostral parasphenoid rises dorsally between the pterygoids.

C. The anteromedial margin contains five pterygoid teeth. (Dubois, 1943, reported three on the pterygoid of C. sexlineatus.) The posteromedial margin is less expanded and the central gap between the two pterygoids is wider at the posterior margins.

Quadrate.—paired bones (Fig. 1, 2, 3, 4, 5, and 6)

A. The quadrate articulates with the articular of the lower jaw. The articulation is on cartilaginous pads thus allowing for greater jaw expansion. In the medial area, articulation is with the pterygoid posteriorly and anteriorly with the squamosal, tabular and paroccipital process of the exoccipital. The lateral border is expanded into a slightly recurved tympanic crest and the medial border also forms a small crest for loose articulation with the prootic. The union of the posterior margins of these two crests forms the seat of the middle ear.

C. The tympanic crest is not as greatly expanded laterally, but is highly recurved, thus forming an anterior tympanic recess.

Parasphenoid. (Fig. 2, 3, 5, and 6)

A. This is a long pointed foil-like projection proceeding anterodorsally from a fused position with the basiaphyseal, between the two pterygoids, and rests beneath the lower surface of the brain. The parasphenoid is considered a separate element from the basiaphyseal as its identity has been established embryologically, structurally, and paleontologically (Dubois, 1943).

C. Relatively little difference is noted.

Septomaxilla. Fig. 3 and 6)

A. The septomaxilla is a thin plate extending from the vomer posterolaterally to the ventral margin of the maxilla with a small projection extending
anteriorly into the nasal canal.

C. Relatively little difference is noted.

Squamosal.—paired bones (Fig. 1, 2, 3, 4, 5, and 6)

A. The squamosal is a relatively simple bone flared posteriorly to articulate with the parietal, tabular, and narrowly with the quadrate. It forms the posterior half of the temporal arch separating the supratemporal fenestra from the infratemporal fenestra and articulates anteriorly with the postorbital-postfrontal.

C. Relatively little difference is noted.

Supraoccipital. (Fig. 1 and 4)

A. Posteriorly, the supraoccipital forms the dorsal margin of the foramen magnum and anteriorly articulates with the parietal. Centrally, a ridge divides the bone into left and right halves. The lateral sutures with the exoccipital and the prootic are not distinct except for a small ridge which proceeds anterodorsally from the paroccipital process of the exoccipital dividing the supraoccipital from the prootic. The posterior end of the anterior semicircular canal and the medial end of the posterior semicircular canal enter anteriorly and unite.

C. The central ridge is not sharp, but the suture lines for the exoccipital and prootic are definable.

Tabular.—paired bones (Fig. 1, 3, 4, and 6)

A. Posteriorly, the tabular inserts between the squamosal, quadrate, paroccipital process of the exoccipital and the posterior end of the parietal. Anteriorly, a small projection is sent forward along the ventral margin of the parietal arch for a short distance.

C. Relatively little difference is noted.

Prevomer.—paired bones (Fig. 2 and 5)

A. Medially, the prevomers exist as paired elements of the central anteroventral surface of the skull, joining the palatine posteriorly and anteriorly the maxilla and premaxilla on the ventral surface and the septomaxilla on the dorsal surface. Small foramina on the anterolateral edge mark the position of the vomeronasal organs of Jacobson and connect them with the nasal canal. Posterolaterally, the medial border of the nasal canal and external nares is formed. A small medial groove beginning centrally and proceeding posteriorly holds the beginning of what appears to be a cartilaginous support for the rostral paraphenoid.

C. Relatively little difference is noted.

Lower Jaw

A. The lower jaw is united anteriorly by a mental symphysis and posteriorly articulates with the quadrate. Each ramus is composed of six bones: the angular, articular, coronoid, dentary, splenial and surangular. The articular makes almost a right angle with the angular, the anterior end of each ramus has a distinct lateral torsion (Fig. 7c), and the ventral surface is rugose. The dentary of each ramus bears a single row of pleurodont teeth, whereas the remaining bones are edentate. The prearticular is fused to the articular in the adult and will not by considered in this report as a separate element of the ramus.

C. The articular and the angular are essentially in a straight line. No lateral torsion is seen in the anterior end of the ramus (Fig. 8c). The ventral surface of the ramus is essentially glabrous.

Angular. (Fig. 7 and 8)

A. The angular is positioned at the posteroventral angle of the lower jaw. It articulates at almost right angles dorsomedially with the articular. Dorsolateral articulation is with the surangular. The element then extends forward where anterolateral articulation is with the dentary and anteromedial articulation is with the splenial. One small foramen, the angular foramen, is located on the medial surface.

C. The articulation of the angular and the articular is essentially a straight line.

Articular. (Fig. 7 and 8)

A. This is the posterior-most bone of the ramus. Fusion with the prearticular is so complete that separate elements are not detectable in the adult. The articulating surface for the quadrates on the anterodorsal margin is somewhat fused with the surangular so that suture lines are determined only with difficulty. The retroarticular process of the posterior edge is winglike and extends medially in the horizontal plane. Posteriorly, articulation is with the sur-angular dorsally and the angular ventrally. The element then extends forward along the medial surface to meet the ventromedial surface of the coronoid. There is articulation with the extreme posterior extension of the dentary and also the splenial. The inner aspect forms the posteromedial border of the large mandibular foramen.

C. The suture line between this bone and the surangular is more distinct. The retroarticular process extends in a ventrally projecting oblique plane.

Coronoid. (Fig. 7 and 8)

A. The coronoid is the central bone of the ramus, articulating posteriorly with the articular medially and the surangular laterally and forming posterocentrally and the anterior border of the mandibular foramen. Anteriorly, articulation is with the splenial and the dentary. On the medial surface an arch over a small posterior extension of the dentary is formed as well as a large coronoid process dorsally.

C. The coronoid process is much sharper and possesses a small posteriorly directed hook.
A. Lateral view.
B. Medial view.
C. Dorsal view.

