**This technical report has been made
electronically available on
the World Wide Web
through a contribution from
and at the behest of**

*The Friends of Meleagris G.
at BackyardChickens.com*

Office of Scientific and Technical Information
Office of Science
U.S. Department of Energy
June, 2008

U.S. DEPARTMENT OF
ENERGY

*Office of
Science*

MASTER

364
11/12/68
516

ATLAS
of
THE DOMESTIC TURKEY
(MELEAGRIS GALLOPAVO)

●

Myology and Osteology

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

AN ATLAS OF THE DOMESTIC TURKEY

(MELEAGRIS GALLOPAVO)

MYOLOGY AND OSTEOLOGY

by

E. B. HARVEY

U. S. Atomic Energy Commission, Germantown, Maryland

H. E. KAISER

Department of Anatomy, School of Medicine

The George Washington University, Washington, D. C.

and

L. E. ROSENBERG

Department of Zoology, University of California, Davis, California

AN ATLAS OF THE DOMESTIC TURKEY

Myology and Osteology

Title Page	i
Table of Contents.	iii
Preface.	v
List of Plates	
Myology	vii
Osteology	x
Introduction	1
Materials and Methods.	3
Discussion	
Myology	5
Muscles of taxonomic significance.	5
Plates	6
Table of bird muscles.	150
Osteology	171
Significant features of the turkey skeleton.	171
Plates	176
Bibliography	234
Index.	237

PREFACE

This Atlas is designed to bring into one publication labeled drawings of the muscles and bones of the domestic turkey, Meleagris gallopavo, an important member of the gallinaceous birds. The nomenclature as used for the muscles is based on the BNA (1920), Fisher (1955), and where no other source was available, we used terms that were as near correctly Latinized as we could make them. Determination of muscle homologies and the final names based on these for birds must await a more thorough study of muscles in other species and understanding of the embryologic origin and innervation of these. Included in this Atlas is a table of bird muscle synonymies that should be useful to the student of bird anatomy. It would be anticipated that this Atlas can become an inexpensive working copy to which additions and corrections can be easily made both on the plates and in the text.

At the beginning of these studies in 1943 at the University of California, Davis, there were few references available in which both the myology and osteology of a single species of birds was covered in a single monograph. Shufeldt (1890) has published a rather complete work on the myology of the raven and in 1913 on the skeleton of the ocellated turkey Agriocharis ocellata. Kaupp (1918) published a volume on the anatomy of the chicken (Gallus) and dealt briefly with the myology. An atlas on the osteology and myology of the chicken primarily for veterinarians has been published by Chamberlain (1938). Two significant and recent publications on bird anatomy are those of Fisher and Goodman (1955) on the myology of the whooping crane and George and Berger (1966) on the gross description of all bird muscles with particular emphasis on the myology of the Rock Dove (Columbia livia). Recognition of other essential references would be redundant since the bibliographies presented by these latter authors are extensive and complete.

In preparation of this Atlas, our particular thanks must go to Mrs. Beverly Farmer at the University of California, Davis, California, who devoted many hours to the initial drawings from dissections and to Mrs. Hazel Thelan, Vacaville, California, who did the final pen and ink drawings. Labeling of the plates of myology was done by Mrs. Elsie Froeschner, Arlington, Virginia, for which \$300.00 was granted by the Research Endowment Funds of Montana State College. Several bone plates were done by Miss Anne V. Donovan, Washington, D. C., for which a grant from the Dowden Fund (No. 2) at George Washington University was used, and the final labeling of bone plates was done by Mrs. J. Switzer of Washington, D. C. Recognition must also be given to Mrs. Carol Freed who typed the manuscript in its final form for publication. Mr. and Mrs. Joseph Garibaldi, Stockton, California, must also receive thanks for their part in making available funds utilized in the overall cost leading to the preparation of this Atlas. Dr. C. L. Dunham, formerly Director of the Division of Biology and Medicine, and Dr. John Totter, Director of the Division of Biology and Medicine of the U.S. Atomic Energy Commission, through their kindness and office, made possible the final steps necessary to the publication of this Atlas. Finally, recognition must be given to Mr. Robert Pigeon, Division of Technical Information, U.S. Atomic Energy Commission, for his continual stimulation that encouraged us to complete and bring to press this publication.

LIST OF PLATES

Myology

<u>Plate</u>	<u>Title</u>	<u>Page</u>
1	Head -- Right lateral view Superficial and second layers.	9
2	Head -- Right lateral view Third and deep layers.	11
3	Head -- Ventral view Superficial and second layers.	13
4	Head and Glossus -- Ventral view Third and fourth layer	14
5	Head and Glossus -- Ventral view Fifth and deep layers.	17
6	Eye -- Right First, second, and deep layers	21
7	Neck -- Dorsal view Superficial layer.	23
8	Neck -- Dorsal view Second layer	25
9	Neck -- Lateral view Superficial layer.	29
10	Neck -- Lateral view Second layer	31
11	Neck -- Lateral view Third layer.	33
12	Neck -- Ventral view Superficial layer.	35
13	Neck -- Ventral view Second and third layers.	37
14	Trunk and Base of Neck -- Lateral view Superficial layer.	39
15	Trunk and Base of Neck -- Lateral view Second layer	41
16	Trunk and Shoulder -- Dorsal view Superficial layer.	43
17	Trunk and Shoulder -- Dorsal view Second layer	45

<u>Plate</u>	<u>Title</u>	<u>Page</u>
18	Trunk and Shoulder -- Dorsal view Third layer.	47
19	Trunk and Shoulder -- Dorsal view Fourth layer	51
20	Trunk and Torso -- Left lateral view Superficial layer.	55
21	Trunk and Torso -- Left lateral view Second layer	59
22	Trunk and Torso -- Left lateral view Third layer.	61
23	Trunk and Torso -- Internal medial view First layer.	65
24	Trunk and Torso -- Internal medial view Second layer	67
25	Trunk and Torso -- Internal medial view Third layers	69
26	Trunk and Torso -- Internal medial view Fourth layer	71
27	Pelvis and Tail -- Dorsal view Superficial and second layers.	73
28	Tail -- Dorsal view Third layer.	75
29	Pelvis and Tail -- Dorsal view Third and fourth layers.	77
30	Tail -- Ventral view Superficial layer.	79
31	Tail -- Ventral view Second and deep layers	81
32	Leg (Femur) - Left - Lateral view Superficial layer.	85
33	Leg (Femur) - Left - Lateral view Second layer	87
34	Leg (Femur) - Left - Medial view Superficial layer.	91
35	Leg (Femur) - Left - Medial view Second layer	93

<u>Plate</u>	<u>Title</u>	<u>Page</u>
36	Leg (Femur) - Left - Medial view Third layer.	95
37	Leg (Tibiotarsus) - Left - Lateral view Superficial layer.	97
38	Leg (Tibiotarsus) - Left - Lateral view Second layer	99
39	Leg (Tibiotarsus) - Left - Lateral view Third layer.	101
40	Leg (Tibiotarsus) - Left - Lateral view Deep layer	103
41	Leg (Tibiotarsus) - Left - Medial view Superficial layer.	105
42	Leg (Tibiotarsus) - Left - Medial view Second layer	109
43	Leg (Tibiotarsus) - Left - Medial view Third layer.	111
44	Leg (Tarsometatarsus and Foot) - Left - Lateral view Superficial layer.	113
45	Leg (Tarsometatarsus and Foot) - Left - Medial view Superficial layer.	115
46	Leg (Tarsometatarsus and Foot) - Left - Dorsal view Superficial layer.	117
47	Foot - Left - Dorsal view Deep layer	119
48	Leg (Tarsometatarsus and Foot) - Left - Dorsal view Deep layer	121
49	Leg (Tarsometatarsus and Foot) - Left - Plantar view Superficial layer.	123
50	Leg (Tarsometatarsus and Foot) - Left - Plantar view Second layer	125
51	Leg (Tarsometatarsus and Foot) - Left - Plantar view Third layer.	127
52	Leg (Tarsometatarsus and Foot) - Left - Plantar view Deep layer	129
53	Wing - Left - Dorsal view Superficial layer.	133

<u>Plate</u>	<u>Title</u>	<u>Page</u>
54	Wing - Left - Dorsal view Second layer	137
55	Wing - Left - Dorsal view Third layer.	141
56	Wing - Left - Ventral view Superficial layer.	145
57	Wing - Left - Ventral view Second layer	147
58	Wing - Left - Ventral view Deep layer	149

Osteology

59	Articulated skeleton <u>Meleagris g. gallapavo</u> (Male).	170
60	Skull - Male - Right lateral view	177
61	Skull - Male - Dorsal view.	179
62	Skull - Male - Ventral view	181
63	Skull - Male - Caudal view.	183
64	Hyoid apparatus - Dorsal, ventral and right lateral view. . .	187
65	Cervical vertebrae - articulated - Left lateral view.	189
66	Atlas - Cranial, caudal, ventral, dorsal, and left lateral views.	191
67	Axis - Right lateral view	193
68	Sixth cervical vertebra - Ventral, dorsal, lateral, cranial, and caudal views.	195
69	Thorax, pelvis, cauda, and ribs - Right lateral view.	199
70	Thorax, pelvis, cauda, and ribs - Dorsal view	203
71	Thorax, pelvis, cauda, and ribs - Ventral view.	205
72	Furcula - Cranial and caudal view	207
73	Coracoid - Cranial and caudal view.	209
74	Sternum - Right lateral view.	211
75	Sternum - Dorsal view - Sternal ribs - Medial view.	213

<u>Plate</u>	<u>Title</u>	<u>Page</u>
76	Femur - Right - Cranial and caudal views.	215
77	Femur - Right - Lateral and medial views.	217
78	Tibiotarsus and Fibula - Right - Cranial, caudal, dorsal, lateral, and medial views.	219
79	Tarsometatarsus - Right - Cranial, caudal, and dorsal views .	221
80	Tarsometatarsus - Right - Lateral and medial views.	223
81	Foot and digits - Left - Dorsal view.	225
82	Scapula - Right - Dorsal and ventral views.	227
83	Humerus - Right - Dorsal and ventral views.	229
84	Radius and ulna - Right - Dorsal and ventral views.	231
85	Carpometacarpus and phalanges - Right - Dorsal and ventral views.	233

INTRODUCTION

"It is curious indeed how very few birds have been at all thoroughly dissected." This quote from Beddard in 1898 is as true today as it was in his time. Even though the domestic turkey has become a bird of worldwide economic importance, it has received little persistent attention from anatomists. As early as 1913, Shufeldt pointed out the differences between the skulls of the domestic turkey (Meleagris gallopavo) and the wild turkey (Agriocharis ocellata) and had earlier (1887) described the skeletal elements of this species. Nevertheless, few references can be found to the soft parts of the domestic turkey.

According to Shufeldt (1913), Meleagris gallopavo domestica, as he preferred to name the domestic turkey in lieu of a documented name, shows the closest relationship to Gallus bankiva and true fowls. In addition, the turkey skeleton, typical of the gallinaceous birds, has other characteristics that connect it with the Phasianidae, pheasant family. More recent work has not clarified the problem of properly classifying the turkey. Shorger (1967) reviews in brief the methods and conclusions of various workers in attempting to properly relate the turkey to other species of birds. Whether to "place the turkey among the pheasants or in a separate family depends on whether the approach is anatomical, physiological, morphological, or otherwise" (Shorger, 1967). Ridgway and Friedmann (1946:63, 436) placed the turkeys in the separate family Meleagridae under the superfamily Phasianoidae on the basis of the head furnishings, the truncated color feathers, the acetabulum, and the weak, straight furcula. Hudson, et al, (1959:56) write that, except for the loss of the femorocaudal portion of the pyramidal muscle, the turkey is essentially a pheasant. Nevertheless, the consensus of opinion holds that the turkey is a primitive member of the Galliformes.

Turkeys are clearly of North American origin, and Howard (1950) has stated that they are known with certainty only from late Pliocene and early Pleistocene. However, Wetmore (1936) believes that they were common in the West during the Miocene.

The South Mexican turkey, the original Meleagris gallopavo of Linnaeus, although a domestic bird (Newton, 1868:102), must be the starting point for the various subspecies. The Mexicans domesticated the native turkey, which extended from Vera Cruz westward, and it is the domestic bird that was introduced into Europe. The wild bird, accordingly, must be Meleagris gallopavo gallopavo. When Gould (1856) described his Mexican turkey (Meleagris mexicana), he contended that Linnaeus based his Meleagris gallopavo on the wild turkey found north of Mexico. This led to the use of M. gallopavo for the eastern turkey in the AOU Check-lists until the turn of the century. Characteristic of the native Mexican race are the white tips of the tail feathers and the upper tail coverts. Bonaparte (1825:98) used these characteristics to identify the tame turkeys sold as wild ones in the Philadelphia and New York markets. The white "rump" has been eliminated in nearly all of the modern domestic turkeys, but the white tips of the tail feathers persist. Baird (1867) stated that the domestic turkey is

unquestionably of Mexican origin. Coues (1897), after discussing the nomenclature, came to a solution, that of naming the Mexican bird Meleagris gallopavo gallopavo.

The origin of the common and generic name of the turkey and its domestication are equally difficult to trace from the literature as are its taxonomic relationships. Shorger (1967) discusses these, and for students wishing to pursue this question further, his bibliography is extensive.

An atlas of the myology and osteology of any species does not in itself help to resolve questions of phylogenetic relationships or the history of domestication. However, if this Atlas increases interest in either of these problems or makes possible new research utilizing the turkey, it will have served its purpose.

MATERIALS AND METHODS

Twenty-five mature male and female domestic turkeys, Meleagris gallopavo, obtained from the poultry department at the University of California, Davis, were used in this study. Two breeds, the Broad-Breasted Bronze and White Holland turkeys, were utilized in studies of the myology and preparation of the skeletal materials. One skeleton of a three-month-old Broad-Breasted Bronze turkey was prepared for separation of the individual skull bones.

The turkeys used for dissection and muscle studies were embalmed and kept refrigerated at 4° C until needed for study.

The turkeys to be embalmed were killed with chloroform or ether. An incision was made through the skin in the caudal lateral aspect of the thigh. This exposes the caudal fan of the M. gluteus primus and M. biceps flexor cruris. These muscles can be separated from each other to the depth of the femur without tearing muscle tissue. The ischiadic nerve and artery and the vena cruralis lie deep and caudal to the femur. The ischiadic artery was lifted carefully and thread tied around the artery at its cardiac end. A canula was placed in an incision that is made in the artery and tied securely.

The embalming fluid consisted of:

Formalin	1.5 parts
Carbolic Acid	2.5 parts
Glycerine	10.0 parts
Water	86.0 parts

and was placed in a two liter perfusion bottle about four feet above the bird. This height permits adequate perfusion pressure. Perfusion was continued until the wattle became distended and the fluid leaked freely from the oronasal passages. For birds over 15 pounds, two liters of fluid is adequate, whereas, for those under 15 pounds, one to two liters are adequate. The birds were left at room temperature for 24 to 48 hours before storing in a cold room at 4° C.

Pencil drawings were made of each layer of muscles as they were exposed, the accuracy of these were confirmed or corrected from subsequent dissections and finally inked for final plates. We utilized a minimum of artistic license; therefore, the larger number of plates than usual in this type of study have permitted us to show accurately the succession of each layer of muscles.

An autoclave method was utilized in the preparation of the skeletal materials. Mature fresh male and female turkeys were eviscerated, skinned, and disjointed. The head, feet, and wings were placed in cheese cloth bags. They were placed in an autoclave for 35 minutes at 15 pounds pressure. Following this treatment, the bones were easily defleshed. To attain bones of good quality for drawings and study purposes, the defleshed bones were placed in a solution of chlorox and water (1:20). This treatment permitted removal of ligamentous materials remaining attached to the bones and also bleached them an appropriate amount.

Preparation of the skeleton in this way, when done carefully so as to avoid breaking small bones and cartilage and excessive removal of skeletal material, takes approximately eight hours.

A. Myology

Research on birds and their anatomy has not advanced at the same rate as that for other classes of vertebrates. Therefore, significant contributions to knowledge in the fields of biology must await the solution to many problems that remain unanswered for birds. Of particular note is the absence in the literature of studies on comparative myology in the birds. This is particularly noteworthy since there are in existence and readily available for research flightless birds, wild as well as domestic species, and representatives from nearly all ecosystems. We must agree with George and Berger (1966) list of four types of research needed on the avian muscular system. These are: "1) Descriptions of the complete appendicular myology of all genera in different families of birds . . .; 2) Comparison of the wing myology of flightless (or nearly flightless) genera with flying genera in the same family . . .; 3) Nerve-muscle experiments on living birds. . .; 4) Studies of the gross pattern of the brachial and lumbosacral plexuses. . . as well as nerve degeneration experiments. . ."

The turkey has been domesticated in the recent history and several wild species are both readily available and maintained easily in captivity. In addition, the turkey has gained prominence as one of the more important economic birds. For these several reasons, intensive research on turkeys would be highly rewarding.

1. Muscles of Taxonomic Significance

Use of muscles for taxonomic purposes in birds has resulted in a number of papers on specific muscle groups thought to be of significance. Little effort has been made to describe all muscles in any one species. We have not oriented this Atlas to the taxonomic significance of the turkey muscles; however, we include here a brief discussion of the muscles as we observed them in the turkey. Garrod (1873 and 1874) used a set of symbols for designation of thigh muscles that he believed were of taxonomic significance. This "set" has been modified by Hudson (1937) and is discussed in some detail by Fisher (1955) and George and Berger (1966).

Following these authors and Newton (1895) the wild turkey M. gallapavo has the formula B C D E F G X Y Am and for the domestic turkey M. g. gallapavo the same formula probably pertains according to our study. However, we did not successfully identify an M. plantaris /F/ of George and Berger (1966).

The M. femorocaudal /A/ (=caudofemoralis) is absent in the turkey. However, the accessory part of M. femorocaudal /B/ (=pars iliofemoralis, = M. piriformis) or ischiofemoralis as we have preferred to name this muscle is present. The gluteus medius et minimus /D/ (=gluteus superficialis of our study), iliacus /E/,

popliteus [G], semitendinosus [X], semitendinosus accessorius [Y], ambiens [Am] and viniculum [V] were all observed in our study. Although we are certain that we identified M. plantaris [F], we would prefer that this question remain to be solved without doubt through future research. George and Berger (1966) report that the tendon of this muscle is ossified in some galinaceous birds.

Other muscles considered of taxonomic importance have been listed by Newton (1895). A brief description of these for the turkey follows (see also description of plates).

There are two pectoralis muscles in the turkey: pectoralis superficialis and pectoralis profundus. The superficial pectoral is the largest muscle of the turkey. It inserts by a broad fascia on the deltoid crest of the humerus and by a more caudal thin but tough fascia to the teres and patagialis. The pectoralis profundus on the other hand inserts on the humerus by a tendon.

The coracobrachialis (M. Supracoracoideus of Newton) inserts on the deltoid crest of the humerus after passing through the foramen triosseum. In the turkey this muscle appears to simply extend the brachium, whereas Newton states that it rotates and abducts the humerus.

The patagialis complex (M. Propatagialis longus, and Propatagialis brevis of Newton) in the turkey is composed of three distinctly different units: the patagialis, tensor patagi longus, tensor patagi caudalis. In the turkey the patagialis inserts broadly by fascia on the extensor carpi radialis superficialis and skin of the wing. The tensor patagi longus inserts on the radial carpal sesamoid that lies just distal to the radial carpal bone. A slip extends from this muscle to insert on the skin of the manus, whereas, the tensor patagi caudalis inserts on the skin of the antibrachium by fascia.

In Gallinae and Columbidae (excluding Cracidae) the propatagialis receives a slip from the biceps. We could find no trace of a slip arising from the biceps and inserting on the patagial complex.

The latissimus dorsi (Latissimus dorsi of Newton) is composed of two portions: a cranial and a caudal head. Insertion of the cranial portion is on the shaft of the humerus, and the caudal portion inserts on the cranial portion. We did not observe inserting fibers or fascia from either portion on the patagium or the anconeus longus as described for other birds.

A muscle described as the expansor secundarium of Newton was not observed in the turkey; however, Newton states that this muscle is in the Gallinae but is absent in Columbidae. It is also of poor taxonomic value according to Newton (1895).

2. Ambiens (M. Ambiens of Newton)

Though a so-called perching muscle, this is absent in many perching birds. In the domestic turkey this muscle is small, originates on the pubis, and inserts on the originating tendon of the flexor digiti terti perforatis. It, therefore, appears to aid in flexing the foot digits II, III and IV. According to Newton (1895) in most birds the M. ambiens originates on the proacetabular ilium and aids in flexion of digits II and III. In Columbae livia, the M. ambiens arises from the pubis and inserts on the M. flexores perforati digiti II, III, IV (George and Berger, 1966).

The ischiofemoralis (caudoiliofemoralis of Newton) inserts on the greater trochanter of the femur. The domestic turkey does not have an accessory (caudal part). According to Newton the accessory femoral caudal arises from the proacetabular ilium and is present in most Gallinae but absent in Pavo and Meleagris. Kaupp (1918) and Chamberlain (1938) report this muscle in the chicken.

Semitendinosus (M. Semitendinosus of Newton) in the domestic turkey originates from the caudal crest of the ilium, whereas, Newton (1895) reports that in Gallinae this muscle originates from the ilium and caudal vertebrae.

3. Semimembranosus (M. Semimembranosus of Newton) is a prominent muscle in the turkey, but Newton claims this to be much reduced in Columbae.

A further discussion of the taxonomic value of muscles in birds would serve no useful purpose here. Without additional information that can only be gotten through new studies, one cannot even be sure that he is comparing homologous muscles of one species with that described by another author.

We utilized as nearly as possible the correct Latinized form for naming of the turkey muscles. A binomial nomenclature was used wherever possible, in which the origin of the muscle was placed first and the insertion second in the binomial. The table of muscle synonymies is intended as a guide and it would be anticipated that many corrections in this table will be made before it will be completed or entirely discarded.

Superficial and Second Layers

1. M. articulohyoideus - (See Plate 3)
2. M. articulomylohyoideus - (See Plate 3)
3. M. biventer maxillae - (See Plate 2)
4. M. complexus - (See Plate 7)
5. M. cutaneus colli lateralis - (See Plate 7)

6. M. depressor palpebrarum ventralis, ventral depressor of the eyelid (not figured)
 FORM AND RELATIONSHIPS: scanty fibers lying in fascia of ventral aspect of orbital fossa; under the eye and its caudal muscles; over dorsal palatine muscles.
 ORIGIN: palatine caudally by fibers.
 INSERTION: ventral eyelid, by fibers to fascia.
 ACTION: depresses ventral eyelid.

7. M. geniohyoideus - (See Plate 2)
8. M. mylohyoideus - (See Plate 3)
9. M. quadratomandibularis - (See Plate 2)
10. M. rectus capitis lateralis - (See Plate 9)
11. M. sternothyrohyoideus - (See Plate 3)

12. M. temporalis et masseter, the temporal and masseter
 FORM AND RELATIONSHIPS: slightly triangular, of three fasciculi which are not separable into a separate temporalis and separate masseter as in the chicken; just deep to zygomaticum; lies caudal to the orbit and cranial to the external auditory meatus; just below the skin, zygomatic fascia and cutaneus colli lateralis; superficial to mandibularis infraorbitalis, the fascia of the orbit, and to the mandible and zygomatic process of alisphenoid.
 ORIGIN: alisphenoid, from caudal portion of zygomatic process; also from temporal fossa.
 INSERTION: mandible lateral border by fibers and coronoid process dorsal portion by a tendon.
 ACTION: closes beak.

13. M. trachelomastoideus - (See Plate 10)
14. M. tracheolateralis - (See Plate 4)

**HEAD-RIGHT LATERAL VIEW
PLATE I**

Third and Deep Layers

1. M. articulohyoideus, articulohyoid - (See Plate 3)
2. M. biventer maxillae, the biventer of the jaw
 FORM AND RELATIONSHIPS: short, thick and triangular; follows contours of caudoventral angle of caudal process of the pars articularis; lies below cutaneus colli lateralis; above lateral portion of the lambdoidal suture; caudal to articulomylohyoideus and articulohyoideus; cranial to geniohyoideus.
 ORIGIN: lambdoidal suture, lateral surface and ridge caudal to the external auditory meatus by fibers.
 INSERTION: pars articularis, caudomedial surface of caudal process of the pars articularis of the mandible by fibers.
 ACTION: opens the beak.
3. M. entotympanicus - (See Plate 4)
4. M. geniohyoideus, geniohyoid
 FORM AND RELATIONSHIPS: mostly tubular, surrounding the cornu of the hyoid apparatus; just under the skin except where covered by articulohyoideus and articulomylohyoideus; caudal to biventer maxillae.
 ORIGIN: mandible, medial surface of splenial element by fibers.
 INSERTION: epibranchial of hyoid by fibers; on cutaneus colli lateralis by fascia.
 ACTION: pulls hyoid apparatus cranially.
5. M. mandibularis infraorbitalis, infraorbital mandibular muscle
 FORM AND RELATIONSHIPS: short, straplike; in caudal area of orbit lateral to rostral process of the quadrate; under the temporalis et masseter laterally; superficial to the quadratomandibularis.
 ORIGIN: along the suture between alisphenoid and temporal wing of sphenoid medially.
 INSERTION: pars supra-angularis, to dorsal portion cranial to coronoid process.
 ACTION: closes beak.
6. M. mandibulopalatinus - (See Plate 4)
7. M. pterygomandibularis, the pterygomandibular muscle
 FORM AND RELATIONSHIPS: flat, fleshy band just ventral to cranial process of pterygoideus; ventral to quadratomandibularis; caudal to mandibulopalatinus; dorsal to medial process of pars articularis of mandible.
 ORIGIN: pterygoideus, dorsal surface.
 INSERTION: pars articularis, dorsal and cranial portion of medial process.
 ACTION: closes beak and pulls pterygoideus laterally.
8. M. quadratomandibularis, quadratomandibular muscle
 FORM AND RELATIONSHIPS: small and thick; deep to the temporalis et masseter; partially covers lateral aspect of quadrate; cranial mandibular articulating process.
 ORIGIN: quadrate cranial process.
 INSERTION: pars supra-angularis, on lateral and medial surfaces.
 ACTION: closes beak.

THIRD LAYER

HEAD-RIGHT LATERAL VIEW PLATE 2

Superficial and Second Layers

1. M. articulothyroideus, articulothyroid
 FORM AND RELATIONSHIPS: flat, bipartite, V-shaped; under the mylothyroideus and basientoglossus, superficial to the sternothyroideus and geniothyroideus, anterior to the biventer maxillae and articulomylothyroideus; one band of muscle extends medially to hyoid and one cranially to lateral surface of entoglossum.
 ORIGIN: pars articularis, caudal process by fibers.
 INSERTION: (a) caudal slip--on basibranchial.
 (b) cranial slip--on basihyal.
 ACTION: suspends and raises hyoid apparatus.

2. M. articulomylothyroideus
 FORM AND RELATIONSHIPS: thin band just below the skin; caudal to articulothyroideus; superficial to geniothyroideus.
 ORIGIN: pars articularis, caudal process between origin of articulothyroideus and insertion of biventer maxillae by fibers.
 INSERTION: on mylothyroideus at caudal limit of its median raphe.
 ACTION: aids in suspending hyoid apparatus.

3. M. geniothyroideus, geniothyroid - (See Plate 2)

4. M. mylothyroideus, mylothyroid
 FORM AND RELATIONSHIPS: broad and flat covering area between mandibles; just under the skin; superficial to articulothyroideus and depressor glossi; anterior to articulomylothyroideus.
 ORIGIN: mandible, medial surface.
 INSERTION: the mylothyroideus of right and left side unite in a median raphe.
 ACTION: suspends and raises hyoid apparatus.

5. M. sternothyroideus, sternothyroid muscle
 FORM AND RELATIONSHIPS: most superficial of the tracheal group of muscles; long and ribbonlike extending the length of the neck; just under skin; under the articulomylothyroideus cranially, over tracheolateralis.
 ORIGIN: cranial thoracic air sac, by fibers; skin, by fascia.
 INSERTION: cricoid cartilage and arytenohyoids by fasciculae.
 ACTION: pulls larynx caudally.

6. M. tracheolateralis, lateral muscle of the trachea - (See Plate 4)

mylohyoideus

articulothyoideus

articulomylohyoideus

fascia around neck

SUPERFICIAL LAYER

salivary gland

median raphe

tracheolateralis

trachea

ceratoglossus

geniothyoideus

sternothyrothyoideus

SECOND LAYER

**HEAD - VENTRAL VIEW
PLATE 3**

Third and Fourth Layers

1. M. biventer maxillae, the biventer of the jaw - (See Plate 2)
2. M. ceratoentoglossus, ceratoentoglossal muscle
 FORM AND RELATIONSHIPS: a small band; under the submaxillary salivary glands and geniohyoideus; superficial to basientoglossus; lateral to depressor glossi.
 ORIGIN: hyoid ceratobranchial element, from lateral border.
 INSERTION: entoglossum, ventral surface.
 ACTION: depresses tip of tongue.
3. M. entotympanicus, the entotympanic muscle
 FORM AND RELATIONSHIPS: short, broad and flat; cranial to basisphenoid; caudal to quadratum, dorsal to pterygoideum.
 ORIGIN: basisphenoid, cranial portion by fibers.
 INSERTION: quadratum ventral process on mediocaudal surface.
 ACTION: aids in maintaining position of mandibula.
4. M. geniohyoideus, geniohyoid - (See Plate 2)
5. M. hyoideus transversus, transverse hyoid muscle
 FORM AND RELATIONSHIPS: broad band, within right and left cornua of hyoid; deeper than the geniohyoideus but superficial to basibranchial element.
 ORIGIN: basibranchial, lateral border.
 INSERTION: ceratobranchial, medial border.
 ACTION: aids closure of larynx by drawing ceratobranchials medially.
6. M. mandibulopalatinus, the mandibulopalatine muscle
 FORM AND RELATIONSHIPS: small, slightly triangular; just dorsal to skin of soft palate; ventral to orbital fossa; cranial to pterygomandibularis.
 ORIGIN: pars articularis, medial to the coronoid process.
 INSERTION: palatine, along lateral border of caudal articulating process by fibers.
 ACTION: pulls palatine laterally and ventrally.
7. M. sternothyrohyoideus, sternothyroid muscle - (See Plate 3)
8. M. temporalis et masseter, the temporal and masseter - (See Plate 1)
9. M. tracheolateralis, lateral muscle of the trachea
 FORM AND RELATIONSHIPS: long delicate muscle laterally on most of trachea.
 ORIGIN: trachea laterally about one-fourth the distance cranially from the bronchi by fibers.
 INSERTION: trachea ventrally; just caudal to superior larynx by fibers.
 ACTION: shortens trachea.

GLOSSUS-THIRD LAYER

HEAD-FOURTH LAYER

**HEAD AND GLOSSUS - VENTRAL VIEW
PLATE 4**

Fifth and Deep Layers

1. M. basientoglossus, basientoglossal muscle
FORM AND RELATIONSHIPS: a small band; under ceratoentoglossus;
superficial to cranial slip of articulothyoideus.
ORIGIN: basihyal, cranioventral surface.
INSERTION: entoglossum, caudolateral process medial surface.
ACTION: depresses tongue.

2. M. depressor glossi, depressor of the tongue
FORM AND RELATIONSHIPS: quite small and thick; just below the
mylohyoideus; medial to ceratoentoglossus.
ORIGIN: basihyal, cranioventral surface.
INSERTION: entoglossum tip, ventrally.
ACTION: depresses the tongue.

3. M. thyrobasihyal, thyrobasihyal muscle
FORM AND RELATIONSHIPS: short and broad; dorsal to basibranchial,
basihyal, ceratobranchial and the hyoideus transversus; the
thyrobasihyals of each side meet medially just superficial to the
laryngeal cartilage.
ORIGIN: thyroid cartilage, from lateral and ventral surfaces.
INSERTION: basihyal, on dorsal surface.
ACTION: elevates the tongue when the thyrobasihyals of each side work
together; deflects tongue laterally when these act individually; aids
in pulling larynx cranially.

FOURTH LAYER

DEEP LAYER

**HEAD AND GLOSSUS, VENTRAL VIEW
PLATE 5**

First and Second and Deep Layers

1. M. obliquus oculi dorsalis, dorsal oblique muscle of the eye
 FORM AND RELATIONSHIPS: triangular; on dorsal surface of eye; lies over the quadratus oculi and under the rectus oculi dorsalis.
 ORIGIN: orbital fundus, from dorsocranial angle.
 INSERTION: sclera, dorsally.
 ACTION: rolls the eye dorsally and slightly caudally.

2. M. obliquus oculi ventralis, ventral oblique muscle of the eye
 FORM AND RELATIONSHIPS: narrow flat band in cranioventral region of the eye; lies over pyramidalis oculi, Harder's gland and sclera; cranio-medial to rectus oculi cranialis.
 ORIGIN: orbital fundus, just cranial to origin of obliquus oculi dorsalis by fibers.
 INSERTION: sclera, ventrally by fibers.
 ACTION: rolls the eye cranially.

3. M. pyramidalis oculi, pyramidalis muscle of the eye
 FORM AND RELATIONSHIPS: flat, triangular; on sclera of eye just anterior to optic nerve; tendon of the muscle lies in a sling formed by the quadratus oculi.
 ORIGIN: sclera, from an area just anterior to optic nerve and at insertion of rectus oculi ventralis.
 INSERTION: nictitating membrane on caudal free border by a tendon.
 ACTION: draws nictitating membrane across the eye; may work independently of other eye movements.

4. M. quadratus oculi, quadrate muscle of the eye
 FORM AND RELATIONSHIPS: broad and flat; composed of three fasciculi; lies dorsally and medially over the sclera; under the rectus oculi dorsalis, rectus oculi caudalis, rectus oculi cranialis, and obliquus oculi dorsalis; forms a sling for tendon of pyramidalis oculi.
 ORIGIN: sclera, dorsal quadrant of eye.
 INSERTION: sclera, just dorsal to optic nerve.
 ACTION: acts as a moveable pulley for tendon of pyramidalis oculi.

5. M. rectus oculi caudalis, caudal rectus muscle of the eye
 FORM AND RELATIONSHIPS: broad and flat; in caudal area of eye; anterior to caudal face of orbital plate of frontal bone.
 ORIGIN: alisphenoid.
 INSERTION: sclera, caudomedially.
 ACTION: rolls eye craniomedially.

6. M. rectus oculi cranialis, cranial rectus muscle of the eye.
 FORM AND RELATIONSHIPS: broad, triangular and flat; superficial to sclera and quadratus oculi.
 ORIGIN: interorbital plate dorsal to optic foramen by fibers.
 INSERTION: sclera, cranial portion of the eye by fibers.
 ACTION: rolls the eye cranially.

7. M. rectus oculi dorsalis, dorsal rectus muscle of the eye
 FORM AND RELATIONSHIPS: triangular; dorsocaudally on eye.
 ORIGIN: orbital plate, just caudal to optic foramen by a tendon.
 INSERTION: sclera superficially to insertion of obliquus oculi dorsalis by loose fascia.
 ACTION: rolls eye dorsocaudally.

8. M. rectus oculi ventralis, ventral rectus of the eye
FORM AND RELATIONSHIPS: flat band in caudoventral region of eye; lies over pyramidalis oculi, under Harder's gland.
ORIGIN: orbital fundus ventral to optic foramen by fibers.
INSERTION: sclera, ventral surface of the eye by fibers.
ACTION: rolls the eye ventrally.

FIRST LAYER

SECOND LAYER

DEEP LAYERS

Superficial Layer

1. M. biventer cervicis, two-bellied cervical muscle
 FORM AND RELATIONSHIPS: long, thin and tapering to head; most dorsal and medial of neck muscles; under the complexus cranially, but otherwise just under the skin; over the longus colli dorsalis and rectus capitis dorsalis; tendinous at origin, becoming fleshy about three-fourths caudally on neck, then tendinous again at about one-half caudally on neck and fleshy again in region of atlas.
 ORIGIN: thoracic vertebrae one and two, dorsal spines by aponeurosis (tendon-like) in common with tendon of longus colli dorsalis.
 INSERTION: occipital crest, medially by fibers.
 ACTION: elevation of head and accentuation of sigmoid curve of neck.

2. M. complexus, complex muscle
 FORM AND RELATIONSHIPS: flat and wide; broadening from origin to give a triangular shape; most dorsal and cranial of the neck muscles; under cutaneus colli lateralis; over and dorsal to trachelomastoideus.
 ORIGIN: cervical vertebrae one, three and four (prezygapophyses) by fascia and fibers.
 INSERTION: occipital crest, dorsally, by fascia.
 ACTION: dorsal flexion of the head.

3. M. cutaneus cleidodorsalis, cleidodorsal cutaneous muscle
 FORM AND RELATIONSHIPS: narrow and flat; just under the skin; over the neck muscles in region of cervical vertebrae thirteen and fourteen.
 ORIGIN: from fascia in ventrocranial omobrachial region.
 INSERTION: spinal pteryla dorsal to fourteenth cervical vertebrae, by fibers in common with inserting fibers of cutaneus spinalis dorsalis.
 ACTION: works with cutaneus spinalis dorsalis to elevate feathers of the spinal pteryla.

4. M. cutaneus colli lateralis, lateral cutaneous muscle of the neck
 FORM AND RELATIONSHIPS: sheet-like, with scanty fibers; forms sheath over muscles of neck, trachea and esophagus.
 ORIGIN: petrous temporal, from caudal border of the external auditory meatus.
 INSERTION: skin of neck laterally and ventrally to level of about the twelfth cervical vertebra.
 ACTION: elevates cervical feathers of the spinal pteryla with cutaneous nuchalis.

5. M. cutaneus nuchalis, nuchal cutaneous muscle
 FORM AND RELATIONSHIPS: six ribbon-like fasciculi in middle two-thirds of neck; under cutaneus colli lateralis and sternothyroideus; the superficial neck muscles.
 ORIGIN: fascia surrounding superficial neck muscles, by fibers which originate ventromedially.
 INSERTION: spinal pteryla in cervical region, by fibers continuous with inserting fibers of cutaneus colli lateralis.
 ACTION: works with cutaneus colli lateralis to elevate cervical feathers of spinal pteryla.

NECK-DORSAL VIEW SUPERFICIAL LAYER
PLATE 7

First Layer

1. M. biventer cervicis, caudal and cranial belly - (See Plate 7)
2. M. interspinales craniales, cranial interspinales, three in number
FORM AND RELATIONSHIPS: ribbon-like; lateral to posterior part of longus colli dorsalis; dorsomedial to obliqui colli; over the obliquotransversales and interspinous ligaments.
ORIGIN: cervical vertebrae ten, eleven and twelve, cranial surface of spinous processes by fibers.
INSERTIONS: cervical vertebrae eight, nine, and ten, spinous processes dorsocaudally by fibers.
ACTION: assists in elevation of the neck.
3. M. longus colli dorsalis, the long muscle of the neck
FORM AND RELATIONSHIPS: long, thin multi-fasciculated muscle dorsal on neck; under the skin and biventer cervicis; over the cervical and first two thoracic vertebrae; dorsal to obliqui colli.
ORIGIN: thoracic vertebrae one and two dorsal spines in common with biventer cervicis.
INSERTIONS: postzygapophyses, dorsocaudally; seven ribbon-like fasciculi extend cranially to insert on fourteenth to seventh cervical vertebrae; main muscle becomes tendinous at level of seventh cervical vertebra and then gives off six more broad, ribbon-like fasciculi which extend caudally to insert on the eighth to third cervical vertebrae; terminal tendon inserts on axis.
ACTION: cranially directed fasciculi elevate neck; caudally directed fasciculi aid in elevating head.

NECK-DORSAL VIEW SECOND LAYER
PLATE 8

Superficial Layer

1. M. articulothylohyoideus - (See Plate 3)
2. M. biventer maxillae - (See Plate 2)
3. M. complexus - (See Plate 7)
4. M. geniohyoideus - (See Plate 2)
5. M. interspinales craniales - (See Plate 8)
6. M. intertransversales - (See Plate 10)

7. M. longi colli, the long neck muscles - (See Also Plate 13)
 This is a complex group of interrelated muscles on the superficial and ventral aspect of the neck. For convenience, the group is subdivided into three groups of fasciculi and each is considered separately.

8. M. longissimus dorsi - (See Plate 15)
9. M. longus colli dorsalis - (See Plate 8)
10. M. longus colli ventralis caudalis - (See Plate 13)
11. M. longus colli ventralis cranialis - (See Plate 13)
12. M. longus colli ventralis medialis - (See Plate 13)

13. M. obliqui colli, the lateral oblique muscles of the neck
 FORM AND RELATIONSHIPS: a complex group of ten slender muscles lateral and superficial on neck from region of third cervical to second thoracic vertebra; just deep to the skin, cutaneus nuchalis and fascia of cutaneus colli lateralis; dorsal to intertransversales interarticulares and obliquotransversales.
 ORIGINS: all arise by fibers laterally on the transverse processes of vertebrae:
 1. sixth cervical vertebra
 2. seventh cervical vertebra
 3. eighth cervical vertebra
 4. ninth cervical vertebra
 5. tenth cervical vertebra
 6. eleventh cervical vertebra
 7. fourteenth cervical vertebra, three fasciculi
 8. first thoracic vertebra
 9. second thoracic vertebra
 10. second thoracic vertebra, in common with No. 9.
 INSERTIONS: all insert by tendons dorsocaudally on postzygapophyses of vertebrae:
 1. third cervical vertebra
 2. on fifth cervical vertebra after receiving tendon of a fasciculus of longus colli dorsalis
 3. on sixth cervical vertebra after receiving tendon of a fasciculus of longus colli dorsalis
 4. on seventh cervical vertebra after receiving tendon of a fasciculus of longus colli dorsalis
 5. on eighth cervical vertebra after receiving fibers from No. 6 of the obliqui colli
 6. on eighth cervical vertebra with No. 5
 7. two fasciculi insert on the tenth cervical vertebra; one fasciculus on the eleventh cervical vertebra
 8. thirteenth cervical vertebra
 - 9 & 10. in common on the fourteenth cervical vertebra.
 ACTION: lateral movement of neck or dorsal flexion if all ten pairs contract simultaneously.

14. M. rectus capitis lateralis, lateral rectus of the head
FORM AND RELATIONSHIPS: flat and triangular; deep to the cutaneous colli lateralis; ventral to complexus and trachelomastoideus; dorsal to rectus capitis ventralis.
ORIGIN: cervical vertebrae three and four, ventral spines, by fibers.
INSERTION: occipital crest, by fascia in common with that of complexus.
ACTION: ventrolateral flexion of head.
15. M. rectus capitis ventralis, ventral rectus of the head
FORM AND RELATIONSHIPS: long and triangular, dorsal to esophagus in region of first four cervical vertebrae; under cutaneous colli lateralis; ventral to rectus capitis lateralis and basitemporal plate.
ORIGIN: third to sixth cervical vertebrae, by fibers ventrally from the centra.
INSERTION: basitemporal plate, by fibers.
ACTION: ventral flexion of the head.
16. M. sacrolumbalis - (See Plate 14)
17. M. scalenius - (See Plate 25)
18. M. tendon biventer cervicis - (See Plate 7)
19. M. trachelomastoideus - (See Plate 10)

NECK-LATERAL VIEW SUPERFICIAL LAYER
PLATE 9

Second Layer

1. M. biventer cervicis - (See Plate 7)
2. M. complexus - (See Plate 7)
3. M. interspinales craniales - (See Plate 8)
4. M. intertransversales, intertransversus muscles of the neck
 FORM AND RELATIONSHIPS: a group of short straplike fasciculi intimately bound to one another; between cervical vertebrae two and three, through thirteen and fourteen; under cutaneus colli lateralis; lateral to obliquotransversales; dorsal to longi colli ventrales.
 ORIGIN: cervical vertebrae three to fourteen fused diapophysis-parapophysis laterally by fibers.
 INSERTION: cervical vertebrae two to thirteen neurapophysis and fused parapophysis.
 ACTION: lateral flexion of neck.
5. M. longus colli dorsalis - (See Plate 8)
6. M. longus colli ventralis caudalis - (See Plate 13)
7. M. longus colli ventralis cranialis - (See Plate 13)
8. M. longus colli ventralis medialis - (See Plate 13)
9. M. obliquotransversales - (See Plate 11)
10. M. obliquus capitis caudalis, caudal oblique muscle of the head
 FORM AND RELATIONSHIPS: short, thick, double; under trachelomastoideus, complexus and rectus capitis dorsalis; over the interarticulares between axis and atlas.
 ORIGIN: fourth cervical vertebra, laterally from alar process by fibers; second cervical vertebra, prezygapophysis and postzygapophysis by fibers.
 INSERTION: atlas, lateral aspect of caudal articulating surface by fibers.
 ACTION: dorsal flexion of head.
11. M. rectus capitis dorsalis - (See Plate 11)
12. M. trachelomastoideus, trachelomastoid muscle
 FORM AND RELATIONSHIPS: well-developed muscle with three fasciculi; separate origins; common insertion; lateral on neck in region of first four cervical vertebrae; under the rectus capitis dorsalis and complexus; over the obliqui capitis caudales; dorsal to rectus capitis lateralis.
 ORIGIN: (a) cranial fasciculus--postzygapophysis of axis dorsal surface by fibers.
 (b) middle fasciculus--postzygapophysis of third cervical vertebra, lateral surface by fibers.
 (c) caudal fasciculus--postzygapophysis of fourth cervical vertebra, lateral surface by fibers.
 INSERTION: basitemporal plate of skull, caudal tubercle by fibers.
 ACTION: ventral flexion of the head and neck.

NECK-LATERAL VIEW SECOND LAYER
PLATE 10

Third Layer

1. M. biventer cervicis - (See Plate 7)
2. M. interarticulares, interarticular muscles; eleven in number
 FORM AND RELATIONSHIPS: deepest muscles of the neck; broad bands between the cervical vertebrae beginning with second and third; lie under the obliquotransversales and obliquospinales.
 ORIGIN: cervical vertebrae neural arches dorsolaterally just cranial to anapophyses by fibers.
 INSERTION: anapophyses of preceding vertebrae caudally.
 ACTION: lateral flexion of the neck.
3. M. longus colli dorsalis - (See Plate 8)
4. M. longus colli ventralis cranialis - (See Plate 13)
5. M. longus colli ventralis medialis - (See Plate 13)
6. M. obliquospinales, oblique muscle of the neck
 FORM AND RELATIONSHIPS: three ribbon-like muscles in region of seventh to eleventh cervical vertebrae; under longus colli dorsalis; over and medial to interarticulares.
 ORIGIN: cervical vertebrae nine, ten and eleven, spinous processes craniolaterally by fibers.
 INSERTION: cervical vertebrae seven, eight and nine, to neural arches dorsocaudal aspect by fibers.
 ACTION: aid in dorsal flexure of the neck.
7. M. obliquotransversales, oblique muscles of the neck
 FORM AND RELATIONSHIPS: short, vermiform bands just under the obliqui colli and with some fibers inserting in obliqui colli; over the cervical vertebrae; dorsomedial to interarticulares.
 ORIGIN: cervical vertebrae seven through fourteen, prezygapophyses laterocranially by fibers.
 INSERTION: cervical vertebrae five through twelve, postzygapophyses dorsal surfaces and spinous processes lateral surfaces by fibers.
 ACTION: dorsal flexion of neck and maintenance of neck curvature.
8. M. obliquus capitis caudalis - (See Plate 10)
9. M. rectus capitis dorsalis, dorsal rectus of the head
 FORM AND RELATIONSHIPS: short, thick and triangular; dorsal to atlas, axis and obliqui capitis caudales; below the complexus and biventer cervicis.
 ORIGIN: axis, dorsal process by fibers.
 INSERTION: occipital bone, dorsally and laterally around foramen magnum by fibers.
 ACTION: dorsal flexion of head.