Foramina of the Lower Jaw
AF. Angular foramen
MAF. Mandibular foramen
MF. Mental foramen
SAF. Surangular foramen
SF. Splenial foramen

Lower Jaw Bones
A. Angular
AR. Articular
CP. Coronoid
D. Dentary
SA. Surangular
SP. Splenial

Fig. 7. *Ameiva undulata parva*. Lower Jaw. (4.9X)
Foramina of the Lower Jaw

A. Angular foramen
B. Mandibular foramen
C. Mental foramen
D. Splenial foramen
E. Surangular foramen

Lower Jaw Bones

A. Angular
B. Articular
C. Coronoid
D. Surangular
E. Dentary
F. Splenial

Cnemidophorus tigris septentrionalis. Lower Jaw. (7.5X)
Dentary. (Fig. 7 and 8)

A. The dentary is the tooth-bearing bone and comprises the entire anterior half of each ramus. Union is made anteriorly by means of a mandibular symphysis with the dentary of the other ramus. Articulation is medially with the splenial, dorsally with the coronoid, posteriorly with the angular and postero-dorsally by means of a projection with the surangular. A dorsal projection proceeds posteriorly beneath the anterior process of the coronoid and unites with the coronoid arch with the articular. On the dorsal surface, there are 23 to 24 pleurodont teeth. Beneath the splenial on the medial surface, the Sulcus Cartilaginis Meckelii is found with a small Meckel's groove proceeding anterior to this sulcus to the mandibular symphysis. On the anterolateral surface, approximately six irregularly placed mental foramina are located.

C. The Meckel's groove proceeding anterior from the Sulcus Cartilaginis Meckelii to the mandibular symphysis is more ventrally placed and there are eight fairly evenly spaced mental foramina found along the lateral surface.

Splenial. (Fig. 7 and 8)

A. The splenial is found entirely on the medial surface of the ramus and articulates anteriorly with the dentary along most of its length. Posteriorly, articulation proceeds from dorsal to ventral with the coronoid, articular, and angular. One large foramen and one or perhaps two small splenial foramina are evident. This bone covers the area of the Sulcus Cartilaginis Meckelii.

C. Relatively little difference is noted.

Surangular. (Fig. 7 and 8)

A. The surangular forms the posterolateral wall of the ramus and articulates anteriorly from dorsal to ventral with the coronoid, dentary, and angular. The angular then proceeds along the ventral surface to the posterior end where articulation is with the articular. There are one large and two to six small surangular foramina found along the upper half of the bone. The surangular forms the lateral wall of the mandibular foramen.

C. There are only two foramina, one large and one small, located in the surangular.

Foramina of the Skull and Lower Jaw

In all cases, the foramina are considered comparatively in alphabetical order and positioning of margining elements is from anterior to posterior, from dorsal to ventral, or lateral to medial as the case applies.

Angular Foramen. (Fig. 7 and 8)

A. The angular foramen is located entirely within the angular.

C. No difference.

External nares. (Fig. 1, 3, 4, and 6)

A. The external naris is surrounded by the premaxilla, nasal, and maxilla and is found at the anterior end of the rostrum.

C. No difference.

Foramen magnum. (Not Figured)

A. The foramen magnum is the posterior-most foramen of the skull. It is bounded by the supraoccipital, occipitals, and basioccipital. The lower border forms a tripartite occipital condyle composed of a medial projection from each exoccipital and ventrally from a posterior projection of the basioccipital.

C. No difference.

Fenestra ovalis. (Not figured)

A. The fenestra ovalis is formed by the prootic and exoccipital bones and lies anterior to the paroccipital process.

C. No difference.

Fenestra Rotundum. (Not figured)

A. The fenestra rotundum is formed by the prootic and exoccipital and lies ventral to the fenestra ovalis.

C. No difference.

Hypoglossal foramen. (Not figured)

A. The hypoglossal foramen is found on the posteroventral side of the skull lateral to the occipital condyles and entirely within the exoccipital.

C. No difference.

Internal nares. (Fig. 2 and 5)

A. The internal nares are in the anteroventral surface of the skull and are surrounded by the maxilla, palatine, and vomer. They form directly posterior to the vomeromastals organs of Jacobson.

C. No difference.

Infraorbital foramen. (Fig. 1, 3, 4, and 6)

A. The infraorbital foramen is surrounded by the palatine, ectopterygoid, and pterygoid and lie on the anteroventral surface of the skull posterior to the internal nares.

C. No difference.

Infratemporal fenestra. (Fig. 3 and 6)

A. This is the large fenestra of the posterolateral margin of the skull. The edges are formed by the jugal, postorbital-postfrontal, squamosal, pterygoid, and quadrate bones.

C. The ectopterygoid bone enters the anterolateral margin.
Lacrimal foramen. (Not figured)
A. The lacrimal foramen is formed from the lacrimal and prefrontal to allow passage of the lacrimal canal.
C. No difference.

Mandibular foramen. (Fig. 7 and 8)
A. This is the large foramen of the posterodorsal surface of each ramus. It is formed from the coronoid, surangular, and articular.
C. No difference.

Mental foramina. (Fig. 7 and 8)
A. There are six irregularly spaced foramina of the lateral surface of each dentary bone.
C. There are usually eight regularly spaced foramina on each dentary bone.

Nasal foramina. (Fig. 8)
A. Usually, 0-1 foramen are found in the anterior end of the nasal.
C. Usually, 1-2 foramina are contained in the nasal bone.

Orbital fenestra. (Fig. 1, 2, 3, 4, 5, and 6)
A. The orbital fenestra is located dorsally in the central portion of the skull and is formed by the prefrontal, os palpebrae, frontal, postorbital-postfrontal, lacrimal, and jugal.
C. No os palpebrae is found on the anteriomedial border.

Palatine canal. (Not figured)
A. Located ventral to the lacrimal foramen, this canal is formed by the lacrimal, palatine maxilla, and pterygoid. A small arch exists internally which appears to belong entirely to the maxilla. (Definite determination necessitates sectioning.)
C. A lateral projection of the prefrontal enters the margin of the canal.

Splenic foramina. (Fig. 7 and 8)
A. Located entirely within the splenial are two foramina, one large and one small.
C. There are three foramina, one large and usually two small, all within the splenial

Surangular foramina. (Fig. 7 and 8)
A. Several foramina occur along the dorsal portion of the surangular bones. These usually consist of one large and 2-6 small foramina.
C. Normally only one large foramen and one small foramen are found in the surangular.

Supralabial Foramina. (Fig. 3 and 6)
A. The supralabial foramina consist of approximately six small regularly spaced foramina on the lateral margin of the maxilla, positioned directly beneath the supralabial scales.
C. The foramina are usually irregularly spaced and number four or five on each side.

Supratemporal fenestra. (Fig. 1, 2, 4, and 5)
A. This is the large posterodorsal fenestra of the skull and is formed by the squamosal, parietal and tabular.
C. No difference.

Vomeronal foramina. (Fig. 2 and 5)
A. The vomeronasal foramina are small, usually three in number, and lie on the anterolateral surface of the skull on each side of the midline. Housed in the vomer and bordered by the maxilla, they serve for olfactory entrants by the tongue to the vomeronasal organs located within the nasal canal.
C. No difference.