NECK-LATERAL VIEW THIRD LAYER
PLATE II

Superficial Layer

1. M. cutaneus nuchalis - (See Plate 7)
2. M. pectoralis superficialis - (See Plate 20)

NECK-VENTRAL VIEW SUPERFICIAL LAYER
PLATE 12

Second and Third Layers

1. M. complexus - (See Plate 7)
2. M. longus colli ventrales - (See Plate 9)
3. M. longus colli ventralis caudalis, long caudoventral neck muscles
 FORM AND RELATIONSHIPS: five straplike fasciculi; just under the pleural peritoneum in region of the crop.
 ORIGIN: thoracic vertebrae two, three and four; fused hypapophyses laterally, by fibers.
 INSERTION: cervical vertebrae ten through fourteen cervical ribs, by tendons. A small group of fibers inserts in common with each of the inserting tendons (these accessory fibers originate on the centra of the vertebrae to which the tendons insert).
 ACTION: ventral flexion at base of neck.
4. M. longus colli ventralis cranialis, long cranioventral neck muscles
 FORM AND RELATIONSHIPS: a complex mass of loosely connected fasciculi; under trachelomastoideus and rectus capitis ventralis; over cervical vertebrae two through five.
 ORIGIN: cervical vertebra five, from hypapophysis, by a tendon and fibers; and cervical vertebra four, by fibers from hypapophysis.
 INSERTION: cervical vertebrae two, three and four; centra and hypapophyses, by fibers.
 ACTION: ventral flexion of head and neck.
5. M. longus colli ventralis medialis, long medioventral neck muscles
 FORM AND RELATIONSHIPS: five long fused fasciculi; just under the skin; over the cervical vertebrae.
 ORIGIN: cervical vertebrae thirteen and fourteen and the first thoracic vertebra, parapophyses, broadly by muscle. The fasciculi extend cranially and terminate in five inserting tendons:
 INSERTIONS: 1. the most lateral fasciculus inserts by a tendon to the cervical rib of cervical vertebra ten (two small accessory fasciculi originate from centra of cervical vertebrae eleven and twelve and fuse with the main fasciculus)
 2. the next fasciculus medially, inserts on the cervical rib of cervical vertebrae nine (two small accessory fasciculi from centra of cervical vertebrae ten and eleven join with the main fasciculus)
 3. the middle fasciculus inserts on cervical rib of cervical vertebra eight (there are three small accessory fasciculi from centra of cervical vertebrae nine and ten and from parapophysis of cervical vertebra twelve)
 4. the fourth fasciculus inserts on cervical rib of cervical vertebra seven after having received three small accessory fasciculi (these originate from centra of cervical vertebrae eight and nine and from parapophysis of eleven)
 5. the most medial fasciculus has two inserting tendons-- one inserts on the cervical rib of cervical vertebra six after receiving five accessory fasciculi from seventh through eleventh cervical vertebrae. The second main inserting tendon terminates on the cervical rib of cervical vertebra five.
 ACTION: ventral flexion of neck and reduction of its sigmoid curve.
6. M. trachelomastoideus - (See Plate 10)

NECK-VENTRAL VIEW
PLATE 13

Superficial Layer

1. M. externus abdominis - (See Plate 25)
2. M. intercostales superficiales, superficial intercostal muscles
FORM AND RELATIONSHIPS: short; deep to fascia of rectus abdominis sacrolumbalis; superficial to intercostales externales.
ORIGIN: uncinat processes, ventral border by fibers.
INSERTION: rib, caudal to preceding uncinat process, by fibers.
ACTION: draws thoracic ribs caudally.
3. M. levatores costarum - (See Plate 24)
4. M. longissimus dorsi - (See Plate 15)
5. M. longus colli dorsalis - (See Plate 8)
6. M. longus colli ventralis caudalis - (See Plate 13)
7. M. longus colli ventralis medialis - (See Plate 13)
8. M. obliqui colli - (See Plate 9)
9. M. sacrolumbalis, cranial and caudal fasciculus
FORM AND RELATIONSHIPS: composed of two fasciculi; cranial fasciculus is long straplike; the caudal is triangular; deep to rhomboideus, serratus dorsalis, sartorius and scapula; superficial to levatores costarum, scalenius and longissimus dorsi.
ORIGIN: caudal fasciculus, by fibers from cranial fasciculus in the region of the third to fifth thoracic ribs; ilium, cranial border from caudal fasciculus by fibers.
INSERTION: cervical vertebrae, thirteen and fourteen, from cranial fasciculus by fibers; thoracic vertebrae three, four, five from caudal fasciculus by fascia and fibers.
ACTION: elevates thorax.

SUPERFICIAL LAYER

TRUNK AND BASE OF NECK-LATERAL VIEW PLATE 14

Second Layer

1. M. intercostales externales, external intercostal muscle
 FORM AND RELATIONSHIPS: five in number, thin, short and flat; deep to pectoralis superficialis, teres, serratus ventralis, intercostales superficiales; superficial to pleura by intercostales internales by third, fourth and fifth intercostales externales.
 ORIGIN: second through sixth thoracic ribs, caudal border and uncinat processes, ventral borders by fibers.
 INSERTION: third through seventh thoracic rib, cranial borders ventral to uncinat process by fibers.
 ACTION: draws preceding rib caudally or succeeding rib cranially.

2. M. levatores costarum - (See Plate 24)

3. M. longissimus dorsi, dorsal longissimus
 FORM AND RELATIONSHIPS: composed of a number of inseparable fasciculi; the caudal fasciculus, the most distinct is fusiform; the cranial fasciculi forms a straplike complex unit; deep to sacro-lumbalis, rhomboides; superficial to transverse processes of the sacral, lumbar, and thoracic ribs.
 ORIGIN: ilium, medioventral border, synsacral and thoracic vertebrae, dorsal spines and transverse processes, by fibers.
 INSERTION: lumbar, thoracic, and cervical vertebrae, transverse processes and spines, by tendons.
 ACTION: elevates thorax and base of neck.

4. M. longus colli dorsalis - (See Plate 8)
5. M. longus colli ventralis caudalis - (See Plate 13)
6. M. longus colli ventralis medialis - (See Plate 13)

SECOND LAYER

TRUNK AND BASE OF NECK - LATERAL VIEW
PLATE 15

Superficial

1. M. cutaneus cleidodorsalis - (See Plate 7)
2. M. cutaneus costohumeralis, costohumeral cutaneous muscle
 FORM AND RELATIONSHIPS: long and straplike, superficial and lateral on trunk; under the skin, sartorius, triceps and intercostales externales; over serratus magnus, teres major and cranial fan of latissimus dorsi.
 ORIGIN: articulation of thoracic rib six with sternal rib four.
 INSERTION: humeral pteryla, by fibers, in common with insertion of cutaneus iliacus.
 ACTION: elevates feathers of humeral pteryla.
3. M. cutaneus iliacus, cutaneous muscle of the flank
 FORM AND RELATIONSHIPS: short, thin and straplike; just under the skin; over caudal and cranial fans of latissimus dorsi.
 ORIGIN: fascia sling over thoracic vertebra five and ilium, by fibers, in common with cutaneus spinalis dorsalis.
 INSERTION: humeral pteryla, by fibers.
 ACTION: elevates feathers of humeral pteryla.
4. M. cutaneus spinalis dorsalis, dorsal cutaneous muscle of the cervico-thoracic area
 FORM AND RELATIONSHIPS: long and straplike; most dorsal of the cutaneous muscles; just under the skin; over latissimus dorsi and longus colli dorsalis.
 ORIGIN: lumbodorsal fascia, by fibers, in common with cutaneus iliacus.
 INSERTION: spinal pteryla at about thirteenth cervical vertebra, by fibers, in common with cutaneus cleidodorsalis; fibers spread out indistinctly on the skin.
 ACTION: with cutaneus cleidodorsalis elevates feathers of dorsal pteryla.
5. M. deltoideus - (See Plate 17)
6. M. latissimus dorsi, wide dorsal muscle
 FORM AND RELATIONSHIPS: two-headed muscle; cranial and caudal heads; cranial head is fan-shaped; deep to skin, cutaneus spinalis dorsalis, caput dorsale of triceps; superficial to teres major; trapezius and caput ventrale and internale of the triceps; caudal head short and thick; deep to cutaneus iliacus, skin; superficial to trapezius.
 ORIGIN: cranial head: first, second and third thoracic vertebrae, dorsal spines, by fascia.
 caudal head: fourth and fifth thoracic vertebrae, dorsal spines, by fascia, and fascia at the origin of sartorius and dorsal distal border of the scapula.
 INSERTION: cranial head: humerus, caudally and one-third distally, by fibers.
 caudal head: head of humerus, caudal border by loose fascia.
 ACTION: flexes and abducts brachium.
7. M. sacrolumbalis - (See Plate 14)
8. M. sartorius - (See Plate 32)
9. M. serratus magnus - (See Plate 18)
10. M. teres - (See Plate 17)
11. M. trapezius - (See Plate 18)
12. M. triceps - (See Plates 17 & 18)

SUPERFICIAL LAYER

TRUNK AND SHOULDER-DORSAL VIEW
PLATE 16

Second Layer

1. M. biceps brachii - (See Plate 54)
2. M. cutaneus costohumeralis - (See Plate 16)
3. M. deltoideus, the deltoid
 FORM AND RELATIONSHIPS: long, thick and tapered; just under skin; over scapulohumeralis maximus, caput internale of triceps and insertion of latissimus dorsi; caudal to proximal portion of patagialis; cranial to caput dorsale of triceps.
 ORIGIN: scapula, from proximodorsal aspect just caudal to origin of scapulohumeralis maximus by fibers.
 INSERTION: humerus, distocaudal two-thirds by a tendon; inserting tendon continues distally to join the inserting tendon of triceps.
 ACTION: flexes and abducts brachium.
4. M. interspinales craniales - (See Plate 8)
5. M. latissimus dorsi, caput caudale - (See Plate 16)
6. M. longissimus dorsi, cranial fan - (See Plate 15)
7. M. longus colli dorsalis - (See Plate 8)
8. M. longus colli ventrales - (See Plate 13)
9. M. patagialis - (See Plate 20)
10. M. sacrolumbalis - (See Plate 14)
11. M. sartorius - (See Plate 32)
12. M. serratus magnus - (See Plate 18)
13. M. teres
 FORM AND RELATIONSHIPS: largest muscle of scapular region; deep to latissimus dorsi, tensor patagii caudalis; superficial to serratus magnus, serratus ventralis, intercostales externales and scapula.
 ORIGIN: scapula, lateral and ventral borders by fibers.
 INSERTION: humeral crest, by a tendon and to tendon of tensor patagii caudalis by a small slip of fibers.
 ACTION: pronates and flexes brachium.
14. M. trapezius - (See Plate 18)
15. M. triceps, the triceps, a three-headed muscle (caputi dorsale, ventrale and internale) along the medial border of the humerus.
 - a. caput dorsale
 FORM AND RELATIONSHIPS: long, fusiform; just under the skin; medial to biceps brachii and deltoideus; dorsal to caputi internale and ventrale and to insertion of latissimus dorsi.
 ORIGIN: scapula, proximodorsally, by a tendon.
 INSERTION: ulna, olecranon process by tendon.
 ACTION: extends antibrachium.
 - b. caput internale - (See Plate 18)
 - c. caput ventrale
 FORM AND RELATIONSHIPS: triangular because of three originating fasciculi; under skin and tensor patagi caudalis; ventral to latissimus dorsi and caput internale; along ventral border of humerus.
 ORIGIN: (a) humerus, near head, (b) humerus, pneumatic fossa, (c) humerus, bicipital crest and ventrocaudal border.
 INSERTION: ulna, olecranon process by tendon.
 ACTION: extends antibrachium.

TRUNK AND SHOULDER-DORSAL VIEW
PLATE 17

Third Layer

1. M. coracobrachialis dorsalis tendon - (See Plate 19)
2. M. latissimus dorsi, cranial fan - (See Plate 16)
3. M. pectoralis profundus tendon - (See Plate 21)
4. M. pectoralis superficialis - (See Plate 20)
5. M. rhomboideus, rhomboid muscle
 FORM AND RELATIONSHIPS: thin and flat; deep to trapezius latissimus dorsi; superficial to longissimus dorsi.
 ORIGIN: thoracic vertebrae one through five, dorsal spines, by fibers and fascia.
 INSERTION: scapula, caudal two-thirds on dorsomedial surface, by fibers.
 ACTION: elevates caudal part of scapula.
6. M. sacrolumbalis - (See Plate 14)
7. M. sartorius - (See Plate 32)
8. M. scapulohumeralis maximus, the large scapulohumeral muscle
 FORM AND RELATIONSHIPS: broad, flat, tapering; under patagialis and deltoides; caudal to pectoralis superficialis over the shoulder (omobrachium) articulations, originating tendon of biceps brachii and inserting tendon of pectoralis profundus.
 ORIGIN: coracoid, dorsomedial tuberosity, by fibers; scapula, proximodorsal portion, by fibers.
 INSERTION: humerus, proximodorsal tuberosity deltoid crest, by fibers.
 ACTION: abducts brachium.
9. M. serratus magnus
 FORM AND RELATIONSHIPS: triangular, flat and thin; deep to skin, sartorius, teres major; superficial to intercostales externales of the fourth through sixth ribs and uncinat processes of third through fifth ribs.
 ORIGIN: vertebral ribs, four through six ventral to articulation of the uncينات processes, by fascia.
 INSERTION: scapula, ventrocaudal angle, by fibers.
 ACTION: depresses caudal part of scapula.
10. M. tensor patagii longus - (See Plate 20)
11. M. teres - (See Plate 17)
12. M. trapezius
 FORM AND RELATIONSHIPS: thin and flat; deep to latissimus dorsi; superficial to rhomboideus.
 ORIGIN: thoracic vertebrae four and five, dorsal border of fused spines, by fibers and thoracic vertebrae one through four, by fascia.
 INSERTION: scapula, vertebral border and dorsomedial surface from the dorsal angle to the neck, by fibers.
 ACTION: elevates scapula, thereby, elevating cranial portion of sternum.
13. M. triceps - (See Also Plate 17)
caput internale
 FORM AND RELATIONSHIPS: long and thin; along caudal surface of humerus; under caputi dorsale and ventrale triceps; dorsal to inserting fibers of latissimus dorsi.
 ORIGIN: humerus, along entire caudal border, by fibers.
 INSERTION: ulna, olecranon process, by fibers.
 ACTION: extends antibrachium.

TRUNK AND SHOULDER-DORSAL VIEW
PLATE 18

Fourth Layer

1. M. coracobrachialis dorsalis, dorsal coracobrachial muscle
 FORM AND RELATIONSHIPS: fusiform; lying between furcula and coracoid; under pectoralis superficialis; over the pleural cavity.
 ORIGIN: manubrium, laterally by fibers; coracoid, dorsoproximal two-thirds, by fibers.
 INSERTION: humerus deltoid crest, by a tendon.
 ACTION: extends brachium.
2. M. coracobrachialis ventralis, ventral coracobrachial muscle
 FORM AND RELATIONSHIPS: long and triangular; two fasciculi; under pectoralis superficialis, dorsolateral to pectoralis profundus; over coracoid, sternocoracoideus and subcoracoideus.
 ORIGIN: coracoid, dorsal border, by fibers; sternum, ventrolateral part of craniolateral process, by fibers.
 INSERTION: humerus, pneumatic fossa, by a tendon.
 ACTION: adducts brachium.
3. M. coracohumeralis, coracohumeral muscle
 FORM AND RELATIONSHIPS: fusiform; under pectoralis superficialis and inserting tendon of biceps brachii.
 ORIGIN: coracoid, proximomedial tuberosity, by heavy tendon.
 INSERTION: humerus, base of deltoid crest ventrally, by fibers.
 ACTION: extends brachium.
4. M. intercostale externale - (See Plate 15)
5. M. levatores costarum - (See Plate 24)
6. M. pectoralis profundus tendon - (See Plate 21)
7. M. rhomboideus - (See Plate 18)
8. M. sacrolumbalis - (See Plate 14)
9. M. sartorius - (See Plate 32)
10. M. scapulohumeralis minimus, small scapulohumeral muscle
 FORM AND RELATIONSHIPS: small, cordlike; under caput ventrale and caput internale of triceps; over inserting tendon of coracobrachialis ventralis.
 ORIGIN: scapular neck, ventral and just cranial to scapulohumeralis ligament, by fibers.
 INSERTION: humerus, pneumatic fossa just proximal to pneumatic foramen, by fibers.
 ACTION: pronates brachium.
11. M. serratus dorsalis, dorsal serrate muscle
 FORM AND RELATIONSHIPS: composed of three short and flat fasciculi; deep to scapula; superficial to levatores costarum, sacrolumbalis.
 ORIGIN: first rib, cranial border by fibers from cranial fasciculus; second rib, caudal border by fibers from the medial and caudal fasciculi.
 INSERTION: scapula, medial surface cranial to its dorsal and ventral angles by fibers from the three fasciculi.
 ACTION: elevates thoracic ribs dorsocaudally.
12. M. serratus magnus - (See Plate 18)
13. M. serratus ventralis, ventral serrate muscle
 FORM AND RELATIONSHIPS: small; deep to teres, pectoralis superficialis;

and superficial to levatores costarum of the second rib.
ORIGIN: second rib, lateral border ventral to articulation of the
uncinate process, by fibers.
INSERTION: scapula, ventral border three cm. distal to glenoid facet by
fascia.
ACTION: elevates asternal rib II.

14. M. subcoracoideus - (See Plate 23)

15. M. subscapularis, the subscapular muscle
FORM AND RELATIONSHIPS: two triangular fasciculi; just under scapula
anteriorly; over peritoneum and first levator costarum.
ORIGIN: scapula, by fibers, from craniomedial fourth and the coracoid,
proximomedial surface, by fibers.
INSERTION: on tendon of subcoracoideus.
ACTION: with the subcoracoideus it pronates and flexes brachium.

Superficial Layer

1. M. basirectricales, the basirectrical muscle
 FORM AND RELATIONSHIPS: fibers of this muscle are folded over shafts of caudal rectrices; deep to skin, levator rectricum, depressor rectricum and caudalis lateralis; superficial to shafts of caudal rectrices.
 ORIGIN: pygostyle, lateral surface, by fibers.
 INSERTION: caudal rectrices, shafts, by fascia.
 ACTION: spreads caudal rectrices laterally.
2. M. caudalis lateralis - (See Plate 30)
3. M. cutaneus costohumeralis - (See Plate 16)
4. M. cutaneus pectoralis caudalis, caudal cutaneous muscle of the breast
 FORM AND RELATIONSHIPS: thin; straplike; just under the skin; over pectoralis superficialis.
 ORIGIN: sternum, fascia over caudal lateral process, by fibers.
 INSERTION: lateral and ventral pteryla, by fibers, in common with cutaneus pectoralis cranialis.
 ACTION: elevates feathers of lateral and ventral pteryla.
5. M. cutaneus pectoralis cranialis, the cranial cutaneous muscle of the breast
 FORM AND RELATIONSHIPS: broad, flat and triangular; over pectoralis superficialis; just under the skin.
 ORIGIN: inserting fascia of teres, by fibers, as three united straplike fasciculi.
 INSERTION: lateral and ventral pteryla, by fibers; the most cranial fasciculus sends slips to tendon of tensor patagii caudalis.
 ACTION: elevation of feathers of lateral and ventral pteryla.
6. M. depressor caudae - (See Plate 22)
7. M. depressor rectricum - (See Plate 22)
8. M. eversor urodeum - (See Plate 30)
9. M. externus abdominis - (See Plate 25)
10. M. levator caudae - (See Plate 27)
11. M. levator rectricum - (See Plate 27)
12. M. patagialis, patagial muscle
 FORM AND RELATIONSHIPS: wide, straplike; just under skin; caudal to pectoralis superficialis; cranial to deltoideus; over and also cranial to scapulohumeralis maximus.
 ORIGIN: terminal fascia of pectoralis superficialis, over the dorso-distal portion of coracoid, by fibers.
 INSERTION: skin of wing, by extensive fascia; to fascia in proximal region of extensor carpi radialis superficialis.
 ACTION: tenses the wing fold.
13. M. pectoralis superficialis, superficial pectoral muscle
 FORM AND RELATIONSHIPS: the largest muscle of the turkey; broad, flat and fusiform; just under skin; three fasciculi.
 ORIGIN: (a) furcula, lateral border, by fibers.
 (b) keel, ventral crest, by fascia.
 (c) sternal ribs, by fibers, from fascia covering sternal ribs and sternal processes.

FOURTH LAYER

TRUNK AND SHOULDER - DORSAL VIEW
PLATE 19

INSERTION: humerus, laterodistal part of deltoid crest, by broad tendinous fascia; teres, by thin fascia.

ACTION: adducts brachium and omobrachium ventromedially.

14. M. tensor patagii caudalis, the caudal tensor of the skin of wing
FORM AND RELATIONSHIPS: mostly tendinous on caudal aspect of brachium; just under skin; over teres, caput ventrale of triceps and the pectoralis superficialis; receives some fibers from cutaneus pectoralis cranialis.
ORIGIN: subcoracoideus, and fascia of axial air sac, by tendon.
(This origin receives a small inserting slip from the teres.)
INSERTION: skin of antibrachium by fascia.
ACTION: tenses caudal skin of antibrachium and spreads the secondary feathers.
15. M. tensor patagii longus, the long tensor of the wing fold
FORM AND RELATIONSHIPS: not muscular in the turkey; long, tendinous forming the base of a triangle between brachium and antibrachium when wing is extended; just under the skin.
ORIGIN: pectoralis superficialis; a slip from patagialis.
INSERTION: sesamoid at distal extremity of radius.
ACTION: tenses patagium between shoulder and distal end of radius.
16. M. transversus perinei - (See Plate 30)
17. M. triceps caput internale - (See Plate 18)
18. M. triceps caput ventrale - (See Plate 17)

TRUNK AND TORSO-LEFT-LATERAL VIEW
PLATE 20

Second Layer

1. M. basirectricales - (See Plate 20)
2. M. coracobrachiales ventralis - (See Plate 19)
3. M. depressor caudae - (See Plate 22)
4. M. eversor urodeum - (See Plate 30)
5. M. externus abdominis - (See Plate 25)
6. M. intercostales externales - (See Plate 15)
7. M. levator caudae - (See Plate 27)
8. M. levator rectricum - (See Plate 27)

9. M. obliquus internus abdominis, the internal oblique muscle of the abdomen
 FORM AND RELATIONSHIPS: triangular, flat; deep to fascia of externus abdominis; superficial to transversus abdominis.
 ORIGIN: pubis, ventral border cranial-third; and ilium, cranioventral border, by fascia.
 INSERTION: sternal rib five, caudal border; thoracic rib seven, caudal border, by fascia.
 ACTION: compresses dorsal abdomen and draws ribs five, six and seven caudally.

10. M. patagialis - (See Plate 20)

11. M. pectoralis profundus, deep pectoral muscle
 FORM AND RELATIONSHIPS: a large breast muscle, long and fusiform; two fasciculi; mostly surrounded by pectoralis superficialis; lies over keel, sternum, coracoid and furcula; ventral to coracobrachialis ventralis.
 ORIGIN: keel, lateral surface, by fibers; sternum, cranial carinal margin, by fibers; furcula, lateral distal aspect, by fascia.
 INSERTION: humerus, area just distal to lateral aspect of deltoid crest, by a tendon.
 ACTION: abducts brachium.

12. M. pectoralis superficialis - (See Plate 20)

13. M. rectus abdominis, the rectus of the abdomen
 FORM AND RELATIONSHIPS: flat, thin, parallelogram; deep to externus abdominis; superficial to transversus abdominis.
 ORIGIN: sternum, dorsolateral process caudal angle, by fibers; caudo-lateral process, medial border, by fascia and fibers.
 INSERTION: pubis, ventral border caudal third, by fascia; caudal median raphe, by fascia.
 ACTION: compresses abdomen.

14. M. scalenius - (See Plate 25)
15. M. serratus magnus - (See Plate 18)

16. M. sphincter ani, anal sphincter
 FORM AND RELATIONSHIPS: sphincter; deep to skin; superficial to transversus perinei.
 ORIGIN AND INSERTION: from and to itself, by fibers.
 ACTION: constricts anal opening.