Teeth

Dentary teeth. (Fig. 9a and 9c)
A. The teeth are of pleurodont type with succession occurring throughout life by receiving replacement teeth which project into the base of the hollow, thinwalled old tooth. There are 22-23 teeth with the first 5 containing no accessory cusps. Beginning about tooth 6, there is a small anterior accessory cusp and, about tooth 9, a posterior accessory cusp. Both of these accessory cusps continue posteriorly to the last tooth.
C. The teeth also number 22-23, but only the first 4 are peglike (without accessory cusps). Beginning with tooth 5, a small anterior accessory cusp occurs and at tooth 20, the posterior accessory cusp is added.

Maxillary and Premaxillary teeth. (Fig. 9b and 9d)
A. The teeth of the premaxilla and maxilla are of the same type as those of the dentary. Only the lateral four of the premaxilla are figured. The premaxilla bears 10 peglike teeth, the maxilla 18-21 teeth. The first maxillary tooth is peglike, but the second (6 in the figure) has an anterior accessory cusp. The third (7 in the figure) contains a posterior accessory cusp and both cusps are retained posteriorly to the last tooth (23 in the figure).
C. There are 8 peglike teeth on the premaxilla. The first tooth of the maxilla (5 in the figure) bears an anterior accessory cusp and the sixteenth (20 in the figure) adds a posterior accessory cusp. The last tooth (22 in the figure) may or may not possess the posterior accessory cusp.

Pterygoid teeth. (Fig. 93)
A. No pterygoid teeth were found.
C. There are five small peglike teeth occurring medially in the central portion of the pterygoid.
A. Dentary teeth. (7.0X)
B. Maxillary and Premaxillary teeth. (5.8X)
*Cnemidophorus tigris septentrionalis*. Teeth.
C. Dentary teeth. (11.0X)
D. Maxillary and Premaxillary teeth. (9.7X)
E. Pterygoid teeth. (20.0X)

Fig. 9. *Ameiva undulata parva*. Teeth.
Wrist

The wrist of most teids seems to consist of 8 or 9 carpal bones including carpals 1-5, a radiale, a proximal central, an ulnare, and an intermedium which may or may not be present. Each of the separate elements is fully described by Avery and Tanner (1964), so the discussion is here limited to the highly variable member of the carpal elements for the family Teiidae— the intermedium.

Stokely (1950) indicated that although this bone is highly characteristic of the lower tetrapods, particularly the amphibians, extinct reptiles and turtles, its presence is highly variable in several saurian families. One of these is the family Teiidae. He found the intermedium absent in Cnemidophorus perplexus, C. melanostethus, Ameiva amea praesignis, Bachia intermedia, and Ophiogomnon abendlusti; but present in Cnemidophorus gularis, C. hypratherus beldingi, and C. t. tessellatus. This extended the list of Camp (1923) for the family Teiidae which included an intermedium in Tupinambis nigropunctatus, Tejus teguiixin and Ameiva vulgaris.

Because of the apparent differences within the genus Ameiva and the genus Cnemidophorus, those specimens of these two genera accessioned in the Vertebrae Natural History Museum at Brigham Young University were X-rayed and the radiographs carefully studied by means of a slide projector with the following results obtained for the specific individual specimens studied: 1. Intermediate present in C. c. communus, C. burti, C. seclineatus, A. u. parva, A. u. hartwigi, and A. u. sinistra. 2. Intermediate absent in C. t. tigris, C. t. septentrionalis, C. gularis, and A. auberti. 3. The presence of the intermedium is questionable in C. t. gracilis, C. t. canus, C. t. aethiops, C. exsanguis, C. d. deppei, C. l. lineatissimus, C. hypotherus, and C. lemniscatus.

MYOLOGY

The determination of muscles and the naming of them according to priority is difficult in the reptiles because of extreme variability as well as a lack of agreement upon homologies. For the most part, names were here chosen which were of the oldest origin as long as the muscle fit the general description of the original author. Where this was not possible, descriptive terminology for naming was applied. The deep skull musculature is not described here because Poglayen-Neuwall (1954) has a very detailed account of greater accuracy than was possible with the technique used in this report. These muscles include the levator bulbi dorsalis, levator bulbi ventralis, levator pterygoidei, protractor pterygoidei, pseudotemporalis profundus, and pseudotemporalis superficialis (Poglayen-Neuwall, 1954: Figs. 16, 9B).

Muscles are named in alphabetical order rather than by groupings into body areas in order to facilitate cross-reference with the figures. Comparative descriptions are listed the same as in the osteology section with A. indicating the five specimens of Ameiva undulata parva and “C.” representing the six specimens of Cnemidophorus tigris septentrionalis observed.

M. Adductor Mandibulae Externus Medius. (Fig. 10, 16, and 17) Poglayen-Neuwall (1954).

A. The fibers of this muscle originate from the medial surface of the squamosal, the posterolateral parietal projection, the dorsolateral beveled surface of the parietal, and from the anterior and dorsal surfaces of the quadrate. The fibers extend anteroventrally with the dorsal ones more anteriorly directed. The insertion is along the dorsomedial surface of the surangular and the posterior surface of the coronoid. The body of the muscle fills the supratemporal fenestra and lies immediately medial to the adductor mandibularis externus superficialis and dorsolateral to the adductor mandibularis externus profundus from which it is only faintly separable.

C. Little difference is noted.

M. Adductor Mandibulae Externus Profundus. (Fig. 17 and 18) Poglayen-Neuwall (1954).

A. The muscle originates from almost the entire postero medial border of the posterolateral projection of the parietal, from the paroccipital process of the exoccipital and from the dorsolateral surface of the posterior process of the prootic. The muscle then turns ventrally to enter the infratemporal fenestra and insert on the posterior surface of the coronoid. The muscle mass is not clearly separable from the adductor mandibularis externus medius in the dorsolateral position.

C. Little difference is noted.

M. Adductor Mandibularis Externus Superficialis. (Fig. 10, 16, 17) Poglayen-Neuwall (1954).

A. The origin is from the ventral surfaces of the postorbital-postfrontal, squamosal, a portion of the jugal and from the dorsal and anterior surface of the tympanic crest. The fibers of the muscle then extend anteroventrally to insert along the depressed lateral surface of the surangular with the more anterior fibers inserting on the lateral and posterolateral surfaces of the coronoid and the lateral surface of the angular. The body of the muscle fills the greater portion of the infratemporal fenestra with the medial portion scarcely distinguishable from the adductor mandibularis externus medius.

C. Little difference is noted.

M. Adductor Mandibularis Posterior. (Fig. 17 and 18) Poglayen-Neuwall (1954).
A. Superficial depth.
B. First depth.

Fig. 10. Ameiva undulata parva. Musculature dorsal view. (2.9X)
A. Second depth.
B. Third depth.

Fig. 11. *Ameiva undulata parva*. Musculature dorsal view. (2.9X)
SPINALIS CAPITUS
HYOGLOSSUS
M. ESOPHAGUS
SERRATUS DORSALIS
STERNOCORACOID. INF.
PROSCAPULOHUMERALIS
INTERCOSTALIS EXT.
LONGISSIMUS
CERATOHYOIDES
ILIACOSTALIS
STERNOCORACOID SUP.
INTERCOSTALIS INT.

A. Fourth depth.
B. Fifth depth.

Fig. 12. *Ameiva undulata parva*. Musculature dorsal view. (2.9X)
Fig. 13. *Ameiva undulata parva*. Musculature ventral view. (2.9X)
A. Second depth.
B. Third depth.

Fig. 14. *Ameiva undulata parva*. Musculature ventral view. (2.9X)
A. Fourth depth.
B. Fifth depth.

Fig. 15. *Ameiva undulata parva*. Musculature ventral view. (2.9X)
First depth.

Fig. 16. *Ameiva undulata parva*. Musculature lateral view. (2.9X)
Second depth.

Fig. 17.  *Ameiva undulata parva*. Musculature lateral view. (2.9X)
Third depth.

Fig. 18. *Ameiva undulata parva*. Musculature lateral view. (2.9X)
Fourth depth.

Fig. 19.  *Ameiva undulata parva*. Musculature lateral view. (2.9X)
Fig. 20. *Ameiva undulata parva*. Musculature lateral view. (2.9X)
A. Some of the fibers of this muscle arise from the lateral and medial surfaces of an aponeurosis which extends along the medial crest of the quadrate, whereas the other fibers originate from the posterior process of the prootic. The fibers all pass anterovertrally and insert on the dorsal surface of the articular. The body of the muscle is thin and lies lateral to the tympanic cavity and medial to the mandible and the adductor mandibularis externus.

C. Little difference is noted.

M. Biceps Brachii. (Fig. 10, 11, 13, 14, 16, 17, and 18) Howell (1936).
A. The fibers of this muscle arise near the proximal head of the humerus on the posterior edge of the scapulae, form a long, broad tendon, and pass along the ventral surface of the humerus to insert on the proximal head of the radius.

C. Little difference is noted.

M. Ceratothyoideus. (Fig. 12 and 15) Gnanamuthu (1937).
A. This is a thin muscle which proceeds between ceratobranchial 1 and ceratobranchial 2. Dorsally, it contacts the oral membrane and lies dorsal to the hyoglossus.

C. Little difference is noted.

M. Cervicomandibularis. (Fig. 10 and 13) Camp (1923).
A. The fibers of this muscle extend from the middorsal fascia to the midventral raphe proceeding posterior to the external auditory meatus and superficial to the pterygomandibularis and the majority of throat muscles. It lies just internal to the skin, and posteriorly the muscle is separated from the constrictor colli by a narrow area of aponeurosis lacking muscle fibers.

C. The division between the cervicomandibularis and the constrictor colli dorsally is less distinct with an anteroventral extension proceeding almost to the center of the dentary and covers most of the geniohyoid and some of the mylohyoideus complex.

M. Constrictor Colli. (Fig. 10 and 13) Camp (1923)
A. The muscle is the most superficial of the cervical and thorax region, arising from the superficial dorsolateral fascia of the neck and passing ventrally to insert on the extensive ventral raphe. It is internal only to the connective tissue of the skin and a few scattered fat pads. It is superficial to the depressor mandibulae and the sternocleidomastoid dorsally and ventrally it overlies the sternohyoideus, omohyoideus and a portion of the deltoideus.

C. The extent of the constrictor colli is more difficult to determine dorsally as it is somewhat fused with the cervicomandibularis.

M. Coracohumerals. (Fig. 13 and 14) Howell (1936).
A. This is a short muscle arising from the anterior margin of the scapulae slightly dorsal to the biceps brachii and inserting mostly under cover of the deltoideus and the pectoralis on the proximal end of the humerus.

C. Little difference is noted.

M. Deltoideus. (Fig. 10, 13, 14, 16, and 17) Howell (1936).
A. The origin of the deltoideus is at the inner margin of the ventral two-thirds of the clavicle with fibers fusing at the insertion with those of the dorsalis scapulae and attaching upon the lateral portion of the proximal end of the humerus.

C. Little difference is noted.

M. Depressor Mandibulæ. (Fig. 10, 16, and 18) Poglayen-Neuwall (1954).
A. The depressor mandibulæ originates on the middorsal fascia in the area of the cervical vertebrae 1-5 and inserts on the posterior end of the retroarticular process of the articular. The body of the muscle lies on the lateral surfaces of the cervical region and borders the auditory meatus anteriorly and in this area is superficial to some of the posterior fibers of the adductor mandibularis externus medius and posterior border of the tympanum. Posteriorly, it passes superficial to the anterior fibers of the trapézius and the sternocleidomastoideus. The cervico mandibularis and constrictor colli overlie most of the body of the muscle.

C. Little difference is noted.

M. Dorsalis Scapulae. (Fig. 10, 11, 16, 17, and 18) Howell (1936).
A. The dorsalis scapulae originates along an oblique line extending from a point near the dorso-caudal portion of the suprascapula to the clavicle. Origin is both from the dorsal portion of the clavicle and the dorsal margin of the girdle. The insertion is fused with that of the deltoid and attachment is upon the lateral portion of the proximal end of the humerus. The body of the muscle is deep to the trapézius and superficial to the serratus ventralis complex and the proscapulohumeralis. A part of the origin is covered by the latissimus dorsi.

C. Little difference is noted.

M. Genioglossus. (Not figured) Camp (1923).
A. This is a small muscle originating deep to the insertion of the mylohyoideus anterior on the medial surface of the dentary. It inserts into the ventral anterolateral portion of the tongue.

C. Little difference is noted.

M. Geniohyoideus. (Fig. 13, 16, and 18) Camp (1923).
A. The origin of the geniohyoideus is along the anterior margin of ceratobranchial 2 of the hyoid
apparatus and inserting in five slips along the medial surface of the dentary. The medial edge is continuous with most of the processus etoglossus which is the medial anterior projection of the hyoid apparatus (Fig. 15). The body of the muscle is superficial to the mandibulohyoideus complex, a greater portion of the ventral surface of the pterygomandibularis, the styloglossus and hyoglossus. It is deep to the mylohyoideus complex and the cervicomandibularis.