17. M. sternocostales - (See Plate 23)
18. M. subscapularis - (See Plate 19)
19. M. tensor patagii caudalis - (See Plate 20)

- 20. M. teres - (See Plate 17)
- 21. M. transversus perinei - (See Plate 30)
- 22. M. triceps caput internale - (See Plate 18)
- 23. M. triceps caput ventrale - (See Plate 17)

TRUNK AND TORSO—LEFT LATERAL VIEW
PLATE 21

Third Layer

1. M. caudalis lateralis - (See Plate 30)
2. M. coracobrachialis dorsalis - (See Plate 19)
3. M. depressor caudae, depressor of the tail
 FORM AND RELATIONSHIPS: triangular, thick and short; deep to caudalis lateralis, levator rectricum; superficial to caudal vertebrae, ventral surfaces of transverse processes and centra.
 ORIGIN: caudal vertebrae one, transverse process ventral surface, by fibers.
 INSERTION: pygostyle, transverse process ventral surface, by fibers.
 ACTION: depresses caudal vertebrae.
4. M. depressor rectricum, depressor of rectrices
 FORM AND RELATIONSHIPS: straplike, flat and narrow; deep to the skin; superficial to eversor urodeum, caudalis lateralis, lateralis rectricum.
 ORIGIN: pubis, ventral and caudal border, by fibers.
 INSERTION: fascia of rectrices one to five, in common with levator rectricum.
 ACTION: depresses caudal rectrix.
5. M. intercostales internales, internal intercostals
 FORM AND RELATIONSHIPS: three in number, small; deep to intercostales externales, superficial to abdominal peritoneum.
 ORIGIN: vertebral ribs four, five and six, caudal borders ventral to uncinat process, by fibers.
 INSERTION: vertebral ribs five, six and seven, cranial border ventral to the uncinat process, by fibers.
 ACTION: draws ribs cranially.
6. M. intercostales superficialis - (See Plate 14)
7. M. levator caudae - (See Plate 27)
8. M. levatores costarum - (See Plate 24)
9. M. sacrolumbalis - (See Plate 14)
10. M. scalenius - (See Plate 25)
11. M. serratus dorsalis - (See Plate 19)
12. M. sternocoracoideus, sternocoracoid muscle
 FORM AND RELATIONSHIPS: broad, flat and short; under coracobrachialis ventralis; over subcoracoideus and pleural peritoneum.
 ORIGIN: sternum, laterocranial process, ventral border, by fibers.
 INSERTION: coracoid, dorsomedial border, by fibers.
 ACTION: draws coracoid caudally.
13. M. sternocostales - (See Plate 24)
14. M. subscapularis - (See Plate 19)
15. M. transversus abdominis, the transverse muscle of the abdomen
 FORM AND RELATIONSHIPS: flat, thin; deep to obliquus internus abdominis, rectus abdominis, sternal ribs four & five and thoracic ribs five, six and seven; superficial to abdominal peritoneum.
 ORIGIN: pubis, ventral border by fibers; ilium, cranioventral border by fascia.
 INSERTION: caudal median raphe and sternum, laterocaudal process by fascia.
 ACTION: compresses abdomen.

THIRD LAYER

TRUNK AND TORSO-LEFT LATERAL VIEW
PLATE 22

First Layer

1. M. caudalis lateralis - (See Plate 30)
2. M. coracobrachialis dorsalis - (See Plate 19)
3. M. depressor caudae - (See Plate 22)
4. M. diaphragma, the diaphragm
 FORM AND RELATIONSHIPS: composed of three groups of fasciculi; cranial, medial and caudal.
 ORIGIN: sternal rib two and four, medial surface by fibers from the cranial fasciculus; thoracic rib six; articulation of thoracic rib six and sternal rib four, medial surfaces by three separate fasciculi of the medial fasciculus by fibers; transversus abdominis, by fascia; and thoracic rib seven, medial surface by the caudal fasciculi.
 INSERTION: pleural membrane surrounding lungs, separately by each fasciculus.
 ACTION: expansion of pleura surrounding lungs.
5. M. gluteus medius - (See Plate 29)
6. M. longus colli ventrales - (See Plate 13)
7. M. obturator internus, the internal obturator
 FORM AND RELATIONSHIPS: two heads with a common insertion; lateral head (caput laterale) is superficial to ilium, ischium, ilioischadic foramen, medial head (caput mediale) lies on medial surface of ischium.
 ORIGIN: lateral head - ilium, ischium, ilioischadic fossa; medial head - ischium, medial surface.
 INSERTION: femur, greater trochanter caudomedial face, by a tendon.
 ACTION: adducts thigh and draws it caudally.
8. M. pectoralis superficialis - (See Plate 20)
9. M. semitendinosus - (See Plate 33)
10. M. sternocoracoideus - (See Plate 22)
11. M. sternocostales
 FORM AND RELATIONSHIPS: two in number, short; deep to pectoralis superficialis, externus abdominis; superficial to thoracic pleura.
 ORIGIN: sternum, craniolateral process, lateral aspect of the apex by first (cranial) sternocostale and medial aspect of the apex by a tendon from the second (caudal) sternocostale.
 INSERTION: thoracic rib one, apex by fibers and tendon of the first sternocostale; and thoracic rib two, apex medial aspect by fibers of the second sternocostale.
 ACTION: depresses asternal ribs one and two.
12. M. sternotrachealis, sternotracheal muscle
 FORM AND RELATIONSHIPS: long and cylindrical; under esophagus cranially; over the crop; lateral to trachea and pleural peritoneum.
 ORIGIN: sternum, craniolateral process, by fibers.
 INSERTION: trachea, laterally by four fasciculi; about one-fourth the distance cranial to bronchi.
 ACTION: pulls trachea caudally.
13. M. subcoracoideus, subcoracoid muscle
 FORM AND RELATIONSHIPS: thick, triangular; under sternocoracoideus and coracoid; over pleural cavity.

ORIGIN: manubrium, by fibers dorsolaterally; coracoid, dorsomedially from proximal third, by fibers.

INSERTION: humerus, distal lip of ligamental grooves, by tendon. (This tendon also receives fibers of the subscapularis.)

ACTION: pronates and flexes brachium.

14. M. subcostales - (See Plate 24)

15. M. subscapularis - (See Plate 19)

16. M. transversus abdominis - (See Plate 22)

TRUNK AND TORSO-INTERNAL MEDIAL VIEW
PLATE 23

Second Layer

1. M. caudalis lateralis - (See Plate 30)
2. M. coracobrachialis dorsalis - (See Plate 19)
3. M. coracobrachialis ventralis - (See Plate 19)
4. M. depressor caudae - (See Plate 22)
5. M. gluteus medius - (See Plate 29)
6. M. intercostales internales - (See Plate 22)

7. M. levatores costarum
 FORM AND RELATIONSHIPS: five flat bands; deep to sacrolumbalis, serratus dorsalis, serratus ventralis, teres; superficial to the pleura.
 ORIGIN: thoracic vertebrae II to V, transverse processes by fascia and fibers.
 INSERTION: thoracic ribs II to VI, cranial borders by fascia and fibers.
 ACTION: draws ribs cranially.

8. M. obliquus internus abdominis - (See Plate 21)
9. M. obturator internus tendon - (See Plate 23)
10. M. rectus abdominis - (See Plate 21)
11. M. scalenius - (See Plate 25)
12. M. scapulohumeralis minimus - (See Plate 19)
13. M. semitendinosus - (See Plate 33)

14. M. serratus dorsalis, dorsal serrate muscle
 FORM AND RELATIONSHIPS: composed of three short and flat fasciculi; deep to scapula; superficial to levatores costarum, and sacrolumbalis.
 ORIGIN: thoracic rib I, cranial border by fibers from cranial fasciculus; thoracic rib II, caudal border by fibers from the medial and caudal fasciculi.
 INSERTION: scapula, medial surface, cranial to its dorsal and ventral angles by fibers from the three fasciculi.
 ACTION: elevates ribs I and II dorsocaudally.

15. M. sternocoracoideus - (See Plate 22)
16. M. sternocostales - (See Plate 23)

17. M. subcostales
 FORM AND RELATIONSHIPS: three in number; the first (cranial) is triangular; the second and third parallelogram; deep to pectoralis superficialis, dorsolateral sternal process; superficial to abdominal peritoneum.
 ORIGIN: sternum, craniolateral process on the caudal border by the first subcostales; sternal rib, caudal border by second subcostales; and sternal rib II by the third subcostales.
 INSERTION: sternal ribs I to III, cranial borders by first, second and third subcostales, respectively.
 ACTION: draws sternal ribs cranially.

18. M. teres - (See Plate 17)

SECOND LAYER

TRUNK AND TORSO-INTERNAL MEDIAL VIEW
PLATE 24

Third Layer

1. M. caudalis lateralis - (See Plate 30)
2. M. coracobrachialis dorsalis - (See Plate 19)
3. M. coracobrachialis ventralis - (See Plate 19)
4. M. cutaneous cleidodorsalis - (See Plate 7)
5. M. deltoideus - (See Plate 17)
6. M. depressor caudae - (See Plate 22)

7. M. externus abdominis, external muscle of the abdomen
FORM AND RELATIONSHIPS: long S-shaped; deep to skin, pectoralis superficialis and medial muscle of the thigh; superficial to rectus abdominis, obliquus internus abdominis, intercostales externales and sternal ribs.
ORIGIN: ischium and pubis, ventral borders; thoracic ribs I to V uncinat processes; thoracic ribs I to IV lateral surface.
INSERTION: median raphe, by fascia; sternum, cranial border of the dorsolateral process, by fascia; and dorsal border of sternal rib facets, by fascia.
ACTION: compresses abdomen and ribs.

8. M. intercostales externales - (See Plate 15)
9. M. intercostales superficiales - (See Plate 14)
10. M. pectoralis profundus - (See Plate 21)
11. M. pectoralis superficialis - (See Plate 20)
12. M. sacrolumbalis - (See Plate 14)

13. M. scalenius, the scalenius
FORM AND RELATIONSHIPS: composed of two fasciculi--cranial and caudal; deep to sacrolumbalis, teres, and scapula; superficial to lateral surface of thoracic ribs I and II.
ORIGIN: fourteenth cervical and first thoracic vertebrae, transverse processes, dorsal surface.
INSERTION: thoracic rib I, lateral surface, by fibers from cranial fasciculus; thoracic rib I, distocaudal surface, and uncinat process of thoracic rib II by fibers.
ACTION: elevates and draws thoracic ribs I and II cranially.

14. M. semitendinosus - (See Plate 33)
15. M. teres - (See Plate 17)
16. M. trapezius - (See Plate 18)

TRUNK AND TORSO-INTERNAL MEDIAL VIEW
PLATE 25

Fourth Layer

1. M. adductor magnus - (See Plate 34)
2. M. ambiens - (See Plate 34)
3. M. caudalis lateralis - (See Plate 30)
4. M. coracobrachialis ventralis - (See Plate 19)
5. M. cutaneus cleidodorsalis - (See Plate 7)
6. M. cutaneus costohumeralis - (See Plate 16)
7. M. cutaneus pectoralis cranialis - (See Plate 20)
8. M. depressor caudae - (See Plate 22)
9. M. externus abdominis - (See Plate 25)
10. M. gluteus medius - (See Plate 29)
11. M. iliacus - (See Plate 29)
12. M. pectoralis profundus - (See Plate 21)
13. M. pectoralis superficialis - (See Plate 20)
14. M. rhomboideus - (See Plate 18)
15. M. sartorius - (See Plate 32)
16. M. scapulohumeralis minimus - (See Plate 19)
17. M. semimembranosus - (See Plate 34)
18. M. semitendinosus - (See Plate 33)
19. M. serratus dorsalis - (See Plate 19)
20. M. serratus magnus - (See Plate 18)
21. M. teres - (See Plate 17)
22. M. trapezius - (See Plate 18)
23. M. vastus internus - (See Plate 35)
24. M. vastus medialis - (See Plate 32)

Superficial and Second Layers

1. M. depressor caudae - (See Plate 22)
2. M. depressor rectricum - (See Plate 22)
3. M. gluteus medius - (See Plate 29)
4. M. gluteus primus, large superficial gluteal muscle
FORM AND RELATIONSHIPS: broad, flat, fan-shaped and composed of two divisions: a cranial fan, tensor fascia latae and caudal fan, biceps femoris. Most superficial of the lateral thigh muscles and overlies the gluteus medius, gluteus minimus, gluteus superficialis, extensor femoris and biceps flexor cruris.
ORIGIN: ilium, dorsocranial crest by tensor fascia latae and dorsal crest by biceps femoris; originating fascia of the cranial fan, tensor fascia latae, is extensive and passes over the gluteus medius while the fascia of the caudal fan, biceps femoris, is short with fibers coming almost to the point of origin.
INSERTION: tibial aponeurosis, by fascia extending from both the cranial and caudal fan.
ACTION: cranial fan of tensor fascia latae draws thigh cranially with slight abduction, and the caudal fan of biceps femoris draws thigh caudally.
5. M. gluteus superficialis - (See Plate 29)
6. M. levator caudae, levator of the tail
FORM AND RELATIONSHIPS: composed of six fasciculi not easily separated; deep to skin; superficial to levator rectricum, interspinales caudae, the sacrum, dorsal surface, the ilium, medial surface of dorsocaudal convex surface.
ORIGIN: ilium, synsacral border; synsacral vertebrae, transverse processes, by fibers.
INSERTION: caudal vertebrae, dorsal processes, by tendons.
ACTION: elevates caudal vertebrae.
7. M. levator rectricum, levator of the rectricis
FORM AND RELATIONSHIPS: triangular; flat; deep to skin, levator caudae, superficial to depressor caudae, lateralis rectricum.
ORIGIN: caudal vertebra two, proximocaudal aspect of transverse process by fibers.
INSERTION: rectricis two to five, at bases by sheath-like tendons.
ACTION: elevates caudal rectrix.
8. M. longissimus dorsi - (See Plate 15)
9. M. sartorius - (See Plate 32)
10. M. semitendinosus - (See Plate 33)

PELVIS AND TAIL—DORSAL VIEW
PLATE 27

Third Layer

1. M. interspinales caudales, the caudal interspinals
FORM AND RELATIONSHIPS: five, very small; deep to levator caudae;
superficial to dorsal surface of caudal vertebrae.
ORIGIN: caudal vertebrae (except pygostyle), caudal aspect of spinous
process, by fibers.
INSERTION: caudal vertebrae 2, including pygostyle, cranial face of
spinous processes, by fibers.
ACTION: elevates caudal vertebrae.
2. M. levator caudae - (See Plate 27)
3. M. levator rectricum - (See Plate 27)

THIRD LAYER

FOURTH LAYER

TAIL - DORSAL VIEW
PLATE 28

Third and Fourth Layers

1. M. basirectricales - (See Plate 20)
2. M. depressor caudae - (See Plate 22)
3. M. depressor rectricum - (See Plate 22)
4. M. gluteus medius, median gluteal muscle
FORM AND RELATIONSHIPS: thick, oval-shaped; occupies cranial concave surface of ilium and is deep to the skin, cranial fan of gluteus primus, proximal two-thirds of the sartorius.
ORIGIN: ilium, cranial concave surface, by fibers.
INSERTION: femur lateral ridge of greater trochanter and cranioproximal aspect of the biceps flexor cruris by fascia.
ACTION: extends thigh.
5. M. gluteus minimus, lesser gluteal muscle
FORM AND RELATIONSHIPS: flat, fan-shaped; deep to gluteus medius, crureus, sartorius, and cranial fan of the gluteus primus and superficial to ventral region of the ilium.
ORIGIN: ilium entire ventral region of the concavity by fibers.
INSERTION: femur trochanteric ridge laterally, base of the greater trochanter by tendinous fascia.
ACTION: extends thigh.
6. M. gluteus superficialis, superficial gluteal muscle
FORM AND RELATIONSHIPS: small fan-shaped; deep to gluteus primus and superficial to gluteus medius.
ORIGIN: ilium, dorsolateral crest just caudal to the acetabulum and cranial to the ilioischadic foramen by fibers.
INSERTION: femur lateral protuberance just distal to the greater trochanter, by a tendon.
ACTION: together with other gluteal muscles aids in extension of thigh.
7. M. iliacus, the iliacus
FORM AND RELATIONSHIPS: fan-shaped, small; deep to gluteus medius and superficial to gluteus minimus.
ORIGIN: pectineal notch by fibers.
INSERTION: femur, tubercle on lateral surface of the greater trochanteric ridge, by fascia.
ACTION: rotates thigh laterally.
8. M. ischiofemoralis minimus - (See Plate 33)
9. M. levator rectricum - (See Plate 27)
10. M. sartorius - (See Plate 32)
11. M. semitendinosus - (See Plate 33)

PELVIS AND TAIL - DORSAL VIEW
PLATE 29

Superficial Layer

1. M. caudalis lateralis, lateral tail muscle
 FORM AND RELATIONSHIPS: flat and broad; deep to depressor rectricum, eversor urodeum; superficial to depressor caudae and sphincter ani.
 ORIGIN: pubis, lateral border; ischium, caudoventral border, by fibers.
 INSERTION: major undercoverts, fascia; pygostyle, caudal border, by fibers.
 ACTION: depresses and draws caudal vertebra laterally.
2. M. depressor caudae - (See Plate 22)
3. M. depressor rectricum - (See Plate 22)
4. M. everzor urodeum, the everzor of the urodeum
 FORM AND RELATIONSHIPS: string-like, thin; deep to skin, depressor rectricum, transversus perinei; superficial to fascia of perineum.
 ORIGIN: major undercoverts, fascia, by fascia.
 INSERTION: deep perineal fascia (ventral to anus) by fibers.
 ACTION: spreads ventral floor of the anus bringing about eversion of the copulatory palps.
5. M. transversus perinei, the transverse muscle of the perineum
 FORM AND RELATIONSHIPS: sphincter-like, broad and thin; deep to skin, sphincter ani; superficial to eversor urodeum, deep perineal fascia.
 ORIGIN: ischium and pubis, caudal border, by fascia.
 INSERTION: median raphe formed by fascia from fibers of the two halves of this muscle; fascia at the ventral anal opening.
 ACTION: compresses cloaca.

TAIL - VENTRAL VIEW, SUPERFICIAL LAYER
PLATE 30

Second and Deep Layers

1. M. caudalis lateralis - (See Plate 30)
2. M. depressor caudae - (See Plate 22)
3. M. depressor rectricum - (See Plate 22)
4. M. eversor urodeum - (See Plate 30)
5. M. levator rectricum - (See Plate 27)
6. M. transversus perinei - (See Plate 30)

TAIL - VENTRAL VIEW, SECOND AND DEEP LAYERS
PLATE 31

Superficial Layer

1. M. biceps flexor cruris, two-headed flexor of the thigh
 FORM AND RELATIONSHIPS: broad, flat, triangular; superficial to ischiofemoralis minimus, semimembranosus, adductor longus, adductor magnus, semitendinosus accessorius, and caudal to the vastus externus.
 ORIGIN: ilium, caudal crest, and ischium, dorsal region along a narrow area.
 INSERTION: fibula, lateral protuberance; by a tendon which passes through the biceps flexor cruris sling (ligament).
 ACTION: flexes tibiotarsus.

2. M. crureus - (See Extensor Femoris - Plate 32)

3. M. extensor femoris, extensor of the thigh
 FORM AND RELATIONSHIPS: thick and triangular; formed by four indistinctly separate fasciculi; crureus, subcrureus, vastus internus, and vastus externus; deep to the sartorius and superficial to the femur, ambiens and abdominal muscles.
 ORIGIN: femur, lateral tuberosity at the base of the greater trochanter, by fibers from the common head of the vastus externus and crureus; middle two-thirds of the shaft, by fibers from the vastus externus; medial and cranial surface of the greater trochanter by fibers, of the vastus internus; distal half of the lateral surface, by fibers from the subcrureus.
 INSERTION: fascia of the gluteus primus by fibers from the crureus; tibial aponeurosis by fascia from vastus externus in common with the inserting tendon of the subcrureus; tibial aponeurosis and patella by fascia and fibers from vastus internus and crureus; tibial aponeurosis by a tendon from the subcrureus in common with fascia from the vastus externus.
 ACTION: extends tibiotarsus.

4. M. flexor digitorum pedis profundus - (See Plate 40)
5. M. flexor digitorum pedis superficialis - (See Plate 42)
6. M. flexor hallucis longus - (See Plate 37)
7. M. gastrocnemius caput mediale - (See Plate 41)
8. M. gluteus medius - (See Plate 29)
9. M. gluteus minimus - (See Plate 29)
10. M. gluteus primus - (See Plate 27)
11. M. ischiofemoralis minimus - (See Plate 33)

12. M. sartorius, sartorius
 FORM AND RELATIONSHIPS: straplike, long; most cranial of thigh muscles; deep to the skin and tendon of the ambiens; superficial to abdominal muscles; and sacrolumbalis, crureus, gluteus medius, cranial head of the gastrocnemius.
 ORIGIN: ilium, from cranial concavity and dorsal part of cranial ridge by fibers.
 INSERTION: tibiotarsus, by fascia into tibial aponeurosis and cranial border of the rotular ridge; in common with inserting fascia of vastus internus.
 ACTION: draws thigh cranially; abducts thigh slightly and extends tibiotarsus.

13. M. semitendinosus - (See Plate 33)

14. M. tibialis cranialis - (See Plate 38)
15. M. vastus externus - (See Extensor Femoris - Plate 32)

SUPERFICIAL LAYER

LEG (FEMUR)-LEFT-LATERAL VIEW
PLATE 32

Second Layer

1. M. adductor longus - (See Plate 35)
2. M. adductor magnus - (See Plate 34)
3. M. crureus - (See Extensor Femoris - Plate 32)
4. M. extensor digitorum pedis longus - (See Plate 39)
5. M. flexor digitorum pedis profundus - (See Plate 40)
6. M. flexor digitorum pedis superficialis - (See Plate 42)
7. M. gastrocnemius - (See Caput Mediale - Plate 41)
8. M. gluteus medius - (See Plate 29)
9. M. gluteus minimus - (See Plate 29)
10. M. gluteus superficialis - (See Plate 29)

11. M. ischiofemoralis minimus, lesser ischiofemoral muscle
 FORM AND RELATIONSHIPS: fan-shaped and flat; deep to biceps flexor cruris, vastus externus and superficial to obturator externus and ischium.
 ORIGIN: ischium, caudodorsal aspect and caudal margin.
 INSERTION: femur, greater trochanter at the base caudally.
 ACTION: draws thigh caudally.

12. M. obturator externus - (See Plate 34)
13. M. sartorius - (See Plate 32)
14. M. semimembranosus - (See Plate 34)

15. M. semitendinosus, the semitendinosus
 FORM AND RELATIONSHIPS: straplike, thick; deep to the skin, biceps flexor cruris, vastus externus, and flexor hallucis longus.
 ORIGIN: ilium, caudal crest, most caudal aspect by fibers.
 INSERTION: tibiotarsus, shaft and in common with inserting tendinosus fascia of the semimembranosus, also by fascia to the proximomedial aspect of the gastrocnemius (caput mediale).
 ACTION: draws thigh caudally and aids in flexing shank.

16. M. semitendinosus accessorius, accessory to the semitendinous muscle
 FORM AND RELATIONSHIPS: broad and flat; deep to biceps flexor cruris, extensor femoris and superficial to adductor magnus and semi-membranosus.
 ORIGIN: femur, caudodistal fourth by fibers.
 INSERTION: raphe of semitendinosus by fibers.
 ACTION: draws thigh caudally with aid of semitendinosus.