C. The insertion is by three slips with the anterior portion continuously in contact with the posterior one-third of the processus etoglossus.

M. Humerotriceps Lateralis. (Fig. 10, 11, 13, 14, 16, and 17) Howell (1936).

A. A muscle of the laterocentral surface of the humerus, the humerotriceps lateralis has its origin on the head of the humerus with fibers running distally to insert on the olecranon process of the ulna.

C. No difference is noted.

M. Humerotriceps Medialis. (Not figured) Howell (1936)

A. This is a muscle of the mediocentral surface of the humerus with its origin on the medial side of the humeral head and extending along the entire shaft of the humerus to insert on the olecranon process of the ulna.

C. No difference is noted.

M. Hyoglossus. (Fig. 11, 12, 14, 15, 17, 19) Oelrich (1956).

A. The hyoglossus originates on the posterior portion of ceratobranchial 2 of the hyoid apparatus and forms the body of the tongue. It is a thick broad muscle lying lateral to the ceratobranchial 2 and medial to the mandibulohyoideus III and the pterygomandibularis and is deep to the mandibulohyoideus I and II, the styloglossus and the geniohyoideus. It is superficial to the ceratohyoideus and the esophagus.

C. Little difference is noted.

M. Iliocostalis. (Fig. 12, 15, 18, 19, and 20) George (1948).

A. The iliocostalis takes a multiple origin from the ilium and fascia of the longissimus with some insertion on the anterior ribs. The anterior insertions, however, are on the atlas vertebra and the occipital region of the skull. The body of the muscle lies ventrolateral to the longissimus and dorsal to the longus colli.

C. Little difference is noted.

M. Intercostalis Externus. (Fig. 11, 12, 14, 15, 17, 18, and 19) Smith (1960).

A. The fibers of the intercostalis externus originate on the ribs and extend posteriorly to insert on the next posterior rib. It is deep to the obliquus abdominus externus, the serratus complex and the levator scapulae complex. It is superficial to the intercostalis internus and transversus thoracis.

C. Little difference is noted.

M. Intercostalis Internus. (Fig. 12, 15, 19, and 20) Smith (1960).

A. The origin of the intercostalis internus is on the ribs with the fibers extending ventrally and slightly anteriorly to insert on the next anterior rib or the sternal portion of the same rib. It is deep to the intercostalis externus and superficial to the transversus thoracis.

C. Little difference is noted.

M. Laryngi. (Fig. 15 and 20) Smith (1960).

A. Muscles of the larynx are small and complex with complete dissection difficult with the technique used in this report. They are here considered as one group of muscles surrounding the laryngeal cartilages. Homologies within the vertebrates need to be determined before the individual muscles of the larynx will be of significance.

C. Little difference is noted.

M. Latissimus dorsi. (Fig. 10 and 16) Howell (1936).

A. The latissimus dorsi originates in the thoracic region of the middorsal fascia with its anterior fibers running posterovertrally and its posterior ones anterovertrally to insert near the origin of the scapulotriiceps of the brachium onto the proximal end of the humerus. It is a sheetlike muscle which covers an extensive portion of the lateral body surface, having anterodorsal fibers deep to the trapezius while the remaining ones are deep only to the skin. It is superficial to the serratus ventralis superficialis and a portion of the dorsalis scapulae.

C. Little difference is noted.

M. Levator Scapulae Profundus. (Fig. 11, 14, 16, 17, and 18) Howell (1936).

A. This muscle originates from the transverse process of the atlas and inserts on the ventral one-third of the anterior border of the suprascapulae. It is a ventral partner to the levator scapulae superficialis and lies in approximately the same position with relation to the surrounding muscles.

C. Little difference is noted.

M. Levator Scapulae Superficialis. (Fig. 10, 11, 14, 16, 17, and 18) Howell (1936).

A. The muscle originates by means of a tendon in common with the levator scapulae profundus from the transverse process of the atlas and extends postero-dorsally to insert on the dorsal two-thirds of the anterior border of the suprascapula. It is a broad, fan-shaped muscle which lies dorsal to the levator scapulae profundus and superficial to the axial mus-
cultura and the posterodorsal fibers of the iliocostalis. The body of this muscle is deep to the constrictor colli, the trapezius and the posterior portion of the depressor mandibulae.

C. Little difference is noted.

M. Longus Colli. (Fig. 15, 19, and 20) Smith (1960).
A. This is the most ventral of the deep neck muscles originating on the centra of the first thoracic vertebrae and inserting on the lower portion of the centra of each of the cervicel vertebrae.
C. Little difference is noted.

M. Longissimus. (Fig. 11, 12, 17, 18, 19, and 20) George (1948).
A. The longissimus originates from the ilium, sacrum, and the neural arches; from these it proceeds anteriorly to insert on part of the neural arches of the anterior vertebrae and on part of the skull at the junction between the parietal, supraoccipital, and a small portion of the parocipital process of the exoccipital.
C. Little difference is noted.

M. Mandibulohyoideus I. (Fig. 14) Oelrich (1956).
A. This is a slightly triangular muscle originating on the central portion of the denticate and extending two-thirds the length of the ramus to insert on the ceratohyal. It lies medial to the mandibulohyoideus II, extending deep to the cervicomandibularis and superficial to the styloglossus, hyoglossus, and mandibulohyoideus III.
C. Little difference is noted.

M. Mandibulohyoideus II. (Fig. 14) Oelrich (1956).
A. This is a short pointed muscle which originates on a posterior portion of the denticate and inserts on the anterior portion of the ceratohyal. It lies lateral to the mandibulohyoideus I and medial to the mandibulohyoideus III, running deep to the cervicomandibularis and superficial to the tongue, styloglossus and the hyoglossus. The body of the muscle is approximately the same width as the mandibulohyoideus I.
C. The muscle is much reduced in width to about one-half that of the mandibulohyoideus I.

M. Mandibulohyoideus III. (Fig. 14) Oelrich (1956).
A. This is a flat sheet of muscle originating on the posterior-most portion of the denticate and a small portion of the angular with its insertion on the ceratobranchial. It extends almost parallel to the mandibular ramus across the mass of the pterygomandibularis and is more or less attached to it by connective tissues. The body of the muscle is deep to the mandibulohyoideus and geniohyoideus, but is superficial to the styloglossus, hyoglossus and cerato-
hyoideus at its posterior end.
C. Little difference is noted.

M. Mylohyoideus Anterior. (Fig. 13) Camp (1923).
A. The mylohyoideus anterior is a small strip of muscle extending anterolaterally on the ventral surface of the throat, originating on the midventral raphe and inserting between the genioglossus and the geniohyoid onto the medial surface of the dentary.
C. This is the most prominent portion of the mylohyoideus and makes a definite division between the genioglossus and the geniohyoid.

M. Mylohyoideus Posterior. (Fig. 13) Camp (1923)
A. The mylohyoideus posterior originates on the midventral raphe just posterior to the mylohyoideus anterior and immediately breaks into 9 separate divisions (4 prominent and 5 minor) which insert by interdigitation with slips of the geniohyoideus. The most posterior of the divisions is partially covered by the cervicomandibularis.
C. The muscle has only 5 divisions (3 major and 2 minor), all rather small and indistinct.

M. Obliquus Abdominis Externus. (Fig. 1, 14, 16, and 17) George (1948).
A. The origin of this muscle is by separate heads from aponeurotic tendons of the lateral and posterior surfaces of the second through eighth ribs near their dorsal articulations. The fibers then extend posterolaterally to insert along the lateral border of the abdominal musculature. The muscles of the abdominal region are highly fused to the ventral scutellation and thus difficult to detach. The body of the muscle is a thin, extensive sheet which covers most of the lateral surface of the body and is deep only to the trapezius and the latissimus dorsi.
C. Little difference is noted.

M. Omohyoides. (Fig. 13, 14, 16, and 17) Gnanamuthu (1937).
A. This is a thick muscle of the ventrolateral surface of the neck, having its origin on the anterior border of the scapula and then proceeding anterolaterally to insert on the proximal end of the basihyal and along ceratobranchial 2. It is deep to the posterior portion of the cervicomandibularis and the anterior portion of the constrictor colli, superficial to the anterior portion of the sternothyroideus and a small portion of the esophagus, and lies lateral to the sternohyoides.
C. The muscle is much broader, covering the sternohyoides to an area midway between the hyoid apparatus and the sternum.

M. Pectoralis. (Fig. 13) Camp (1923).
A. The pectoralis is an extensive superficial muscle of the sternal region, originating from the inner
angle of the clavicle, the interclavicle, the sternum and the midventral raphe and inserting on the proximal end of the humerus. It is superficial to the sternum, some of the sternal ribs and the coracoid and is deep only to the skin of the chest region.

C. Little difference is noted.

M. Proscapulohumeralis. (Fig. 12, 15, and 19) Howell (1936).
A. The proscapulohumeralis originates on the anteroventral margin of the scapula with fibers proceeding ventrally which immediately join those of the coracohumeralis of the same layer. Toward the insertion, the latter muscle passes over a small ligament while the former passes beneath it to insert upon the humerus between the medial and lateral heads of the humerotriceps. It lies superficial to the sternocoracoideus superior and deep to the deltoideus.
C. Little difference is noted.

M. Pterygomandibularis. (Fig. 10, 11, 13, 14, 16, 17 and 18) Oelrich (1956).
A. This is the largest muscle of the lateral surface of the skull, originating on the pterygoid along the margin of the infraorbital foramen by means of a large tendon attached to the ectopterygoid process. The fibers extend posteriorly and posterodorsally to cover the ventral and lateral surfaces of the angular and surangular they then continue posteriorly along the condyle of the quadrate and insert on the angular process of the articular. It is deep to the cervicomandibularis dorsally and the mandibulohyoideus III ventrally and lies superficial to the esophagus.
C. The muscle is not as bulky, but otherwise little difference is noted.

M. Scapulotriceps. (Fig. 11, 13, 14, 16, 17, and 18) Howell (1936).
A. The origin of the scapulotriceps is on the scapula near the glenoid fossa. The fibers then loop around the insertion of the latissimus dorsi and proceed distally to insert on the olecranon process of the ulna.
C. Little difference is noted.

M. Serratus Dorsalis. (Fig. 11, 12, 18, and 19) Howell (1936).
A. This muscle consists of three ribbonlike slips of muscle which partially overlap one another in such a way that they appear serratuslike from a dorsal view when the suprascapula is freed away from the lizard’s body (as in Fig. 11 B). It arises by fasciculae from the lateral surfaces of the three cervical ribs and then passes slightly dorsolaterally to insert separately, but slightly overlapping one another, along the medial surface of the suprascapula near its dorsal border. Although the muscle is partially continuous with the serratus ventralis complex, it lies medial and some-what dorsal to the ventral slips.
C. Little difference is noted.

M. Serratus Ventralis I. (Fig. 11) Howell (1936).
A. The serratus ventralis I originates centrally slightly beneath the serratus dorsalis on the first two ribs and inserts on the anteromedial border of the scapula. The body of the muscle is deep to the subscapularis and superficial to the intercostalis externus.
C. Little difference is noted.

M. Serratus Ventralis II. (Fig. 11 and 18) Howell (1936).
A. This muscle originates immediately ventral to the last slip of the serratus dorsalis and its origin is centrally on the posteromedial portion of the scapula and is immediately ventrolateral to the serratus ventralis I.
C. Little difference is noted.

M. Serratus Ventralis Superficialis. (Fig. 10, 14, and 17) Howell (1936).
A. The muscle originates by means of several slips from the first two ribs, then proceeds anterodorsally to insert on the posterior border of the scapula. The body of the muscle is deep to the latissimus dorsi and superficial to serratus ventralis I and II as well as intercostalis externus.
C. Little difference is noted.

M. Spinalis Capitus. (Fig. 11, 12, 17, 18, and 19) George (1948).
A. This is the large anterior epaxial muscle originating in common with the spinalis cervicis and inserting on the posterior margin of the parietal. It is deep only to the middorsal fascia and the dorsal portion of the cervicomandibularis and is superficial to the longissimus, ilio-costalis and longus colli.
C. Little difference is noted.

M. Sternocleidomastoideus. (Fig. 11, 13, 14, 16, and 17) Howell (1936).
A. Sometimes called the episternocleidomastoid (Robison and Tanner, 1962), it is a thick, ribbonlike muscle obliquely crossing the lateral surface of the cervical region, originating by a superficial aponeurosis from the posterior cranial region along the extreme posterolateral margin of the parietal and the parietal process and inserting along the dorsal margin of the clavicle with a small slip attaching to the anterior portion of the sternum. Anterodorsally, it is deep to the depressor mandibularis; otherwise, it lies superficial to the sternothyroideus, levator scapulae profundus and superficialis, and the deep epaxial musculature.
C. Little difference is noted.
M. Sternopectoralis Superior. (Fig. 15 and 20) Howell (1936).
A. This is a broad muscle originating from the most of the ventral surface of the sternum and inserting by a broad thin tendon on the ventral portion of the scapula, appearing to insert on the clavicle.
C. Little difference is noted.