17. M. subcrureus - (See Extensor Femoris - Plate 32)
18. M. vastus externus - (See Extensor Femoris - Plate 32)

SECOND LAYER

LEG (FEMUR) -LEFT-LATERAL VIEW
PLATE 33

Superficial Layer

1. M. adductor longus - (See Plate 35)
2. M. adductor magnus, large adductor muscle
 FORM AND RELATIONSHIPS: fan-shaped, thick and broad (cranial to semimembranosus) and superficial to ischiofemoralis minimus, biceps flexor cruris, adductor longus, and semitendinosus accessorius.
 ORIGIN: pubis, lateral and dorsal surface, by fascia.
 INSERTION: femur, medial condyle, by fibers.
 ACTION: adducts thigh.
3. M. ambiens, perching muscle
 FORM AND RELATIONSHIPS: flat, thin, small; deep to sartorius and rectus abdominus; superficial to vastus internus.
 ORIGIN: pubis, ventral and cranial border.
 INSERTION: originating tendon of flexor digiti terti perforatus after passing through pectineal groove of patella and the tibial aponeurosis.
 ACTION: aids in flexing digits II, III, and IV.
4. M. biceps flexor cruris - (See Plate 32)
5. M. crureus - (See Extensor Femoris - Plate 32)
6. M. gastrocnemius caput caudale - (See Plate 41)
7. M. gastrocnemius caput craniale - (See Plate 41)
8. M. gemellus, gemellus muscle
 FORM AND RELATIONSHIPS: small, straplike, superficial to the cranial portion of the pubis and acetabulum and cranial to adductor magnus, adductor longus and tendon of obturator internus.
 ORIGIN: pubis, dorsal surface just cranial to obturator foramen.
 INSERTION: subtrochanteric fossa, by fibers.
 ACTION: aids in adduction of thigh.
9. M. gluteus medius - (See Plate 29)
10. M. gluteus minimus - (See Plate 29)
11. M. gluteus superficialis - (See Plate 29)
12. M. iliacus - (See Plate 29)
13. M. ischiofemoralis minimus - (See Plate 33)
14. M. obturator externus, external obturator
 FORM AND RELATIONSHIPS: broad and flat; deep to ischiofemoralis minimus, and superficial to inserting tendon of obturator internus, and ischium.
 ORIGIN: ischium, caudal to ilioischiatric foramen, by fibers.
 INSERTION: femur, greater trochanter, caudal lateral face at the base.
 ACTION: draws thigh caudally.
15. M. obturator internus - (See Plate 23)
16. M. sartorius - (See Plate 32)
17. M. semimembranosus, semimembranosus muscle
 FORM AND RELATIONSHIPS: slightly triangular, broad and flat, deep to biceps flexor cruris, semitendinosus, semitendinosus accessorius, gastrocnemius and superficial to rectus abdominus.
 ORIGIN: ischium (middle third), ventral border, by fibers.
 INSERTION: tibiotarsus, proximomedial aspect in common with inserting fascia of the semitendinosus accessorius.
 ACTION: draws thigh caudally and flexes thigh.

18. M. semitendinosus - (See Plate 33)
19. M. vastus internus - (See Extensor Femoris - Plate 32)
20. M. vastus medialis - (See Extensor Femoris - Plate 32)

SUPERFICIAL LAYER

LEG (FEMUR) - LEFT - MEDIAL VIEW
 PLATE 34

Second Layer

1. M. adductor longus, long adductor muscle
 FORM AND RELATIONSHIPS: broad and straplike; deep to vastus externus, semitendinosus accessorius, biceps flexor cruris, obturator externus, ischiofemoralis minimus and superficial to adductor magnus.
 ORIGIN: ischium, ventral border, cranial third, by fibers.
 INSERTION: femur, distocaudal two-thirds.
 ACTION: adducts thigh and draws it slightly caudalward.
2. M. biceps flexor cruris - (See Plate 32)
3. M. crureus - (See Extensor Femoris - Plate 32)
4. M. flexor digitorum pedis profundus - (See Plate 40)
5. M. flexor digitorum pedis superficialis - (See Plate 42)
6. M. gluteus medius - (See Plate 29)
7. M. gluteus minimus - (See Plate 29)
8. M. gluteus primus - (See Plate 27)
9. M. iliacus - (See Plate 29)
10. M. ischiofemoralis minimus - (See Plate 29)
11. M. peroneus longus - (See Plate 37)
12. M. semitendinosus - (See Plate 33)
13. M. semitendinosus accessorius - (See Plate 33)
14. M. tibialis caudalis - (See Plate 42)
15. M. tibialis cranialis - (See Plate 38)
16. M. vastus internus - (See Extensor Femoris - Plate 32)

SECOND LAYER

LEG (FEMUR) - LEFT - MEDIAL VIEW

PLATE 35

Third Layer

1. M. biceps flexor cruris - (See Plate 32)
2. M. crureus - (See Extensor Femoris - Plate 32)
3. M. flexor digitorum pedis profundus - (See Plate 40)
4. M. flexor digitorum pedis superficialis - (See Plate 42)
5. M. gastrocnemius caput caudale - (See Plate 41)
6. M. gluteus medius - (See Plate 29)
7. M. gluteus minimus - (See Plate 29)
8. M. gluteus primus - (See Plate 27)
9. M. iliacus - (See Plate 29)
10. M. tibialis cranialis - (See Plate 38)
11. M. vastus externus - (See Extensor Femoris - Plate 32)

**LEG (FEMUR)-LEFT-MEDIAL VIEW, THIRD LAYER
PLATE 36**

Superficial Layer

1. M. biceps flexor cruris - (See Plate 32)
2. M. flexor digiti quarti perforatus - (See Plate 42)
3. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
4. M. flexor digiti terti perforatus - (See Plate 42)
5. M. flexor digiti terti perforatus et perforans - (See Plate 38)
6. M. flexor digitorum pedis profundus - (See Plate 40)

7. M. flexor hallucis longus, long flexor of the hallux
FORM AND RELATIONSHIPS: fan-shaped, narrow; deep to flexor digitorum pedis superficialis and superficial to flexor digitorum pedis profundus.
ORIGIN: femur, intercondylar fossa, by fibers and fascia.
INSERTION: hallux, first phalanx, by tendinous slip, and fascia covering foot digits.
ACTION: flexes and adducts hallux; aids in flexing digits II, III, IV.

8. M. gastrocnemius caput caudale - (See Plate 41)
9. M. gastrocnemius caput craniale - (See Plate 41)
10. M. gluteus primus fascia - (See Plate 27)

11. M. peroneus longus, the long peroneus
FORM AND RELATIONSHIPS: broad, thick and tapering; deep to the skin, superficial to tibialis cranialis, extensor digitorum pedis longus and caudal to gastrocnemius caput craniale.
ORIGIN: tibiotarsus, procnemial ridge, lateral cranial border and apex of the cnemial ridge by fibers.
INSERTION: third digit, by a long tendon and in common with the tendon of the flexor digiti terti perforatus and to the tarsometatarsal capsule, by a short tendon.
ACTION: extends tarsometatarsus and aids in flexing digits II, III, IV.

12. M. semimembranosus - (See Plate 34)
13. M. tibialis cranialis - (See Plate 38)

SUPERFICIAL LAYER

**LEG (TIBIOTALAR)-LEFT-LATERAL VIEW
PLATE 37**

Second Layer

1. M. biceps flexor cruris - (See Plate 32)
2. M. extensor digitorum longus - (See Plate 39)
3. M. flexor digiti quarti perforatus - (See Plate 42 - No. 6)
4. M. flexor digiti secundi perforatus - (See Plate 42 - No. 6)
5. M. flexor digiti secundi perforatus et perforans, the perforated and perforating flexor of the second digit

FORM AND RELATIONSHIPS: flat and thin; deep to the skin; superficial to flexor digiti terti perforatus et perforans and inserting tendon of biceps flexor cruris and cranial to gastrocnemius caput caudale.

ORIGIN: tibial aponeurosis, by fibers.

INSERTION: by two tendinous slips which insert one on second phalanx of the second digit, proximolateral process, and one on proximomedial process.

ACTION: flexes digit II.
6. M. flexor digiti terti perforatus - (See Plate 42 - No. 6)
7. M. flexor digiti terti perforatus et perforans, the perforated and perforating flexor of the third digit

FORM AND RELATIONSHIPS: narrow and long; deep to the skin of the shank; superficial to the tibialis cranialis, extensor digitorum pedis longus and inserting tendon of the biceps flexor cruris, caudal to peroneus longus.

ORIGIN: tibial aponeurosis and fibula, lateral protuberance, by fibers.

INSERTION: digit III, third phalanx, laterally on the caudal articulating process by a tendinous slip and by the other tendinous slip plantarly and medially on the caudal and medial articulating process.

ACTION: flexes digit III.
8. M. flexor digitorum pedis profundus - (See Plate 41)
9. M. flexor hallucis longus - (See Plate 37)
10. M. peroneus brevis - (See Plate 40)
11. M. tibialis cranialis, the cranial tibialis muscle

FORM AND RELATIONSHIPS: straplike, long and thick, with two heads (superficial and deep heads); deep to peroneus longus and superficial to peroneus brevis, tibiotarsus, extensor digitorum longus.

ORIGIN: superficial head: tibiotarsus, procnemial and ecnemial ridges, by fibers.

deep head: femur, lateral epicondyle, by a tendon.

INSERTION: tarsometatarsus, dorsally by a tendon.

ACTION: flexes tarsometatarsus.

SECOND LAYER

LEG (TIBIOTARSUS) - LEFT-LATERAL VIEW
PLATE 38

Third Layer

1. M. biceps flexor cruris - (See Plate 32)

2. M. extensor digitorum pedis longus, the long extensor of the foot digits
FORM AND RELATIONSHIPS: long and narrow with a bifurcating tendon;
deep to tibialis cranialis; superficial to procnemial crest of
tibiotarsus.
ORIGIN: tibiotarsus, rotular ridge and procnemial crest lateral face.
INSERTION: the medial tendon gives rise to three slips; the medial of
these three slips inserts on digit II, terminal phalanx; the middle
slip inserts on digit IV, proximomedial process of phalanx II; and the
lateral slip inserts on digit II, phalanx I, proximolateral process
as well as digit III, phalanx I, dorsomedial process and phalanx II
proximodorsal process.

The lateral tendon gives rise to two slips; the medial slip
also bifurcates and inserts on digit III, terminal phalanx, and also
to the proximodorsal process.

The lateral slip bifurcates and inserts on digit IV,
terminal phalanx, and on phalanx II proximodorsal process.

ACTION: extends digits II, III, IV.

3. M. flexor digiti quarti perforatus - (See Plate 42)
4. M. flexor digiti terti perforatus - (See Plate 42)
5. M. flexor digitorum pedis profundus - (See Plate 40)
6. M. flexor hallucis longus - (See Plate 37)
7. M. peroneus brevis - (See Plate 40)

THIRD LAYER

LEG (TIBIOTARSUS) - LEFT - LATERAL VIEW
PLATE 39

Deep Layer

1. M. extensor digitorum pedis longus - (See Plate 39)
2. M. flexor digitorum pedis profundus, deep flexor of the foot digits
FORM AND RELATIONSHIPS: flat and long with fibers converging on an ossified tendon; deep to flexor hallucis longus; superficial to peroneus brevis, popliteus and caudal face of fibula and tibiotarsus.
ORIGIN: fibula and tibiotarsus, caudal faces, by fibers.
INSERTION: uncinat (terminal) phalanges of digits II, III and IV, plantarly, by three slips from the tendon.
ACTION: flexes digits II, III, IV.
3. M. peroneus brevis, short peroneus
FORM AND RELATIONSHIPS: thin, terminating in an ossified tendon; deep to deep head of tibialis cranialis; superficial to flexor digitorum pedis profundus.
ORIGIN: tibiotarsus and fibular stylus, distal two-thirds, by fibers.
INSERTION: hypotarsus; by a tendon.
ACTION: probably to hold tarsometatarsus firmly to tibiotarsus during flexion of the tarsometatarsus. It may aid in extension of tarsometatarsus.
4. M. popliteus, the popliteal
FORM AND RELATIONSHIPS: bandlike, short; deep to flexor digitorum pedis superficialis, flexor digitorum pedis profundus, superficial to proximocaudal tenth of tibiotarsus.
ORIGIN: fibula, head, medial aspect, by fibers.
INSERTION: tibiotarsus, popliteal depression, by fibers.
ACTION: adducts fibular head.

DEEP LAYER

LEG (TIBIOTARSUS) - LEFT - LATERAL VIEW
PLATE 40

Superficial Layer

1. M. extensor digitorum pedis longus - (See Plate 39)
2. M. flexor digitorum pedis profundus - (See Plate 40)

3. M. gastrocnemius, gastrocnemius

FORM AND RELATIONSHIPS: largest of shank muscles and composed of three heads; caput caudale, caput craniale, and caput mediale. Their fibers end distally to form the achilles tendon.

Caput caudale: broad, flat; deep to the skin; superficial to flexor digiti secundi perforatus et perforans, biceps flexor cruris, flexor hallucis longus, flexor digitorum pedis superficialis, cranial to caput mediale.

ORIGIN: femur, lateral epicondyle, by a tendon.

INSERTION: tarsometatarsus, plantar lateral crest, by fascia in common with caput mediale, and caput craniale.

ACTION: extends tarsometatarsus.

Caput mediale: triangular and long; deep to the skin, distal fibers of semimembranosus; superficial to tibialis caudalis, biceps flexor cruris, flexor hallucis longus, flexor digitorum pedis superficialis; caudal to caput craniale.

ORIGIN: femur, medial condyle, by fascia.

INSERTION: tarsometatarsus, ossified tendon in common with caput craniale by fibers.

ACTION: extends tarsometatarsus.

Caput craniale: broad and flat; deep to skin; superficial to tibialis cranialis, extensor digitorum pedis longus, tibialis caudalis and tibiotarsus; cranial to caput mediale.

ORIGIN: tibial aponeurosis by fibers; tarsometatarsus, rotular ridge and medial face of procnemial ridge by fibers.

INSERTION: tarsometatarsus, plantar lateral crest by fascia in common with caput caudale.

ACTION: extends tarsometatarsus.

4. M. peroneus longus - (See Plate 37)

SUPERFICIAL LAYER

LEG (TIBIOTARSUS) - LEFT - MEDIAL VIEW

PLATE 41

Second Layer

1. M. crureus - (See Extensor Femoris - Plate 32)
2. M. extensor digitorum pedis longus - (See Plate 39)
3. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
4. M. flexor digiti tertii perforatus et perforans - (See Plate 38)
5. M. flexor digitorum pedis profundus - (See Plate 40)
6. M. flexor digitorum pedis superficialis, superficial digital flexor of the foot

FORM AND RELATIONSHIPS: a complex muscle composed of five fasciculi which terminate in three tendons; deep to gastrocnemius; superficial to flexor hallucis longus, tibialis caudalis and flexor digitorum pedis profundus and popliteus. Subdivisions of the superficial digital flexor are designated as (a) the flexor digiti perforati of the second, third and fourth digits. The five fasciculi are apportioned respectively as follows: (a) medial, (b) distal and caudal, and (c) proximal and lateral.

ORIGIN:

- M. flexor digiti secundi perforatus - the medial fasciculus takes its origin by fibers from the proximal and caudal fasciculi.
- M. flexor digiti tertii perforatus - the caudal fasciculus takes its origin by fibers from the proximal fasciculus. The distal fasciculus originates by a tendon from the lateral collateral ligament. This originating tendon also receives the inserting tendon of the ambiens.
- M. flexor digiti quarti perforatus - the proximal fasciculus arises by fibers and fascia from the fibular groove of the femur. The lateral fasciculus originates by a fascia from the belly of the proximal fasciculus.

INSERTION:

- M. flexor digiti secundi perforatus - an ossified tendon of this fasciculus extends distally, passing through the tarsometatarsal capsule, and bifurcates at the first phalanx of the second digit. One slip of the tendon inserts on the proximolateral process of the first phalanx of the second digit and the second slip inserts on the proximomedial process of the same phalanx. M. flexor digiti secundi perforatus et perforans, perforates the tendon at the point of its bifurcation.
- M. flexor digiti tertii perforatus - the fibers of both fasciculi terminate in a common ossified tendon which continues distally passing through the tarsometatarsal capsule. Just distal to the tarsometatarsal capsule it is joined inseparably by the tendon of the peroneus longus. The continuing tendon bifurcates at the distal articulation of the first phalanx of the third digit. One slip inserts on the proximolateral process of the second phalanx of the third digit. The second slip inserts on the proximomedial process of the same phalanx. The tendon is perforated at its bifurcation by the tendon of the flexor digiti tertii perforatus et perforans.
- M. flexor digiti quarti perforatus - the two fasciculi of this muscle terminate in an ossified tendon which continues distally and passes through the tarsometatarsal capsule onto the plantar surface of the tarsometatarsus. It trifurcates at the proximal articulation of the first phalanx of the fourth digit. One slip inserts on the proximolateral process of the second phalanx of the fourth digit, a second slip inserts on the intercondyloid process of the same phalanx and a third slip inserts also on the proximomedial process of the third phalanx of the fourth digit. At the point of trifurcation, this

flexor is perforated by one of the tendinous slips of the M. flexor digitorum pedis profundus.

ACTION: flexes digits II, III and IV.

7. M. tibialis caudalis, caudal tibialis muscle

FORM AND RELATIONSHIPS: cone-shape and small; deep lateral and cranial to caput craniale of gastrocnemius, flexor digitorum pedis superficialis and superficial to proximocaudal aspect of tibiotarsus.

ORIGIN: tibiotarsus, at base of rotular ridge.

INSERTION: tibial cartilage and fascia and capsule caudal to the tibiotarsus--tarsometatarsus articulation by a tendon.

ACTION: extends tarsometatarsus.

8. M. tibialis cranialis - (See Plate 38)

9. M. vastus internus - (See Extensor Femoris - Plate 35)

**LEG (TIBIOTARSUS)-LEFT-MEDIAL VIEW
PLATE 42**

Third Layer

1. M. extensor digitorum pedis longus - (See Plate 39)
2. M. flexor digitorum pedis profundus - (See Plate 40)
3. M. popliteus - (See Plate 40)

LEG (TIBIOTARSUS) -LEFT - MEDIAL VIEW THIRD LAYER
PLATE 43

Superficial Layer

1. M. abductor digiti quarti pedis, abductor of the fourth foot digit
FORM AND RELATIONSHIPS: two bellies separated by tendon; deep to tendon of flexor digitorum pedis profundus; superficial to the plantar surface of the tarsometatarsus.
ORIGIN: tarsometatarsus, hypotarsus plantar surface by fibers and third trochlea, plantar surface by fibers.
INSERTION: digit IV phalanx I, proximolateral surface, by a tendon.
ACTION: abducts digit IV.
2. M. flexor digiti quarti perforatus - (See Plate 42)
3. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
4. M. flexor digiti terti perforatus - (See Plate 42)
5. M. flexor digiti terti perforatus et perforans - (See Plate 38)
6. M. flexor digitorum pedis profundus - (See Plate 40)
7. M. peroneus longus - (See Plate 37)

PLATE 44
LEG (TARSOMETATARSUS AND FOOT)-LEFT-LATERAL VIEW

First Layer

1. M. abductor digiti secundi pedis - (See Plate 48)
2. M. adductor digiti secundi pedis, adductor of the second foot digit
FORM AND RELATIONSHIPS: two bellies connected by a tendon; deep to tendons of flexor digitorum pedis profundus and superficial to plantar surface of tarsometatarsus.
ORIGIN: hypotarsus, distal surface, by fibers.
INSERTION: digit II phalanx I, proximolateral process, by a tendon.
ACTION: adducts digit II.
3. M. extensor digiti terti pedis brevis - (See Plate 48)
4. M. extensor digitorum pedis longus - (See Plate 39)
5. M. extensor hallucis longus, long extensor of the great toe
FORM AND RELATIONSHIPS: narrow, long; deep to tendons of extensor digitorum pedis longus, skin; superficial to dorsal surface of tarsometatarsus.
ORIGIN: tarsometatarsus, proximal two-thirds medial surface, by fibers.
INSERTION: fascia surrounding digit I, by a tendinous slip; and digit I the terminal phalanx, dorsal surface, by another tendinous slip.
ACTION: extends and abducts hallux.
6. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
7. M. flexor digiti terti perforatus et perforans - (See Plate 38)
8. M. flexor hallucis brevis, short flexor of the great toe
FORM AND RELATIONSHIPS: triangular; deep to skin; superficial to plantar surface of tarsometatarsus.
ORIGIN: tarsometatarsus, proximomedial surface, by fibers.
INSERTION: digit I phalanx I, proximomedial surface by tendinous slip.
ACTION: flexes and adducts hallux.
9. M. flexor hallucis longus - (See Plate 37)

LEG (TARSOMETATARSUS AND FOOT) - LEFT - MEDIAL VIEW
PLATE 45

Superficial Layer

1. M. abductor digiti secundi pedis - (See Plate 48)
2. M. extensor digiti quarti pedis brevis - (See Plate 48)
3. M. extensor digiti terti pedis brevis - (See Plate 48)
4. M. extensor digitorum pedis longus - (See Plate 39)
5. M. extensor hallucis longus - (See Plate 45)
6. M. tibialis cranialis - (See Plate 38)

PLATE 46
LEG (TARSOMETATARSUS AND FOOT)-LEFT-DORSAL VIEW

Deep Layer

1. M. extensor digitorum pedis longus - (See Plate 39)

tendons of extensor digitorum
pedis longus

FOOT-LEFT-DORSAL VIEW DEEP LAYER
PLATE 47

Deep Layer

1. M. abductor digiti secundi pedis, abductor of the second foot digit
 FORM AND RELATIONSHIPS: flat, short; deep to skin; superficial to metatarsal I, medial surface.
 ORIGIN: tarsometatarsus, distal-fifth medial surface, and metatarsal I, lateral surface, by fibers.
 INSERTION: digit II phalanx I, proximomedial process, by a tendon.
 ACTION: abducts digit II.

2. M. extensor digiti quarti pedis brevis, short extensor of the fourth digit
 FORM AND RELATIONSHIPS: thin, long; deep to tendons of extensor digitorum pedis longus; skin; superficial to dorsal surface of tarsometatarsus.
 ORIGIN: skin, fascia over tibiotarsus-tarsometatarsus articulation and tarsometatarsus, dorsal surface, by fibers.
 INSERTION: digit IV phalanx I, proximomedial process, by a tendon.
 ACTION: flexes and adducts digit IV.

3. M. extensor digiti terti pedis brevis, short extensor of the third digit
 FORM AND RELATIONSHIPS: triangular; small; deep to skin, tendons of extensor digitorum pedis longus; superficial to dorsodistal surface of the tarsometatarsus.
 ORIGIN: tarsometatarsus, dorsodistal one-fourth, by fibers.
 INSERTION: digit III phalanx I, proximodorsal articulating process, by a tendon.
 ACTION: flexes digit III.