M. Sternopectoralis. (Fig. 13 and 14) Camp (1923).
A. This is a large flat muscle extending along the ventrolateral side of the neck, originating in a sheet from the anterior portion of the sternum and inserting along most of the posterior length of ceratobranchial 2. The body of the muscle lies deep to the sternocleidomastoideus and the posterior portion of the omohyoideus. It is superficial to the esophagus.
C. Little difference is noted.

M. Styloglossus. (Fig. 11, 13, 14, and 17) Smith (1960).
A. Although the exact extent of this muscle is somewhat questionable because of the fascia on its posterodorsal surface, it appears to originate by means of a thin sheet of fascia from the posterior region of the cranium and quadrate and inserts on the mandibular symphysis of the dentaries. It covers the hyoglossus and forms a small part of the basal sheath which covers the posterior margin of the tongue.
C. The origin appears almost tendinous posterodorsally and anteroventrally no basal sheath is contributed to the tongue.

M. Subscapularis. (Not figured) Howell (1936).
A. The subscapularis arises from the base of the medial side of the suprascapula and the adjoining portion of the scapula; its fibers converge to a tendinous insertion upon the retractor process of the humerus. It is deep only to the scapula, but is superficial to the serratus ventralis complex as well as a portion of the serratus dorsalis.
C. Little difference is noted.

Supralabial Ligament. (Fig. 16) New Name.
A. This is a strong superficial ligament of the lateral surface extending beneath the supralabial scales of the skin from the rostral area to insert on the anteroventral margin of the quadrate. It is deep only to the fascia of the skin and is superficial to the pterygomandibularis.
C. Little difference is noted.

M. Trapezius (Fig. 10 and 16) Howell (1936).
A. This is an extensive, superficial muscle located on the dorsolateral surface of the cervical and thoracic regions. It is the most superficial muscle of the area with the exception of the depressor mandibularis and the constrictor colli which originate on the mid-dorsal raphe in the area of the lower cervicals and insert on the crest of the anterior margin of the suprascapula, the superficial fascia along the clavicle and the anterior margin of the pectoralis to the origin of the sternocleidomastoideus. This muscle varies greatly in thickness throughout its extent. Posteriorly, it is considerably developed, this being the major part to insert on the suprascapula. However, anteriorly, it comes to be only one muscle layer in thickness. The body of the muscle is superficial to the levator scapulae superficialis and profundus as well as the dorsal portion of the dorsalis scapulae.
C. Little difference is noted.
DISCUSSION

Phylogenetic speculations on reptiles have been based upon information derived from three areas: (1) the fossil record, (2) the geographic distribution, and (3) the comparative morphology of living genera (Camp, 1923). The third area has been the main focus of attention in this report. The most reliable hypotheses of phylogeny require careful examination of all potential data; therefore definitive phylogenetic conclusions are not justified by this study. Howes (1902) discussed the idea that comparative morphology is the primary practical basis of a working classification. He further noted that comparisons should be first made on closely related forms, passing later to larger and less closely related groups. The present comparisons, restricted to Cnemidophorus and Ameiva provide an initial step. The genus Cnemidophorus is a probable offshoot of Ameiva as speculated by Barbour and Noble (1915) and as well by Burt (1931b).

Camp (1923) listed 34 different paleotectic characters of importance in considerations of phylogeny as determined by comparative morphology. Although some of these characters are of little significance below the family level, those which are of importance to phylogeny of the genera discussed in this report include in the order of significance listed by Camp: (1) fusion of median skull elements, (2) the postorbital-postfrontal, (3) the lacrimal, (4) mandibular teeth, (5) palatine teeth, (6) throat musculature, (7) the lower jaw, (8) the os intermedium (9) the epitygoid, and (10) the shoulder musculature. These are not all of the phylogenetically significant characters which have been discussed in such texts as those by Smith (1960) and Romer (1964), but the list may lend an index to phylogenetic studies.

In the following discussion, osteological variables are treated first, then myological variables. The two sets of variables together should provide a more reliable bases for speculation on phylogenetic relationships than one of them alone. As pointed out by Nopcsa (1928), osteological characters alone are insufficient to distinguish all of the Teiidae from all of the Iguanidae, for example, and it is probable that the reverse is also true.

Osteology.

Elements of the skull and lower jaw (as indicated in fig. 1-8) show considerable variation between the members of the two genera described. Considerable variation is noted in the general appearance of the skull and lower jaw. In A. u. parva, the skull can be considered heavily ossified with a rugose dorsal surface; deep indications of indentation for integumentary scutellation are evident and an os palpebrae is evident in the anteromedial border of the orbit. In the lower jaw, there is a slight lateral torsion of each ramus, the articular and angular are at almost right angles to each other, and the ventral surface of the dentary is rugose. In C. t. septentrionalis, the skull is comparatively lighter with a relatively glabrous dorsal surface. There is little indication of indentation of integumentary scutellation and the anteromedial border of the orbit is cartilaginous. In the lower jaw, there is no lateral torsion, the articular and angular essentially form a straight line, and the ventral surface of the dentary is relatively glabrous.

For further references to variation of the separate elements is noted in the general description. Elements discussed in which a difference is noted include the basioccipital, exoccipital, frontal, jugal, lacrimal, maxilla, nasal, os palpebrae, palatine, parietal, postorbital-postfrontal, prefrontal, premaxilla, prootic, pterygoid, quadrate, supraglacial, and most of the elements of the lower jaw except the splenial.

The most unstable element of osteological import appears to be the intermediate of the wrist. Romer (1956) points out that fusion and sometimes complete loss of some wrist bones is common in lizards. With the methods used in this report, an element as minute as the intermediate is difficult to locate on small specimens and may account for its apparent absence in some of the species and subspecies observed. Possession of this element may indicate primitiveness, but this is questionable because of its variation even between subspecies. The degree of ossification of this structure and other carpals is probably a function of age of the individual. It is recognized that a need for using larger series in most of the species is necessary for a complete study; however, the data presented seems significant since all of the Ameiva undulata group examined appear to possess the element whereas it is seemingly absent in examples of the Cnemidophorus tigris group examined by us.

Teeth.

The teeth of A. u. parva and C. t. septentrionalis show some similarity of shape and relative size, but they differ considerably in the positioning and number of cusps on specific teeth. Perhaps the greatest difference noted was the absence of pterygoid teeth in A. u. parva. Camp (1923) suggests that the presence of these teeth may be of paleontic significance, but he hastened to add that the absence of such teeth may or may not be of significance owing to the likelihood of dropping out or the migration and development of cutaneous tooth buds from one bone to another in the course of recent phylogeny.
Age is also exhibited by tooth structure of both genera, as the older specimens have some of the posterior accessory cusps well worn or reduced to small swellings. Several of the teeth are also loose or missing (replacement) and broken.

Myology.

The problems of myological research are at times rather complex. Huntington (1903). Camp (1923). Romer (1956) and Smith (1960) indicate that the musculature of major groups such as orders and classes is rather plastic and variable and are, thus, rather difficult to interpret. At the family level, however, myology appears to be a sufficiently stable character to be of phylogenetic use. Tanner (1952) indicated that in Mexican and Central American groups of the salamander family Plethodontidae the musculature is consistent enough to define genera. This conclusion has been further supported by Wake (1966) on the osteology of the plethodontid salamanders and by work in reptilian myology by Robison and Tanner (1962). and Avery and Tanner (1964). The two genera of the family Teiidae examined in this report seem to support this conclusion. Of the forty-nine muscles dissected in A. u. parva and compared in C. t. septentrionalis, only six differed significantly between the two genera as far as configuration, origin, insertion, or size was concerned. Because of the relative stability of the myology within these two genera, this could perhaps be used as a tool for interpretation of phylogenies and variations.

The greatest myological variation appears to be centered around the anterior segments of the ventral musculature. In A. u. parva, the myohyoideus complex interdigitates frequently with the geniohyoideus by nine separate bundles, whereas in C. t. septentrionalis this complex interdigitates in only five bundles of rather simple structure. Camp (1923) seems to believe that the variation in this musculature is a good indicator of primitiveness. He pointed out that above the family level a primitive saurian condition is represented by eight or more interdigitation bundles of these two muscle groups.

Other myological variations for A. u. parva include a distinct division of the cervicomandibularis by the constrictor colli, a mandibulohyoideus II which is the same width as the mandibulohyoideus I, and an omohyoideus which is rather narrow and located ventrally in the neck region. In C. t. septentrionalis, there is a dorsal fusion of the cervicomandibularis with the constrictor colli, the mandibulohyoideus II is only one-half the width of the mandibulohyoideus I, and the omohyoideus is relatively broad, extending ventrally to the midcentral region of the neck.

The differences in configuration of these muscles may indicate that the variability is not suited for phylogenetic comparisons between these two genera, or they may support the distinction of the two genera. Further study of the entire family would be necessary before definitive conclusions could be reached.

CONCLUSIONS AND SUMMARY

The anterior osteological elements of the skull, lower jaw, and wrist along with the anterior myological characters discussed and figured in this report suggest that A. u. parva and C. t. septentrionalis are members of distinct groups which can be differentiated by internal morphologic characters. Although comparisons were restricted to highly geographically separated individuals of the same family, their general body form and structure appear to be similar.

A great number of anatomical structures are shared in common, but the significant differences between them include:

1. General skull appearance.

The skull of C. is generally lighter, that is the bones are thinner, than in A. and with a larger portion relatively glabrous on the dorsal surface with little indication of integumentary scutellation. The most notable differences are found in the occipital region of A. where much fusion of elements and exact suturing is difficult to distinguish. In C., the occipital elements are easily distinguished.

2. Skull elements.

Those elements of greatest difference and significance are noted in the sections titled descriptions and discussion. The elements include the ectopterygoid, exoccipital, frontal, jugal, os palpebrae, postorbital-postfrontal, premaxilla, and the quadrate.

3. Lower jaw elements.

Those elements of greatest difference and significance are noted in the sections titled descriptions and discussion. The elements include the angular, articular, and dentary.

4. Foramina of the skull and lower jaw.

The foramina of significant difference
between the two genera are noted in the sections titled description and discussion. These include the infratemporal fenestra, mental foramina, nasal foramina, palatine canals, splenial foramina, surangular foramina, and the supralabial foramina.

5. The teeth of the maxilla, dentary, and pterygoid.

The teeth are mostly peglike with the first accessory cusp of the dentary appearing on tooth 5 in C. and tooth 6 in A. There are eight peglike teeth on the premaxilla of C. and ten on the premaxilla of A. The greater number is a probable indicator of greater antiquity. In the maxilla a posterior accessory cusp is found on the second tooth of A. and the sixteenth of C. Perhaps the most significant point is that five peglike teeth occur on the pterygoid of C. and none were found on A.

6. The intermedium wrist element.

An intermedium was found to be present in the manus of C. communis, C. gularis, C. burti, C. sexlineatus, A. u. parva, A. u. hartwegi, and A. u. sinistra. It is either absent or questionably present in C. t. tigris, C. t. septentrionalis, C. t. gracilis, C. t. canus, C. t. aethiops, C. gularis, C. exsanguis, C. d. deppei, C. d. lineatissimus, C. h. hyperyrhynchus, C. o. lemniscatus, and A. auberti. It is evident from the above distribution that the presence or absence of the intermedium may not be of paleontic significance at the generic level, but may be at the specific level. It may also be intraspecifically variable.

7. The musculature.

The greatest myological variation appears to be centered around the anterior segment of the ventral musculature. The mylohyoideus com-plex interdigitates frequently with the geniohyoideus in A. u. parva. Nine separate bundles were found in the species studied. Camp (1923) stated that above the family level in suarians, eight or more bundles was a valid indicator of primitiveness. The other muscles of generic variation include the m. cervicomandibularis, m. constructor colli, m. mandibulohyoideus II, m. omphyoideus, m. styloglossus and the associated basal tongue sheath.

The anatomical differences existing in the sheath associated with the tongue of A. u. parva is of special significance. A basal sheath is connected to the tongue sheath and extends for attachment to cranial and mandibular bones. This establishes a real anatomical basis for the tongue sheath character now used by some to separate these genera. Further exploration of the species in these genera should be made to determine the stability of the character. This is particularly true in view of the comments made by Burt (1931b) concerning this structure, which, based on his findings, may be an inadequate character to separate these genera.

It is evident from the findings that specialization has occurred not only intergenerically but intragenerically, and care must be taken to distinguish the two levels of variation. Clearly the presence or absence of the intermedium is of little significance intergenerically, but may be of importance intragenerically. The presence or absence of the pterygoid teeth may also fit this category, but with our present understanding of the paleontic significance within this family it is impractical to draw a conclusion. Barbour and Noble (1915) and Burt (1931b) concluded from their study of external morphology that Anotiva is a more primitive genus than Chenid phoros. Our observations of osteological and myological structures which are seemingly of paleontic significance also support this conclusion.

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1 It is to be noted that the terminology of this muscle has not been determined in the literature. The name of a similarly placed mammalian muscle is temporarily adopted until complete homologies can be determined.
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