4. M. extensor hallucis longus - (See Plate 45)
5. M. tibialis cranialis - (See Plate 38)

PLATE 48
LEG (TARSOMETATARSUS AND FOOT) -LEFT- DORSAL VIEW

Third Layer

1. M. abductor digiti secundi pedis - (See Plate 48)
2. M. adductor digiti secundi pedis - (See Plate 45)
3. M. extensor digitorum pedis longus - (See Plate 39)
4. M. flexor digiti quarti perforatus - (See Plate 42 - No. 6)
5. M. flexor digiti secundi perforatus - (See Plate 42 - No. 6)
6. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
7. M. flexor digiti terti perforatus - (See Plate 42 - No. 6)
8. M. flexor digiti terti perforatus et perforans - (See Plate 38)
9. M. flexor digitorum pedis profundus - (See Plate 40)
10. M. flexor hallucis brevis - (See Plate 45)

LEG (TARSOMETATARSUS AND FOOT)-LEFT-PLANTAR VIEW
 PLATE 49

Superficial Layer

1. M. abductor digiti secundi pedis - (See Plate 48)
2. M. adductor digiti quarti pedis - (See Plate 44)
3. M. flexor digiti quarti perforatus - (See Plate 42 - No. 6)
4. M. flexor digiti secundi perforatus et perforans - (See Plate 38)
5. M. flexor digiti terti perforatus - (See Plate 42 - No. 6)
6. M. flexor digiti terti perforatus et perforans - (See Plate 38)
7. M. flexor digitorum pedis profundus - (See Plate 40)
8. M. flexor digitorum pedis superficialis - (See Plate 42)
9. M. flexor hallucis brevis - (See Plate 45)

flexor digitorum superficialis

adductor digiti

quarti pedis

flexor hallucis brevis

tendon flexor digiti tertii
perforatus et perforans

flexor digiti tertii perforatus
et perforans

spur

abductor digiti
secundi

abductor digiti quarti

flexor digiti
quarti perforatus

flexor digiti
terti perforatus

flexor hallucis
brevis tendon

flexor digiti secundi
perforatus et perforans

flexor
terti perforatus et perforans

SECOND LAYER

flexor digitorum pedis profundus

LEG (TARSOMETATARSUS AND FOOT)-LEFT-PLANTAR VIEW

PLATE 50

Second Layer

1. M. abductor digiti quarti pedis - (See Plate 44)
2. M. flexor digitorum pedis profundus - (See Plate 40)
3. M. flexor hallucis brevis - (See Plate 45)
4. M. flexor hallucis longus - (See Plate 37)

flexor hallucis longus tendon

abductor digiti quarti pedis

flexor hallucis brevis

flexor digitorum pedis
profundus

flexor digitorum
pedis profundus

flexor hallucis longus
tendon

flexor hallucis brevis

THIRD LAYER

LEG (TARSOMETATARSUS AND FOOT)-LEFT- PLANTAR VIEW
PLATE 51

Fourth Layer (Deep)

1. M. abductor digiti quarti pedis - (See Plate 44)
2. M. abductor digiti secundi pedis - (See Plate 48)
3. M. flexor hallucis brevis - (See Plate 45)

LEG (TARSOMETATARSUS AND FOOT)-LEFT-PLANTAR VIEW
PLATE 52

Superficial Layer

1. M. abductor digiti secundi manus - (See Plate 56)
2. M. adductor digiti secundi manus - (See Plate 56)
3. M. anconeus lateralis - (See Plate 54)
4. M. deltoideus - (See Plate 17)
5. M. extensor carpi radialis profundus - (See Plate 54)
6. M. extensor carpi radialis superficialis, the superficial extensor of the carpus
 FORM AND RELATIONSHIPS: long and fusiform; just under the skin; over the radius and extensor carpi radialis profundus; cranial to flexor digiti secundi et digiti terti manus and pronator brevis.
 ORIGIN: humerus, proximal to the external epicondylar prominence, by fibers and tendon.
 INSERTION: metacarpal II, distal process, by a tendon.
 ACTION: extends the carpometacarpus with assistance of the carpi radialis profundus.
7. M. extensor digiti secundi manus - (See Plate 55)
8. M. extensor digiti terti manus distalis, distal extensor of digit three
 FORM AND RELATIONSHIPS: broad and flat; lies ventrally on metacarpal III, just under the skin and tendons of extensor digiti terti manus medialis and flexor carpi ulnaris cranialis; ventral to adductor digiti secundi manus.
 ORIGIN: carpometacarpus, fusiform process, by fibers.
 INSERTION: digit III, phalanx II, by a tendon to proximoventral aspect of articular process; phalanx I of same digit by fascia to proximo-cranial aspect.
 ACTION: extends digit III.
9. M. extensor digiti terti manus lateralis - (See Plate 58)
10. M. flexor digiti secundi et digiti terti manus - (See Plate 55)
11. M. flexor metacarpi longus, long flexor of the metacarpus
 FORM AND RELATIONSHIPS: fusiform; most caudal of the superficial muscles of the forewing; deep to the skin and superficial to anconeus lateralis, supinator brevis and the ulna.
 ORIGIN: humerus, external epicondyle, by a tendon in common with that of the anconeus lateralis.
 INSERTION: metacarpal III, intermetacarpal process, caudal aspect and bases of the medial secondaries by a fascial connection from the tendon of origin.
 ACTION: flexes carpometacarpus with a slight abduction simultaneously, and elevates medial secondaries.
12. M. interosseus dorsalis, dorsal interosseus muscle
 FORM AND RELATIONSHIPS: small and flat; between metacarpals III and V, deep to the skin and superficial to interosseus ventralis.
 ORIGIN: metacarpals III and V, by fibers.
 INSERTION: digit III, phalanx I, by a tendon.
 ACTION: supinates digit III.
13. M. latissimus dorsi - (See Plate 16)
14. M. patagialis - (See Plate 20)
15. M. pectoralis superficialis - (See Plate 20)

16. M. tensor patagii longus - (See Plate 20)
17. M. triceps caput dorsale - (See Plate 17)

WING-LEFT-DORSAL VIEW SUPERFICIAL LAYER
PLATE 53

Second Layer

1. M. abductor digiti secundi manus - (See Plate 56)
2. M. adductor digiti secundi manus - (See Plate 56)
3. M. anconeus lateralis, lateral anconeus muscle
 FORM AND RELATIONSHIPS: fusiform; broad; deep to flexor metacarpi longus and flexor digiti secundi et digiti terti manus and superficial to humerus and ulna concave surface.
 ORIGIN: humerus external epicondyle, by a tendon in common with that of the flexor metacarpi longus.
 INSERTION: ulna, intermuscular line, by fibers.
 ACTION: flexes antibrachium.
4. M. biceps brachii, biceps muscle of the brachium
 FORM AND RELATIONSHIPS: long, fusiform; two fasciculi; just under skin on lateral surface of humerus.
 ORIGIN: coracoid, brachial tuberosity, by a broad flat tendon.
 INSERTION: (a) ulna, bicipital prominence, by a tendon which passes superficially over inserting tendon of ventral fasciculus.
 (b) radius, just distal to head radius, by two small tendons.
 ACTION: flexes antibrachium.
5. M. brachialis - (See Plate 58)
6. M. deltoideus - (See Plate 17)
7. M. extensor carpi radialis profundus, deep extensor of the carpus
 FORM AND RELATIONSHIPS: fusiform; just under the skin and flexor digiti secundi et digiti terti manus and overlies (medially) the radius, extensor carpi obliquus, extensor digiti terti manus medialis, pronator longus and brachialis.
 ORIGIN: radius and ulna proximal articulation and concave borders, by fibers.
 INSERTION: metacarpal II, distal process, by a tendon in common with that of the extensor carpi radialis superficialis.
 ACTION: extends carpometacarpus with assistance of extensor carpi radialis superficialis.
8. M. extensor carpi radialis superficialis - (See Plate 53)
9. M. extensor digiti secundi manus - (See Plate 55)
10. M. extensor digiti terti manus distalis - (See Plate 53)
11. M. extensor digiti terti manus lateralis - (See Plate 58)
12. M. flexor digiti secundi et digiti terti manus - (See Plate 55)
13. M. flexor metacarpi caudalis - (See Plate 55)
14. M. flexor metacarpi longus - (See Plate 53)
15. M. interosseus dorsalis - (See Plate 53)
16. M. interosseus ventralis - (See Plate 55)
17. M. latissimus dorsi - (See Plate 16)
18. M. patagialis - (See Plate 20)
19. M. pectoralis profundus - (See Plate 21)
20. M. pectoralis superficialis - (See Plate 20)
21. M. scapulohumeralis maximus - (See Plate 18)
22. M. supinator brevis, short supinator
 FORM AND RELATIONSHIPS: bandlike; most cranial of the second layer of muscles of the forewing; deep to extensor carpi radialis superficialis, flexor metacarpi longus, flexor digiti secundi et

digiti terti manus, and tendon of anconeus lateralis; superficial to the radius and pronator brevis.

ORIGIN: humerus, external epicondyle by a tendon.

INSERTION: radius, proximal third, by fibers.

ACTION: supinates and flexes the antibrachium.

- 23. M. tensor patagii longus - (See Plate 20)
- 24. M. triceps caput dorsale - (See Plate 17)
- 25. M. triceps caput internale - (See Plate 18)

WING-LEFT-DORSAL VIEW SECOND LAYER
 PLATE 54

Third Layer

1. M. abductor digiti secundi manus - (See Plate 56)
2. M. adductor digiti secundi manus - (See Plate 56)
3. M. extensor carpi obliquus - (See Plate 58)
4. M. extensor carpi radialis profundus - (See Plate 54)
5. M. extensor carpi radialis superficialis - (See Plate 53)
6. M. extensor digiti secundi manus, extensor of the second wing digit
 FORM AND RELATIONSHIPS: small and triangular; deep to the skin and superficial to the adductor digiti secundi manus and metacarpal II.
 ORIGIN: metacarpal II, dorsal aspect, by fibers.
 INSERTION: phalanx of digit II, cranioproximal articular process, by a tendon.
 ACTION: extends and supinates digit II.
7. M. extensor digiti terti manus distalis - (See Plate 53)
8. M. extensor digiti terti manus lateralis - (See Plate 58)
9. M. extensor digiti terti manus medialis - (See Plate 56)
10. M. flexor digiti quarti manus longus - (See Plate 57)
11. M. flexor digiti secundi et digiti terti manus, the flexor of the second and third digits of the wing
 FORM AND RELATIONSHIPS: delicate and fusiform terminating in one long and one short tendon; just under the skin; caudal to extensor carpi radialis superficialis; cranial to flexor metacarpi longus; over anconeus lateralis, extensor carpi radialis profundus and supinator brevis.
 ORIGIN: humerus, external epicondylar prominence, by a tendon.
 INSERTION: digit II, by the short tendon to the caudal aspect of the phalanx; digit III, by the long tendon to the proximoventral process of the first phalanx.
 ACTION: supinates digit II; but extends digit III; flexes carpometacarpus.
12. M. flexor digiti secundi manus, flexor of the second wing digit - (See Plate 56)
13. M. flexor et abductor digiti quarti manus, the flexor and abductor of the fourth digit of the wing
 FORM AND RELATIONSHIPS: small and fusiform; just under the skin; on distal part of metacarpal IV dorsally and caudally.
 ORIGIN: metacarpal IV, from the distal tenth dorsocaudally, by fibers.
 INSERTION: digit IV, phalanx I, proximocaudal articular process, by a tendon.
 ACTION: flexes and abducts digit IV.
14. M. flexor metacarpi brevis, short flexor of the metacarpals
 FORM AND RELATIONSHIPS: small and delicate; deep to the skin and overlying the adductor digiti secundi manus, flexor digiti secundi manus, and metacarpal III.
 ORIGIN: radial carpal, dorsodistal angle, by fibers.
 INSERTION: metacarpal III cranial aspect, by fibers, and to the tendinous slip of flexor digiti secundi et digiti manus which in turn inserts on the articular process of phalanx I of digit III.
 ACTION: aids in extending and supinating digit III; it may also aid in flexing the carpometacarpus.

15. M. flexor metacarpi caudalis, caudal flexor of the metacarpus
FORM AND RELATIONSHIPS: narrowly wedge shaped; composed of three fasciculi; deep to the skin and inserting tendons of flexor digiti quarti manus longus and flexor metacarpi longus; superficial to the ulna.
ORIGIN: ulna dorsocranial aspect, by a tendon common to the dorsal and ventral fasciculi; and ulnar carpal, by a tendon from the intermediate fasciculus.
INSERTION: metacarpal IV, by the dorsal and intermediate fasciculus and to follicles of the primary feathers by fascia from the ventral fasciculus.
ACTION: flexes the metacarpus and spreads the primaries.
16. M. flexor metacarpi longus - (See Plate 53)
17. M. interosseus dorsalis - (See Plate 53)
18. M. interosseus ventralis, ventral interosseus muscle
FORM AND RELATIONSHIPS: small; deep to the skin and ventral (deep) to interosseus dorsalis; lies between metacarpals III and IV.
ORIGIN: metacarpals III and IV internal surfaces, by fibers.
INSERTION: digit III, phalanx II, ventral surface, by a tendon.
ACTION: supinates digit III and flexes phalanx II.
19. M. latissimus dorsi - (See Plate 16)
20. M. supinator brevis - (See Plate 54)

WING-LEFT-DORSAL VIEW THIRD LAYER
 PLATE 55

Superficial Layer

1. M. abductor digiti secundi manus, abductor of the second wing digit
 FORM AND RELATIONSHIPS: triangular along the cranial and ventral surfaces of the phalanx of digit II.
 ORIGIN: tendinous slip from the tensor patagii longus near insertion of the latter.
 INSERTION: phalanx I of digit II cranial and ventral surface, by fibers.
 ACTION: abducts digit II.
2. M. adductor digiti secundi manus, adductor of the second wing digit
 FORM AND RELATIONSHIPS: thin and delicate; in the caudal aspect of digit II; deep to the skin and flexor metacarpi brevis and overlying extensor digiti terti manus distalis.
 ORIGIN: metacarpal III proximocranial aspect.
 INSERTION: digit II, phalanx I, caudal aspect.
 ACTION: adducts digit II.
3. M. biceps brachii - (See Plate 54)
4. M. brachialis - (See Plate 58)
5. M. extensor carpi obliquus - (See Plate 58)
6. M. extensor carpi radialis profundus - (See Plate 54)
7. M. extensor carpi radialis superficialis - (See Plate 53)
8. M. extensor digiti terti manus distalis - (See Plate 53)
9. M. extensor digiti terti manus medialis
 FORM AND RELATIONSHIPS: fusiform with extensive tendon extending distally from the wrist joint; under brachialis, anconeus medialis, flexor carpi ulnaris cranialis and flexor carpi ulnaris caudalis; over extensor carpi obliquus and ulna.
 ORIGIN: ulna, proximal half of the radial face, by fibers.
 INSERTION: digit III, phalanx II, proximocranial angle, by a tendon.
 ACTION: extends digit III and carpometacarpus.
10. M. flexor carpi ulnaris caudalis, caudal ulnar flexor of the carpus
 FORM AND RELATIONSHIPS: the most caudal of the radio-ulnar group; fusiform; along the caudal border of the ulna; under fascia of flexor carpi ulnaris cranialis and skin.
 ORIGIN: humerus, external epicondyle medial surface, by a tendon.
 INSERTION: ulnar carpal, medial surface, by a strong tendon.
 ACTION: flexes carpometacarpus.
11. M. flexor carpi ulnaris cranialis, the cranial ulnar flexor of the carpus
 FORM AND RELATIONSHIPS: this is principally a tendinous fascia over the flexor carpi ulnaris caudalis.
 ORIGIN: humerus, internal epicondylar prominence, by a tough tendon.
 INSERTION: the inserting tendon passes ventral to ulnar carpal and continues distally along metacarpal III. At the articulation of metacarpal III and phalanx I of digit III it divides into two small muscular slips which insert on the proximodorsal aspect of phalanx II; fascia from this inserting area extends proximally to insert at the bases of the caudal feather follicles of the wing.
 ACTION: extends digit III and flexes the carpus slightly.
12. M. flexor digiti quarti manus longus - (See Plate 57)

13. M. flexor digiti secundi manus, flexor of the second hand digit
FORM AND RELATIONSHIPS: straplike; short and delicate; deep to the skin and adductor digiti secundi manus, caudal to metacarpal II and superficial to the flexor metacarpi brevis.
ORIGIN: carpus cranial fossa, by fibers.
INSERTION: digit II, phalanx I, caudoventral articular process, by fibers.
ACTION: flexes digit II.
14. M. interosseus ventralis - (See Plate 55)
15. M. latissimus dorsi - (See Plate 16)
16. M. patagialis - (See Plate 20)
17. M. pronator brevis, short pronator of the wing
FORM AND RELATIONSHIPS: fusiform; just under skin; cranial to pronator longus and extensor digiti terti manus medialis; over biceps brachii insertion, supinator brevis, brachialis anticus, and radius.
ORIGIN: humerus, internal epicondylar tuberosity, by a tendon, just proximal to origin of pronator longus.
INSERTION: radius, mid-lateral surface, by fibers.
ACTION: acts with the pronator longus to pronate antibrachium.
18. M. pronator longus, long pronator of the wing
FORM AND RELATIONSHIPS: fusiform; just under skin; cranial to flexor carpi ulnaris cranialis and anconeus medialis; caudal to pronator brevis; over insertion of biceps brachii and ventral surface of radius.
ORIGIN: humerus, internal epicondylar prominence, by a tendon in common with that of anconeus medialis.
INSERTION: radius, ventral surface of shaft, by fibers.
ACTION: acts in common with the pronator brevis to pronate antibrachium.
19. M. tensor patagii caudalis - (See Plate 20)
20. M. tensor patagii longus - (See Plate 20)
21. M. teres - (See Plate 17)
22. M. triceps caput dorsale - (See Plate 17)
23. M. triceps caput internale - (See Plate 18)
24. M. triceps caput ventrale - (See Plate 18)

SUPERFICIAL LAYER

WING-LEFT-VENTRAL VIEW

SECOND LAYER OF SECOND DIGIT

PLATE 56

Second Layer

1. M. anconeus medialis, medial elbow muscle
 FORM AND RELATIONSHIPS: flat, triangular; under flexor carpi ulnaris caudalis and flexor carpi ulnaris cranialis; caudal to pronator longus; over brachialis and extensor digiti tertii manus medialis, ulna and humero-ulnar articulation.
 ORIGIN: humerus, internal epicondylar prominence in common with that of pronator brevis by a tendon.
 INSERTION: ulna, proximal third of ventral surface by fibers.
 ACTION: extends antibrachium.

2. M. biceps brachii - (See Plate 54)
3. M. brachialis - (See Plate 58)
4. M. extensor carpi obliquus - (See Plate 58)
5. M. extensor carpi radialis profundus - (See Plate 54)
6. M. extensor carpi radialis superficialis - (See Plate 53)
7. M. extensor digiti tertii manus distalis - (See Plate 53)
8. M. extensor digiti tertii manus lateralis - (See Plate 58)
9. M. extensor digiti tertii manus medialis - (See Plate 56)
10. M. flexor carpi ulnaris caudalis - (See Plate 56)

11. M. flexor digiti quarti manus longus
 FORM AND RELATIONSHIPS: long narrow band, deep to the skin and caudal to metacarpal IV; superficial to flexor metacarpi caudalis.
 ORIGIN: ulnar carpal and metacarpal IV, by fibers.
 INSERTION: digit IV phalanx I, proximocaudal articular process by a tendon in common with that of the flexor et abductor digiti quarti manus.
 ACTION: flexes digit IV.

12. M. flexor digiti secundi manus - (See Plate 56)
13. M. flexor metacarpi caudalis - (See Plate 55)
14. M. interosseus dorsalis - (See Plate 53)
15. M. latissimus dorsi - (See Plate 16)
16. M. patagialis - (See Plate 20)
17. M. pronator brevis - (See Plate 56)
18. M. supinator brevis - (See Plate 54)
19. M. triceps caput dorsale - (See Plate 17)
20. M. triceps caput internale - (See Plate 18)
21. M. triceps caput ventrale - (See Plate 18)

WING-LEFT-VENTRAL VIEW SECOND LAYER
 PLATE 57

Deep Layer

1. M. anconeus lateralis - (See Plate 54)

2. M. brachialis
 FORM AND RELATIONSHIPS: short, straplike at humero-ulnar articulation; ventral to pronator brevis, pronator longus and anconeus medialis; cranial to cubital ligament; over extensor digiti tertii manus medialis and inserting tendon of biceps brachii.
 ORIGIN: humerus, brachialis depression by fibers.
 INSERTION: ulna, brachialis depression by fibers.
 ACTION: flexes antibrachium upon brachium.

3. M. extensor carpi obliquus, oblique extensor of the carpus
 FORM AND RELATIONSHIPS: broad and flat; on distal third of ulna ventrally; under extensor digiti tertii manus medialis, and flexor carpi ulnaris caudalis.
 ORIGIN: ulna, distal third ventrally by fibers.
 INSERTION: carpometacarpus II, proximal protuberance dorsally by a tendon which passes obliquely over radial carpal.
 ACTION: extends and pronates the manus.

4. M. extensor carpi obliquus - (See Plate 58)

5. M. extensor digiti tertii manus lateralis
 FORM AND RELATIONSHIPS: thin and fusiform; under the pronator brevis and the skin; over the extensor carpi radialis profundus and the concavity of the radius distally.
 ORIGIN: radius, distal half of the concave surface by fibers.
 INSERTION: digit III, phalanx I, by a tendon. This tendon passes over the articulation of ulna and carpometacarpus laterally and then to dorsal surface of metacarpal III before inserting on the phalanx. Near the articulation of ulna and carpometacarpus it receives an inconspicuous muscular slip from the aponeurosis which covers the dorsal surface of the manus.
 ACTION: extends digit III and aids in extension of whole manus.

6. M. extensor digiti tertii manus medialis - (See Plate 56)
7. M. supinator brevis - (See Plate 54)

DEEP LAYER

WING-LEFT-VENTRAL VIEW
PLATE 58

Table I - Bird Muscle Synonomies*

Harvey, Kaiser Rosenberg (Turkey)	George + Berger (Aves)	Romer (Aves)	Fisher (Whooping Crane)	Howell (Aves)	Chamberlain (Chicken)	Shufeldt (Raven)
abductor digiti quarti pedis	abductor digiti IV		abductor digiti IV		interossei	
abductor digiti secundi pedis	abductor digiti II		abductor digiti II			
abductor digiti secundi manus	abductor pollicis		abductor pollicis			extensor proprius pollicis
adductor digiti secundi manus	adductor pollicis		adductor pollicis	adductor pollicis	adductor of the second digit	flexor brevis pollicis
adductor digiti secundi pedis	adductor digiti II		adductor digiti II			
adductor longus	adductor longus	puboischio- femoralis	adductor super- ficialis	adductor super- ficialis	adductor 1. lateral 2. medial	adductor longus
adductor magnus	adductor profundus		adductor profundus	adductor profundus		adductor magnus
ambiens	ambiens	ambiens	ambiens	ambiens	pectineus	ambiens
anconeus lateralis	anconeus	extensor antebrachii ulnaris	anconeus		anconeus	anconeus
anconeus medialis					anconeus medialis	

articulohyoideus	stylo- hyoideus				articulo- hyoideus	stylo- hyoideus
articulomylo- hyoideus	platysma myoides				cutaneous aucheniatia	platysma myoides
basientoglossus					copuloento- glossum	
basirectricales	lateralis caudae		lateralis caudae			lateralis caudae
biceps brachii	biceps brachii	biceps brachii	biceps	biceps	biceps brachii	biceps
biceps flexor cruris	biceps flexor cruris	iliofibu- laris	extensor ilio- fibularis	extensor ilio- fibularis		biceps flexor cruris
biventer cervicis	biventer cervicis				biventer cervicis	biventer cervicis
biventer maxillae	depressor mandibulae				occipito- mandibularis	biventer maxillae
brachialis	brachialis	brachialis	brachialis	brachialis	brachialis	brachialis
caudalis lateralis	lateralis coccygis		lateralis coccygis		lateralis coccygeus	lateralis coccygis
ceratoentoglossus	cerato- hyoideus				styloento- glossum	cerato- hyoideus
circumconcha (Not figured)	circum- concha					circum- concha
complexus	complexus				complexus	complexus

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
coracobrachialis dorsalis	coraco- brachialis anterior		coracobra- chialis anterior subcor- accoideus	coracobra- chialis anterior subcor- accoideus	supracora- coid	coraco- brachialis
coracobrachialis ventralis	coraco- brachialis posterior	coracobra- chialis	coracobra- chialis posterior	coracobra- chialis posterior	coracobra- chialis ventralis	pectoralis tertius
coracohumeralis	coraco- humeralis		coracobra- chialis anterior	coracobra- chialis anterior		coraco- humeralis
cutaneus cleido- dorsalis	dermocleido- dorsalis				cutaneus cleido- dorsalis	dermocleido- dorsalis
cutaneus colli lateralis	cutaneus colli				cutaneus colli lateralis	dermo- temporalis
cutaneus costohumeralis	dermo- ulnaris				cutaneus costo- humeralis	dermo- ulnaris
cutaneus iliacus	dermo- iliacus				cutaneus iliacus	dermo- iliacus

cutaneus nuchalis	cleido- trachealis				cutaneus nuchalis	cleido- trachealis
cutaneus pectoralis caudalis	dermo- pectoralis				cutaneus trunci- ventralis	dermo- pectoralis
cutaneus pectoralis cranialis	dermo- pectoralis				cutaneus cleido- ventralis	dermo- pectoralis
cutaneus spinalis dorsalis	dermo- spinalis				cutaneus spina- lis dorsalis	dermo- spinalis
deltoideus	deltoideus	deltoideus	deltoideus minor	deltoideus deep-brevis	deltoideus	scapulo- humeralis
depressor caudae	depressor caudae		depressor coccygis		depressor coccygis	depressor coccygis
depressor glossi	depressor glossus					depressor glossus
depressor palpebrarum ventralis	depressor palpebrae inferio- ris				depressor palpebrarum ventralis	depressor palpebrarum interior
depressor rectricum	depressor caudae		depressor caudae		coccygeus	depressor caudae
diaphragma	costopulmonares					diaphragma
entotympanicus					pterygo- palatinus	ento- tympanicus
eversor urodeum	levator cloacae	levator cloacae	levator cloacae		eversor urodeum	

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
extensor carpi obliquus	flexor carpi ulnaris brevis		flexor carpi ulnaris		extensor carpi obliquus	flexor carpi ulnaris brevior
extensor carpi radialis profun- dus	extensor metacarpi radialis		extensor metacarpi radialis pars palmaris		extensor carpi radialis; deep head	
extensor carpi radialis super- ficialis	extensor metacarpi radialis		extensor metacarpi radialis pars anconalis		extensor carpi radialis	extensor meta- carpi radialis longior
extensor digiti quarti pedis brevis	extensor brevis digiti IV		extensor brevis digiti IV			
extensor digiti secundi manus	extensor pollicis brevis		extensor pol- licis brevis		extensor digiti secundi	
extensor digiti terti manus distalis	abductor indicis		abductor indicis			
extensor digiti terti manus lateralis	extensor indicis longus		extensor indicis longus		extensor digiti terti	extensor indicis longus
extensor digiti terti manus medialis	flexor digitorum profundus		flexor digi- torum pro- fundus		extensor digiti terti	flexor digitorum profundus

extensor digiti terti pedis brevis	extensor brevis digiti III		extensor brevis digiti III			
extensor digitorum pedis longus	extensor digitorum communis	extensor digitorum communis	extensor digitorum longus		extensor digitus longus	extensor longus digitorum
extensor femoris	extensor femoris				rectus femoris	
crureus	vastus medialis		vastus medialis	vastus medialis	medial vasti	crureus
subcrureus						
vastus externus	vastus exter- nus		vastus lateralis	vastus lateralis	lateral vasti	vastus externus
vastus internus	vastus internus		femori- tibialis internus			vastus internus
extensor hallucis longus	extensor hallucis longus		extensor hallucis longus		extensor hallucis brevis	extensor hallucis brevis
externus abdominis	obliquus abdominis externus	obliquus abdominis externus			obliquus abdominis externus	obliquus externus abdominis
flexor carpi ulnaris caudalis	flexor carpi ulnaris	flexor carpi ulnaris	flexor carpi ulnaris, posterior part			flexor carpi ulnaris
flexor carpi ulnaris cranialis			flexor carpi ulnaris, anterior part			

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
flexor digiti quarti manus longus	flexor digiti IV		flexor digiti III		flexor longus digiti quarti	flexor minimi digiti
flexor digiti secundi manus	flexor digiti II		adductor pollicis		adductor of the second digit	flexor brevis pollicis
flexor digiti secundi et digiti terti manus	extensor digitorum communis		extensor digitorum communis			extensor digitorum communis
flexor digiti secundi per- foratus et perforans	flexor per- forans and perforatus digiti II		flexor per- forans et perforatus digiti II		flexor digitus perforatus et perforans digiti secun- di (median digital interme- diate flexor)	flexor perfo- ratus indicis secundus pedis
flexor digiti terti perforatus et perforans	flexor per- forans and perforatus digiti III		flexor per- forans et perforatus digiti III		flexor digitus perforatus et perforans digiti terti (intermediate digital flexor)	flexor perfo- ratus medius secundus pedis
flexor digitorum pedis profundus	flexor digitorum longus	flexor profundus	flexor digi- torum longus		flexor digitus perforans	flexor perforans digitorum pro- fundus

flexor digitorum
pedis super-
ficialis

1. flexor digiti
quarti per-
foratus
2. flexor digiti
secundi per-
foratus
3. flexor digiti
terti perfora-
tus

flexor et
abductor di-
giti quarti
manus

flexor hallucis
brevis

flexor hallucis
longus

flexor metacarpi
brevis

flexor metacarpi
caudalis

flexor
brevis
digiti III

flexor
hallucis
brevis

flexor
hallucis
longus

flexor
metacarpi
brevis

flexor
metacarpi
posterior

flexor hal-
lucis
longus

1. flexor per-
foratus
digiti II

2. flexor per-
foratus di-
giti III

3. flexor per-
foratus di-
giti IV

flexor brevis
digiti III

flexor hallucis
brevis

flexor hal-
lucis longus

flexor
metacarpi
posterior

superficial
digital
flexor

1. flexor digi-
tus perfora-
tus digiti
secundi

2. flexor digi-
tus per-
foratus di-
giti terti

3. flexor digi-
tus perfora-
tus digiti
quarti

flexor brevis
digiti quarti

flexor hallucis
brevis

flexor hallucis
longus

extensor of the
3rd digiti

1. flexor perfor-
atus indicis
primis pedis

2. flexor perfora-
tus medius
primis pedis

3. flexor perfora-
tus annularis
primis pedis

flexor minimi
digiti brevis

flexor brevis
hallucis

flexor longus
hallucis

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
flexor metacarpi longus	flexor metacarpi radialis		flexor meta- carpus radialis		ulnaris lateralis	flexor metacarpus radialis
gastrocnemius 1. caput caudale 2. caput craniale 3. caput mediale	gastro- cnemius	1. gastro- cnemius internus 2. gastro- cnemius externus	gastrocnemius		gastrocnemius	gastrocnemius
gemellus	gemellus	part of ischio- femoralis	obturator externus		gemelli	gemellus
geniohyoideus	geniohyoideus				hyomandibu- laris II	geniohyoideus
gluteus medius	gluteus medius	iliofemo- ralis externus	gluteus profundus	gluteus profundus	gluteus medius	gluteus medius
gluteus minimus	gluteus minimus	iliotro- chantericus	iliacus	iliacus	gluteus pro- fundus	gluteus minimus
gluteus primus	gluteus primus	iliofibu- laris	extensor iliotibialis lateralis	extensor iliotibialis lateralis	tensor fasciae latae	gluteus primus

gluteus super- ficialis	piriformis	piriformis	piriformis	gluteus super- ficialis	
hyoideus trans- versus				hyoideus trans- versus	
iliacus	iliacus	psoas	psoas	iliacus	
interarticulares	interar- tibulares				interar- ticulares
intercostales externales	intercostales externus			external intercostals	external set
intercostales internales	intercostales internus			internal intercostals	internal set
intercostales superficiales				costouncinate ligament	appendico- costales
interosseus dorsalis	interosseus dorsalis	interosseus dorsalis		interosseus dorsalis	interosseus dorsalis
interosseus ventralis	interosseus ventralis	interosseus palmaris		interosseus ventralis	interosseus palmaris
interspinales caudales	inter- spinales	inter- spinales			
interspinales craniales	inter- spinales			interspinales	

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
intertransversales	intertrans- versarii				intertrans- versales	intertrans- versales
ischiofemoralis minimus	ischio- femoralis	ischio- femoralis	caudofemo- ralis	caudofemo- ralis	cruratus caudalis	femoro- caudal
latissimus dorsi	latissimus dorsi	latissimus dorsi	latissimus dorsi	latissimus dorsi	latissimus dorsi	latissimus dorsi
levator caudae	levator coccygis		levator coccygis		levator coccygeus	levator coccygis
levator rectricum	levator caudae		levator caudae			levator caudae
levatores costarum	levator costarum				levatores costari	levatores costarum
longi colli ventrales	longus colli ventralis				semispinalis capitis	longus colli anterior
longissimus dorsi	longissimus dorsi				longissimus dorsi (illiocostalis)	longissimus dorsi
longus colli dorsalis	longus colli posticus				longus colli	longus colli posticus
longus colli ventralis caudalis						longus colli anterior
longus colli ven- tralis cranialis	longus colli ven- tralis anterior					

longus colli ven-
tralis medialis

mandibularis
infraorbitalis

mandibulo-
palatinus

mylohyoideus

obliqui colli

obliquospinales

obliquo-
transversales

obliquus capitis
caudalis

longus colli
ventralis

mylo-
hyoideus

obliquus
colli

obliquo-
transver-
salis

mylohyoideus

multifidus
cervicis

pterygoideus
internus

mylo-
hyoideus

obliquus
colli

obliquo-
transver-
sales

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
obliquus internus abdominis	obliquus internus abdominis				obliquus abdominis internus	obliquus internus abdominis
obliquus oculi dorsalis	obliquus superior	superior oblique			obliquus oculi dorsalis	obliquus superior
obliquus oculi ventralis	obliquus inferior	inferior oblique			obliquus oculi ventralis	obliquus inferior
obturator externus	obturator externus	obturator externus	obturator externus		obturator externus	gemellus
obturator internus	obturator internus	part of ischio- femoralis	obturator internus	obturator	obturator internus	obturator internus
patagialis	patagialis		1. tensor patagii brevis 2. tensor pa- tagii longus	1. deltoideus superfi- cial layer	1. patagialis brevis 2. patagialis longus 3. patagialis accessorius	1. tensor pa- tagii brevis 2. tensor pa- tagii longus
pectoralis profundus		pectoralis	supracoraco- ideus	coracobra- chialis	pectoralis profundus (subclavis)	pectoralis secundus

pectoralis super- ficialis	pectoralis super- ficialis	pectoralis	pectoralis super- ficialis	pectoralis super- ficialis	pectoralis super- ficialis	pectoralis major
peroneus brevis	peroneus brevis	peroneus brevis	peroneus brevis		peroneus tertius	tibialis posticus
peroneus longus	peroneus longus	peroneus longus	peroneus longus		peroneus longus	peroneus longus
popliteus	popliteus	popliteus	popliteus		popliteus	
pronator brevis	pronator brevis		pronator brevis		pronator longus brevis	pronator brevis
pronator longus	pronator longus		pronator longus		pronator longus brevis	pronator longus
pterygomandi- bularis						pterygoideus externus
pyramidalis oculi	pyramidalis nictitantis				pyramidalis oculi	pyramidalis nictitantis
quadratomandi- bularis					quadratomandi- bularis	
quadratus oculi	quadratus nictitantis				quadratus oculi	quadratus nictitantis

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
rectus abdominis	rectus abdominis				rectus abdominis	rectus abdominis
rectus capitis dorsalis	rectis capitis posticus				rectus capitis dorsalis major	rectus capitis posticus major
rectus capitis lateralis	rectus capitis lateralis				rectus capitis lateralis	rectus capitis lateralis
rectus capitis ventralis	rectus capitis ventralis				rectus capitis ventralis major	rectus capitis anticus minor
rectus oculi caudalis	rectus externus	posterior rectus			rectus oculi lateralis	rectus externus
rectus oculi cranialis	rectus internus	anterior rectus			rectus oculi medialis	rectus internus
rectus oculi dorsalis	rectus superior	superior rectus			rectus oculi dorsalis	rectus superior
rectus oculi ventralis	rectus inferior	inferior rectus			rectus oculi ventralis	rectus oculi inferior

rhomboideus	rhomboideus profundus et super- ficialis		rhomboideus profundus	rhomboideus profundus	rhomboideus	rhomboideus
sacrolumbalis	longissimus dorsi				longissimus dorsi (iliocostalis)	sacro- lumbalis
sartorius	sartorius	sartorius	extensor iliotibia- lis ante- rior	extensor iliotibia- lis anterior	sartorius	sartorius
scalenius	scalenus				1. scalenius medius 2. scalenius dorsalis	scalenius medius
scapulohumeralis maximus	scapulo- humeralis posterior	subcoraco- scapularis scapulo- humeralis posterior	deltoideus minor	deltoideus deep brevis	spinatus	scapulo- humeralis
scapulohumeralis minimus	scapulo- humeralis anterior	scapulo- humeralis anterior	proscapulo- humeralis brevis		subscapularis	teres minor
semimembranosus	semimem- branosus	ischio- flexorius	flexor cruris medialis	flexor cruris medialis	semitendinosus	semimem- branosus

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
semitendinosus	semiten- dinosus	ischio- flexorius	flexor cruris lateralis 1. proximal accessory head 2. distal accessory head	flexor cruris lateralis	semimem- branosus	semi- tendinosus
semitendinosus accessorius	semiten- dinosus accessory	ischio- flexorius	flexor cruris lateralis 1. proximal accessory head			accessory pant.
serratus dorsalis	serratus anterior				serratus dorsalis	serratus parvus
serratus magnus					serratus ven- tralis caudal part	serratus anticus magnus
serratus ventralis	serratus ventralis				serratus ven- tralis cranial part	serratus parvuus anticus

sphincter ani				sphincter ani	
sternocoracoideus	sterno- coracoideus	sternocora- coideus	sternocora- coideus	sternocora- coideus	subclavius
sternocostales					
sternothyrohyoi- deus	sternothy- rohyoideus			sternothyro- hyoideus	cleido- trachealis
sternotrachealis	sternotra- chealis			sternotrach- ealis	sterno- trachealis
subcoracoideus	subcora- coideus	subcoracoi- deus	subcoracoi- deus		coraco- brachiales
subcostales				subcostals	triangularis sterni
subscapularis	subscapu- laris	proscapulo- humeralis	proscapulo- humeralis	subscapularis	supra- spinatus
supinator brevis	supinator brevis	supinator brevis		1. supinator lateralis 2. supinator medialis	supinator brevis

Table I - Bird Muscle Synonomies (continued)

Harvey, Kaiser, Rosenberg	George + Berger	Romer	Fisher	Howell	Chamberlain	Shufeldt
temporalis et masseter					1. temporal 2. masseter	1. temporal 2. masseter
tensor patagii caudalis	tensor patagii				expansor secundarium	
tensor patagii longus	tensor patagi longus		tensor pata- gii longus		patagialis longus (brachiora- dialis)	tensor patagii longus
teres	scapulo- humeralis anterior	scapulo- humeralis anterior	dorsalis scapulae	dorsalis scapulae	teres major	teres et infra- spinatus
thyrobasihyal	sterno- hyoideus				thyroento- glossum	sterno- hyoideus
tibialis caudalis	tibialis posticus	tibialis posticus	peroneus brevis		tibialis caudalis	tibialis posticus
tibialis cranialis	tibialis anterior	tibialis anterior	tibialis anterior		tibialis cranialis	tibialis anticus
trachelomastoideus					trachelomas- toideus	trachelo- mastoideus
tracheolateralis	tracheo- lateralis				ypsilotra- chealis (trachialis lateralis)	tracheo- lateralis
transversus abdominis	transversus abdominis	transversus abdominis			transversus abdominis	transversus abdominis

transversus perinei	transversus perinei				transversus perinei
trapezius	rhomboideus super- ficialis	rhomboideus super- ficialis	rhomboideus super- ficialis	trapezius	trapezius
triceps 1. caput dorsale 2. caput inernale 3. caput ventrale	triceps 1. brachii 2. coracoidus 3. cubiti	triceps	triceps 1. external head 2. scapular head	triceps (long, medial, lateral heads)	triceps

*Explanation of the Table

Synonyms are not presented except where the muscle named and described for the turkey was similar to the muscle named in the references cited. In a number of instances, the study cited was concerned with only specific areas of another bird; therefore, no muscles comparable to the turkey were described. It should also be noted that no attempt was made in our study to determine muscle homologies.

B. Osteology

1. Significant Feature of the Turkey Skeleton

The skeletal elements of the domestic turkey do not differ significantly from that of the rock dove (Columba livia) described by George and Berger (1966) nor that of the chicken as shown by Chamberlain (1943). Shufeldt (1887) has described in detail the skeleton of the ocellated turkey and compared the skulls of the domestic turkey with that of Meleagris g silvestris.

The purpose of this presentation is, therefore, to describe the characteristics of the turkey skeleton that clearly identifies this bird as a member of the gallinaceous birds. The excellent presentation of George and Berger (1966) for the rock dove both as to the order of presentation and context leads us to follow their presentation and as a result to borrow heavily from the facts they have gathered through their detailed search of the original literature.

The domestic turkey is not generally considered a flying bird. Nevertheless, the domestic turkey is derived from the wild turkey which possessed a good ability to fly. All turkeys can fly and do perch at night.

The selection that has occurred in the domestication of the turkey has not resulted in loss or significant alteration of the characteristics that are used in taxonomic studies of birds. However, it should be pointed out here that the skulls of the domestic turkeys from which our drawings were taken are far less angular than the skull of the domestic turkey from which Shufeldt made his drawings (1887a). In that paper Shufeldt pointed, however, that the skull of the domestic turkey in his hands was still less angular than that of the wild turkey. To determine the full impact that selection has had on the skeletal structures in the process of domestication would demand a highly sophisticated study utilizing quantitative evaluations. Though general agreement has been reached on the proper terminology of the skeleton and its parts, much needs to be done on the embryonic origin of the bones, detailed studies of the reptilian skeleton, and functional comparisons within the bird groups before agreement will be reached on a standard of nomenclature.

The adaptive significance of pneumatization in bones of turkeys has not been fully determined nor has a comparative study of the rate of closure of skull sutures been done. Indeed, it has not yet been fully agreed whether the 15th vertebra is the last of the cervicals or the first of the thoracics nor has it been determined if gallinaceous bird lose the first digit of the manus during development (Montagna 1945, George and Berger 1966).

Skull (Pls. 60-63)

The brain case of the turkey skull is composed of the occipital, parietal, frontal, temporal bones and the sphenoidal complex. In the adult bird these are fused. In the 14 month bird, however, sutures between these are clearly evident.

The orbits are separated by a thin bony interorbital septum. In the case of the turkey a well-developed lacrimal bone (Pl. 60-63) has a dorsocaudal projection that extends the supraorbital ridge dorsally and laterally, whereas, a ventrocaudal process extends into the orbit to which fascia that encompasses a well-developed lacrimal gland adheres.

The external nares are bounded by the premaxilla, nasals, and maxilla which form the facial portion of the turkey skull. The nostrils open externally, thus, are pervious. The nares are separated by a nasal septum that extends from the nasal capsule cranially to the ethmoid caudally; and from the nasal process of the premaxilla dorsally and to the vomer ventrally.

The maxilla, as described by us, is the cranial bone of the zygomatic. Many ornithologists, however, consider the premaxillae as the "upper mandibles" or maxillae. In some birds these are capable of some extension and flexion (kinetic) by way of a transverse craniofacial or nasa-frontal hinge (the articulation with the cephalic edge of the frontals). Nevertheless, neither the maxilla as we identify it nor the premaxilla (upper mandibles) in the turkey are kinetic in the adult turkey.

Vertebral Column and Ribs (Pls. 65-71)

For purposes of descriptions we have preferred retention of the terms, cervical, thoracic, lumbosacral, sacral, synsacral, and caudal vertebrae including the pygostyle.

There are 14 cervical vertebrae including the atlas and axis in the turkey. In the several skeletons we studied, there was no variation in this number. The cervical vertebrae each have distinctive characteristics that would permit a careful student of osteology to distinguish each from the other. The 14th cervical vertebra does not have a free (asternal) rib as described for the chicken. The 15th vertebra in the turkey has a free rib and has been included as the first thoracic vertebra in our study.

We prefer to classify the 15th vertebra as a thoracic vertebra since it does have ribs that articulate freely

on parapophyses characteristic of thoracic vertebrae; whereas, "ribs" on cervical vertebrae are firmly fused and are much reduced in the 13th and 14th cervicals. The free rib, therefore, of the 15th vertebra cannot at this point be homologized with the fused ribs of the cervical vertebrae. This question cannot be resolved without more comparative anatomical research in birds.

Notarium (Pls. 69-71)

There are seven thoracic vertebrae in the turkey. The first and sixth articulate freely and have asternal ribs, whereas, the second through the fourth are fused to each other at their processes as in the chicken and rock dove. The seventh thoracic vertebra is fused to the first lumbar vertebra at the centrum and to the ilium dorsally and by transverse processes laterally. An asternal rib is fused to the seventh thoracic vertebra.

The lumbar and sacral vertebrae are fused and are, therefore, considered as the lumbosacral vertebrae.

The lumbar vertebrae (vertebrae lumbales) probably four in number, are fused to each other and to the ilium.

The sacral vertebrae form the caudal fourth of the pelvic roof as a result of fusion of their dorsal spines and transverse processes.

The six synsacral vertebrae form the caudal three-fourths of the pelvic girdle and are fused laterally by their transverse processes to the medial borders of the ischii.

The sixth synsacral vertebra is fused to the first caudal vertebra by cartilage in the mature bird.

The turkey has six or seven free caudal vertebrae including a pygostyle. This number varies even between individuals. According to George and Berger (1966) the numbers of cervical and thoracic vertebrae, however, remain relatively constant within a species.

Pelvic Girdle (Pls. 69-71)

The synsacrum is fused with the ilium and ischium to form a rigid pelvic girdle in the turkey. The pelvic bones are fused cranially with the ischii. A long narrow ischiopubic foramen (fenestra) lies between the two points of contact of the ischium and pubic bones. An obturator foramen is formed similarly but is cranial to the elongate ischiopubic fenestra.

A well-developed iliopectineal process is present cranial and ventral to the acetabulum.

The neural canals in the pelvic girdle are formed by fusion of the dorsomedial borders of the ilium and the synsacral vertebrae (fused lumbar and sacral vertebrae).

Pectoral Girdle (Pls. 72-75)

The pectoral girdle of turkeys is composed of the typical three bones: scapula, coracoid, and furcula.

The scapula is flat and thin and extends parallel to the thoracic vertebrae. It articulates with the coracoid and is attached to the free dorsal ends of the furcula by ligaments. The coracoids and furcula are not fused to each other. A reduced hypocleideum is formed by fusion of the clavicles in the turkey.

A foramen tiosseum is formed by the dorsal apposition (articulation) of the head of the scapula, coracoid, and furcula.

Both the scapula and coracoids have well-developed pneumatic foramen in which there are extensive air sacs.

Sternum (Pls. 74-75)

The turkey like most carinates has a ventrally directed keel or carina sterni. Extending caudally from the sternum is a single median xiphoid process (metasternum), two caudolateral processes, and two dorsolateral processes. The turkey, therefore, has two lateral notches but does not have a posteriomedial fenestra as reported by George and Berger (1966) for Columba livia.

Hind Limb (Pls. 76-81)

The hind limb of the turkey consists of a femur, tibiotarsus, patella, tarsometatarsus, and four digits.

The femur is pneumatized from the large abdominal air sacs. The tibia is well developed in the turkey but distally is a composite of the tibia and tarsal bones. The fibula on the other hand is poorly developed. It does have a well-developed head that articulates with the femur and the head of the tibia proximally. The fibula extends about three-fourths the length of the tibia and is styliiform at its distal end.

The tarsometatarsus is formed by fusion of the distal tarsals with three metatarsals. George and Berger (1966) report

that an independent first metatarsal articulates with the medial border of the tarsometatarsus. In addition to a free metatarsal I, the turkey has a well-developed hypotarsal sesamoid that is in close apposition with the medial trochlea of the tarsometatarsus.

The male turkey has a well-developed spur at the distal end of the hypotarsal styliiform process. The spur is absent in the female; nevertheless, the hypotarsal styliiform process is well developed in the female.

The hallux of the turkey points obliquocaudally and has one phalanx plus an ungal phalanx. The first phalanx articulates with the free metatarsal I. Digit II points obliquomedially and has two phalanges and an ungus. Digit III, the heaviest of the digits, points cranially and is composed of three heavy bodied phalanges and an ungus. Digit IV is pointed craniolaterally and is composed of four phalanges and one ungus. With this configuration the turkey foot may be considered anisodactyle and to be typical of the perching foot.

The Wing Bones (Pls. 83-85)

The humerus is pneumatic in the turkey as in nearly all birds and has a single pneumatic foramen for an air chamber from the interclavicular air sac.

The ulna is characteristically longer and heavier than the radius. The first carpometacarpus is separated from the distal ends of the ulna and radius by two free carpal bones; the radiale (scapholunar) and ulnare (cuneiform). The remaining carpals are fused with the proximal ends of the three metacarpals of the manus.

Although birds characteristically have three metacarpals, in the adult turkey metacarpal II is fused with carpal II and does not form a distinctive process.

We have followed Montagna (1945), Holmgren (1955), and Fisher and Goodman (1955) in our labeling of the metacarpals and digits of the hand as II, III, and IV. There is embryological evidence that metacarpals II, III, and IV, as well as Digits II, III, and IV only, are retained after hatching. George and Berger (1966), however, cast some doubt on this conclusion.

Digits II and IV of the turkey have one phalanx as in most birds, and Digit III has two phalanges.

Description of Skeletal Elements

Plates 60-63

Skull (Male)

Right Lateral, Dorsal
Ventral, and Caudal Views

Ethmoid

The ethmoid is the most medial of the cranial bones and its caudal region forms the mediocranial border of the cranium. It is bounded dorsally by the frontal, dorsolaterally by the orbital plates of the frontal, and by the caudal portion of the nasal. Cranially it is bounded by the vomer and ventrally by the rostrum of the basisphenoid. Its lateral borders are bounded caudally by the medial borders of the alisphenoid and presphenoid.

- b. The splénial is thin and flat and lies medially on the mandibular complex and overlays the caudal projections of the pars dentalis.
- c. The pars supraangularis projects into the bifurcation of the pars dentalis and lies dorsal on the mandible. The coronoid process lies dorsally on the supraangularis just cranial to the articular facet of the pars articularis.
- d. The pars articularis is distinguished by two processes and the mandibular condyle. The mandibular condyle articulates with the ventral process of the quadrate. The caudal process of the pars articularis extends toward the median line of the basitemporal plate from the mandibular condyle.
- e. The pars angularis is thin and lies ventral to the pars articularis and supraangularis. Its caudal region forms the ventral surface of the mandibular process.

Frontal

Position: The frontals lie between the cranial border of the parietals and the caudal border of the nasals and touches the temporal at the caudal border of the supraorbital process. The cranial borders of the frontals extend to the dorsal and medial aspect of the nasal processes of the premaxilla and the cranial aspect of the supraorbital processes. The frontals also touch the orbital processes of the lachrymals. A portion of the frontal (orbital plate) forms the roof and the caudal aspect of the orbital fossa. The orbital plate meets with the alisphenoid in the caudal aspect of this fossa. In the median line dorsally, the right and left orbital plates meet the ethmoid bone of the facial group.

In the three-month bird the right and left frontals are separated by the frontal suture. The sphenofrontal suture clearly separates the alisphenoid and the frontal in the caudal orbital region. In the fifteen-month bird these sutures are not visible.

At the junction of the orbital fundus with the orbital plate of the frontal are two foramina through which the first and second divisions of the trigeminal nerve pass. At the junction of the orbital fundus and orbital plate are two other foramina. The more cranial and larger is the olfactory foramen, and just caudal to this foramen, about four mm., is the trochlear nerve foramen.

SKULL (MALE) - RIGHT - LATERAL VIEW
PLATE 60

The optic foramen is in the same vicinity and is the largest in the orbital region. Ventral to it are two or three (variable) nutrient foramina at the sutures of the ethmoid, alisphenoid, and presphenoid.

Lacrima

The lacrima is one of three facial bones: the lacrima, nasal, and premaxilla and forms the dorsocranial limit of the orbit. Its body articulates broadly with the nasal and narrowly with the frontals. The distinctive feature of the lacrimals are the dorsal and ventral orbital processes. The dorsal process extends caudally and somewhat laterally and thereby enlarges the orbit. The ventral process extends mediocaudally into the orbit.

Mandible

The mandible, the most ventral bone of the facial group, forms the apex of the ventral beak and extends to the auditory meatus.

This bone is composed of five embryonic units that are fused in a fifteen-month bird, but in the three-month bird these are still distinguishable.

- a. The pars dentalis forms the lower beak, from which extends the right and left caudal projections. In its medial aspect there is a "tongue-and-groove" union with the splenia dorsally, and with the pars supra-angularis, and the pars dentalis laterally.

Nasal

The nasal is bounded caudally by the frontal, laterally by the lacrima, and medially by the nasal process of the premaxilla. Ventrally it touches the maxilla, premaxilla, and palatine. It is composed of a body, caudalis processus frontalis, from which two processes extend: the processus intermaxillaris and processus maxillaris cranialis. The three processes form the caudal, lateral, and medial borders of the external nares. The body is convex laterally and concave toward the median line. Its caudal border is separated from the frontal by the nasofrontal suture and lies on the dorsal surface of the ethmoid.

Nasal septum

The nasal septum is in the median aspect of the nasal aperture. Its caudal border meets the ventral process of the ethmoid, and is bounded by the ethmoid caudally, the vomer ventrally, the oblique process of the vomer cranially, and dorsally by the caudal fourth of the nasal process of the premaxilla.

The cranial half of the nasal septum is bounded by the nasal capsule, the nasal process of the premaxilla and the oblique process of the vomer.

Occipital

The occipital is the most caudal bone of the cranium and is bounded dorsally and cranially by the caudal border of the parietals, laterally by the caudal border of the temporal (squamosal), and ventrally by the caudal border of the basisphenoid (basitemporal plate).

SKULL - (MALE) - DORSAL VIEW

From a caudal view of the cranium, the occipital forms an arc from dorsal to about two-thirds ventral, at which point it becomes variously shaped to help form the lateroventrally placed foramen lacerum. The foramen magnum is centrally located in this bone.

Ventral to the foramen magnum is a single occipital condyle that articulates with the atlas. During extreme flexion of the skull, a subcondyloid fossa ventral to the base of the occipital condyle receives the body of the atlas.

There are two pairs of occipital foramen lateral to the occipital condyle; the spinal accessory nerve foramen and the foramen lacerum lateral to these.

In the three-month turkey it is possible to distinguish the four bones from which the occipital has been derived: a supra-occipital dorsal, two exoccipitals lateral and a basioccipital ventral to the foramen magnum.

Palatine

The palatine is long and thin. The caudal triangular process is convex dorsally and concave ventrally and articulates medially with the rostrum of the basisphenoid.

Caudally, the palatine articulates with the medial articular surface of the pterygoid and cranially with the dorsal surface of the palatine process of the premaxilla. The caudal fifth of the palatine articulates with the rostrum of the basisphenoid medially and laterally with the superior maxilla and the maxillary process of the premaxilla.

Parietal

The parietals are quadrilateral in shape. These two bones (fused in the fifteen-month bird) are the most caudal of the dorsal bones of the cranium. They are bounded cranially by the frontals, laterally by the temporals, and caudally by the dorsal border of the occipital. In the fifteen-month bird it is difficult to see the demarcation between the parietals, frontals and the temporal (squamosal) bones. A sagittal depression marks where the fusion of the interparietals has occurred.

In the three-month bird the parietals are separated from the frontals, temporals and the occipital by the coronal sutures cranially, the squamosal sutures laterally, the lambdoidal sutures caudally and the interparietal suture medially. The frontal fontanel and occipital fontanel may still be seen and the interparietals are not yet completely incorporated into the parietals.

Premaxilla

The premaxilla forms the upper beak and the cranial border of the nasal aperture. It has three pairs of processes that project caudally:

- a. The nasal process is biramous, extends to the frontal and overlays the ethmoid and is bounded laterally by the nasal.
- b. The maxillary process meets with the maxillary process of the nasal medially and the cranial extensions of the palatine and maxilla at its caudal limit. The maxilla and

SKULL-(MALE)-VENTRAL VIEW
 PLATE 62

the maxillary process forms the bony support for the upper beak.

- c. The palatine process projects caudally parallel to the maxillary process but is medial to it. It meets with the cranial projection of the maxilla dorsally and forms a bony support for the "gum" plate of the palate.

The premaxilla forms the cranial border of the external nasal aperture.

Pterygoid

The pterygoid is medial to the quadrate and lies caudoventrally in the orbit. It articulates with the quadrate, the articular process of the basisphenoid, and the caudal limit of the palatine.

Its three articular surfaces are: quadrate articulare on its laterocaudal surface; rostrum articulare on its medial surface; and palatine articulare on its mediocranial surface.

Quadrate

The quadrate is Y-shaped and is the most caudal of the facial bones. Its caudal aspect helps to form the cranial curvature of the external auditory meatus.

Its caudal process projects dorsally and caudally to articulate with the squamous temporal, the cranial process projects medio-cranially in a line parallel with that of the pterygoid with which it articulates, and its ventral process articulates with the quadratojugal.

Sphenoid (Sphenoidal complex: basisphenoid, presphenoid and alisphenoid)

The sphenoidal complex is composed of the basisphenoid, presphenoid and alisphenoid.

The caudal portion of the basisphenoid is covered by a broad, bony plate, the basitemporal plate, whereas the rostrum of the basisphenoid extends craniomedially to meet the vomer.

The presphenoid element is dorsal to the basisphenoid and may be seen as the cranial border of the external auditory meatus.

The alisphenoid, as seen in a three-month bird, projects from the presphenoid as a rectangular plate and is in contiguity with the caudoventral border of the orbital plate of the frontal. In the mature bird the points of fusion cannot be distinguished. What has been called the supraorbital process of the frontal is actually a process of the alisphenoid, alae orbitales. We have named this process the zygomatic process of the alisphenoid. This process, however, is composed of much reduced processes from the frontals and temporals.

Temporal

The temporals are bounded caudally by the occipitals, dorsally by the parietals, laterally and ventrally by the quadrates, ventrally by the sphenoids, and cranially they are contiguous with the alisphenoids.

SKULL - (MALE) - CAUDAL VIEW

The squamous portion of the temporal forms the lateral wall of the cranium, whereas the petrosal forms the floor. The squamosal and petrosal are fused and contain the auditory structures.

At a point just cranial to the articulation of the temporal with the quadrate, a small osseous process continues as cartilage (zygomatic process of the temporal) to meet with the ossified zygomatic process of the alisphenoid. This cartilage is ossified in the fifteen-month bird. From our observations it would appear that the so-called supra-orbital process of the frontal in birds, at least in the turkey, is actually a process (alae orbitalis) of the alisphenoid. We have therefore called this process the zygomatic process of the alisphenoid.

The external auditory meatus is bounded caudally by the external auditory process of the occipital, ventrally and cranially by the temporal wing of the sphenoid, and dorsally by the squamous temporal.

The foramina observed in the petrous temporal seen by looking into the external auditory meatus are: the foramen lacerum, which is a large cavity, and this is divided into two other cavities deeply. The most ventral of these is the fenestra ovals, through which the columella passes. The most dorsal of the foramina in the auditory meatus is the foramen for the semi-circular canal.

Vomer

The vomer is delicate and lies cranial to the rostrum of the basisphenoid. This bone in the turkey does not have a bony or cartilaginous articulation with the rostrum as in the chicken (Kaupp, 1918). Cranially the vomer articulates with the caudal aspect of the palatine process of the maxilla. The vomer acts as a base for the internasal septum. A dorsocaudal process projects obliquely from the vomer in the caudal third of the nasal aperture to articulate with the ethmoid.

Its main center of ossification is slightly parallelogram in shape, with a short caudal ligamental projection from which strong ligaments connect to the cranial projection of the rostrum.

Zygomatic (jugal, quadratojugal, maxilla)

The zygomatic is a complex of three bones that extend from the ventral process of the quadrate to the maxillary process of the nasal:

- a. The quadratojugal of the zygomatic complex is long and thin. At its caudal limit it articulates with the ventral process of the quadrate. It extends cranially to about the middle of the ventral orbital region where it fuses with the caudal projection of the superior maxilla.
- b. The jugal lies dorsally over the cranial projection of the quadratojugal and the caudal projection of the "superior" maxilla.
- c. The "superior" maxilla extends from the maxillary process of the nasal caudally and passes ventral to the jugal and articulates with the cranial projection of the quadratojugal.

At its nasal articulation the "superior" maxilla is bounded ventrally by the maxillary process of the premaxilla. A palatine process extends medially from the cranial limit where it forms a part of the caudal floor of the nares.

Hyoid Apparatus

The hyoid apparatus lies between the mandibles and is partially embedded in the tongue. It is composed of seven units variously ossified: entoglossum (one unit, cartilaginous); basihyal (one unit, bony); basibranchial (one unit, cartilaginous); ceratobranchial (two units, cartilaginous); and epibranchials (two units, cartilaginous).

The entoglossum is convex dorsally and concave ventrally and lies within the tissue of the tongue. It is "Y" shaped. The tail of the "Y" points in the direction of tongue tip whereas the arms of the "Y" are directed caudally.

The basihyal is the more ossified unit of the apparatus. It is convex on the ventral surface and has a ridge on the dorsal surface medially. It has four articulating surfaces: one cranial for articulation with the entoglossum; one caudal for articulation with the basibranchial; and two caudolaterally for articulation with the ceratobranchial units.

The basibranchial lies on the ventral surface of the superior larynx. It is styliform in shape and directed caudally.

The ceratobranchials lie between the basihyals and the epibranchials. The epibranchials are styliform and directed dorsally. Its union with the ceratobranchial is cartilaginous and is not a free articulation.

DORSAL VIEW

VENTRAL VIEW

HYOID APPARATUS RIGHT LATERAL VIEW
 PLATE 64

Cervical Vertebrae - Articulated

There are fourteen cervical vertebrae in the turkey. These include the atlas and axis. The first cervical, the atlas, articulates with the occipital condyle, and the fourteenth with the first thoracic vertebra.

The atlas and axis are distinctly different in structure from each other as well as the other cervical vertebrae. The third and fourth cervicals are morphologically similar but differ from the other cervicals in that they possess alar processes between the postzygapophyses and the prezygapophyses. The fifth through the twelfth cervicals have a ventral carotid arch and are thus distinguished from the thirteenth and fourteenth cervicals that lack these.

The thirteenth cervical vertebra has a foramen located ventrally just caudal to its cervical rib base; the fourteenth cervical vertebra, however, lacks this foramen.

Third and Fourth Cervical Vertebrae

These two vertebrae are similar in structure, thus are described together.

A dorsal spine and the prezygapophyses are in the most cranial portion of these vertebrae.

The cranial articular surface is ventral to the neural canal and lateral to these are two intravertebral nutrient foramina.

The diapophysis is just ventral to the prezygapophysis, and the parapophysis lies ventral to the diapophysis. A pleurapophysis (cervical rib) is fused to these tubercles and projects caudally.

The alar processes with large intervertebral foramina lateral to the dorsal spine extend broadly between the prezygapophyses and postzygapophyses.

These vertebrae have the anapophyses dorsal to the postzygapophyses and neuropophyses with an intervertebral notch.

Fifth Cervical Vertebra

The fifth cervical vertebra has a dorsal spine, postzygapophyses and prezygapophyses and a ventral carotid arch. Two intravertebral foramina are lateral to the cranial articular surface.

Thirteenth and Fourteenth Cervical Vertebrae

The thirteenth cervical vertebra is longer than the fourteenth, but the latter is wider and deeper in its cranial aspect with a more pronounced dorsal spine. A carotid arch is absent in these two cervicals, and they have a single ventral spine (hypapophysis).

The tenth through the fourteenth cervical vertebrae have a deep ligamental fovea in the caudal aspect of the dorsal spine for attachment of the intervertebral ligaments. The fourteenth cervical vertebra does not have a free cervical rib as in chickens (Kaupp, 1918).

CERVICAL VERTEBRAE-ARTICULATED - LEFT-LATERAL VIEW
PLATE 65

Atlas

The atlas, the first cervical vertebra, is ring-shaped and lacks a dorsal spine. The dorsal neural arch, formed by the fused neuropophyses, surrounds the neural canal. An articular facet for the occipital condyle is on its cranial surface ventral to the neural canal. The ventral spine is variable in shape. It may be broadly triangular or have a median and two reduced lateral protuberances.

Three articular surfaces face caudally, two lateral articular facets for the articular processes of the axis and one medial articular facet that articulates with the odontoid process of the axis.

CRANIAL

CAUDAL

VENTRAL

DORSAL

ATLAS-LEFT LATERAL VIEW
PLATE 66

Axis

The axis, the second cervical vertebra, has a broad neural spine dorsal to the neural arch. Its articular processes (prezygapophyses) face caudolaterally from the roof of the neural arch and articulate with the craniomedially faced articular processes of the atlas. An odontoid process (embryologically the centrum of atlas) projects sufficiently into a facet in the atlas so that it articulates with the occipital condyle.

The cranial articular surface of the centrum is ventral to the odontoid process and articulates with the reduced centrum of the atlas.

The two caudal articular surfaces, postzygapophyses, project laterally and articulate with the prezygapophyses of the third cervical vertebra. An intervertebral notch, an indentation of the neurapophysis, lies between the postzygapophyses and the centrum. Its caudal articular surface on the centrum articulates with the cranial articular surface of the third cervical vertebra. The hypapophysis forms a single reduced ventral spine on the centrum.

AXIS - RIGHT - LATERAL VIEW
PLATE 67

Sixth through Twelfth Cervical Vertebrae

The sixth through the twelfth cervical vertebrae have a much reduced dorsal spine.

There are two intravertebral foramina lateral to the cranial articulating surface. In the dorsal arch of the intravertebral foramina may be seen nutrient foramina. These vertebrae have fused cervical ribs that project caudally.

The parapophyseal projections that form the carotid arch are more pronounced in each succeeding vertebra to the tenth cervical. The carotid arch is reduced on the eleventh cervical. In the twelfth cervical the two bases of the carotid arch are united, and the arch is reduced to a ventral groove at the cranial end of the hypapophyseal ridge, whereas the anapophysis is more prominent in the more caudal of the cervical vertebrae.

VENTRAL VIEW

DORSAL VIEW

LATERAL VIEW

CRANIAL VIEW

CAUDAL VIEW

Thoracic Vertebrae

The first thoracic vertebra articulates with the fourteenth cervical and the seventh thoracic vertebra is fused with the first lumbar vertebra.

The first and sixth thoracic vertebra articulate freely, whereas the second through the fifth are fused (notarium). Seven thoracic ribs articulate with the seven thoracic vertebrae.

First Thoracic Vertebra

This vertebra has a prominent dorsal spine. The ventral spine is like that of the fourteenth cervical. The transverse process (an expansion of the diapophysis) is lateral to the prezygapophysis. The prezygapophyses have a ventrally-faced costal facet for the articulation with the rib tubercles of the first thoracic rib.

Second, Third, Fourth and Fifth Thoracic Vertebrae

The dorsal spines, the pre- and postzygapophyses, the cranial and caudal articular facets and the ventral spines of these vertebrae are fused to one another. The transverse processes are fused only at their lateral borders.

Pneumatic foramina are present in the base of the transverse processes of the first, second, third and fourth thoracic vertebrae.

The cranial border of the ilium lies dorsal to the caudal half of the sixth thoracic vertebra.

The seventh thoracic vertebra is fused to the first lumbar vertebra. This vertebra contains all the elements of the other thoracic vertebrae. The postzygapophyses are fused with the prezygapophyses of the lumbar vertebrae and the transverse processes are fused laterally and dorsally to the ventral surface of the ilium.

Thoracic Ribs

The seven pairs of thoracic ribs articulate with the thoracic vertebrae. The five caudal pairs articulate with sternal ribs; the other two pairs end freely.

The first two thoracic ribs are the false or asternal ribs. The first is styliiform and is the shortest of the ribs. The first rib pair articulates with the first thoracic vertebra but is sometimes referred to as a cervical rib. The ribs have two proximal articulating processes: the rib tubercle, a dorsal process, articulates with costal facet of the diapophysis and the head of the rib (ventral process) with the costal facet of the parapophysis.

Ribs 2 through 6 also possess uncinate processes which project caudodorsally and lie over the next succeeding rib. The uncinate processes arise from the caudal borders of the ribs about two-thirds distal their vertebral articulations. The distal ends of these ribs are rounded and touch on a cartilage pad which acts as an articulation between the thoracic and sternal ribs.

The seventh thoracic rib lacks an uncinate process. Proximally, it articulates with the fused seventh thoracic and first lumbar vertebra. Distally this rib articulates with the fifth (or false) sternal rib.

THORAX, PELVIS, CAUDA AND RIBS - RIGHT - LATERAL VIEW
PLATE 69

Lumbar Vertebrae

The centra of the lumbar vertebrae are fused. The transverse processes of these vertebrae are fused to the ventral surface of ilium. The dorsal spines form a bridge between the dorsal crests of the ilii. The M. longissimus dorsi passes under this bridge. Parapophyses of the third and fourth lumbar vertebrae extend laterally from the centra of their respective vertebrae to unite with the ilium medioventrally in the cranial portion of the pectineal notch of the ilium.

Sacral Vertebrae

The sacral vertebrae form the caudal fourth of the pelvic roof by fusion of their dorsal spines and transverse processes. The lateral borders of the fused sacral vertebrae articulate with the medial border of the cranial iliac crest.

Synsacral Vertebrae

These six vertebrae form the caudal three-fourths of the pelvic roof. They are fused with the mediodorsal border of the ilium. Of this group, the sixth is fused with the first coccygeal vertebra by cartilagenous tissue.

Coccygeal Vertebrae

The coccygeal vertebrae (seven in number) are the tail vertebrae. The seventh is the pygostyle.

The dorsal spines of the first five caudal vertebrae are short and thick and bifurcate dorsally. The bifurcation increases the area for attachment of the M. levator caudae. The transverse processes are laterally directed and ventral spines are absent.

The seventh coccygeal vertebra (pygostyle) is directed dorsally and lacks transverse processes. The dorsal spine bifurcates. Caudal to the dorsal spine is the crest, a flat blade-like process, which ends in an apex. The cranial articular surface is just ventral to the neural canal. The haemal canal passes caudally and is bridged by a thin lamina of bone.

Ilium

The ilium extends caudally from the sixth thoracic rib to the caudal limit of the pelvic girdle.

The ilium is concave laterocranially and convex dorsocaudally. The crest of the ilium from cranial to caudal is S-shaped. The cranial portion of the crest forms the dorsal border of the ilium and the caudal portion forms its lateral border. The ilium forms the cranial, dorsal and part of the caudal borders of the acetabulum. The dorsal and the cranial border of the ilioischadic foramen is formed by the ventrally-directed plate at the caudal aspect of the ilium.

In ventral view the ilium is concave. The M. obturator internus originates from the entire inner concavity of the ilium. Caudal to the ilioischadic foramen is the obturator depression formed by the roof of the caudal ilium. The floor of the obturator depression is formed by a ventrolaterally-direc-

ted plate that fuses with the medial surface of the ischium.

Sternal Ribs

The cranial four sternal ribs articulate with the articular facets of the sternum. The fifth sternal rib is a false sternal rib since it articulates with the caudal process of the fourth sternal rib but does not reach the sternum proper. These ribs articulate dorsally with the third to the seventh thoracic rib.

The first four sternal ribs are short and three-sided with the apex of the triangle directed caudally. They become increasingly longer from the first through the fourth. The fifth sternal rib is flat but somewhat broadened at its thoracic rib articulation. The fifth sternal rib appears to have a caudal process at its dorsal end; however, this is a separate flattened bone that is firmly attached to the rib.

Ischium

The ischium extends caudally from the ventral border of the acetabulum and ends just beyond the caudal termination of the ilium. It lies ventral to the ilio-ischiadic foramen, lateral to the caudal crest of the ilium and dorsal to the obturator foramen and the pubis.

This bone is triangular, its apex forms most of the ventral border of the acetabulum. Its base lies between the caudal limits of the ilium and pubis.

The ischium forms the dorsal and caudal borders of the obturator foramen just ventral to the antitrochanter. The dorsal border of the ischio-pubic fenestra is formed by the ventral border of the ischium and is caudal to the obturator foramen.

THORAX, PELVIS, CAUDA AND RIBS - DORSAL VIEW
 PLATE 70

Pubis

The pubic bone is the most ventral of the pelvic girdle and extends about one-fifth its total length caudally beyond the ventral ischiatic angle. It is long and thin and at its cranial end forms a small portion of the cranio-ventral border of the acetabulum. The pectineal process extends from the pubis cranial to the acetabulum. The pubic bone caudal to the acetabulum forms the ventral border of the obturator foramen and the ischio-pubic fenestra.

THORAX, PELVIS, CAUDA AND RIBS VENTRAL VIEW
PLATE 71

Furcula

The furcula is V-shaped with a short ventral process, the hypocleideum extending beyond the fusion (symphysis) of the right and left clavicles. The dorsal projections of the furcula articulate at their free ends in the furcular facets of the acromium of the coracoid. The ventral process is attached to the cranial carinal margin of the sternum by the hypocleideal ligament.

FURCULA
PLATE 72

Coracoid

The coracoid is lateral to the fourteenth cervical vertebra and extends medioventrally from the shoulder apex to the cranial aspect of the sternum.

The ventral part of the coracoid flares out from the shaft and its ventral surface articulates with the coracoidal articular sulci of the sternum. The cranial face is smooth; the caudal face is rough and contains a pneumatic fossa and foramen. The shaft is tubular; the scapular facet is a depression just dorsal to the caudal face of the shaft; medial to this is the procoracoid tuberosity; and lateral and dorsal to this is the long glenoid facet. Dorsal and medial to the glenoid facet is the acromium; the furcula articulates on the cranial face of the acromium. The neck of the coracoid lies between the procoracoid and the acromium.

CORACOID
PLATE 73

Sternum

The sternum (breast bone) is carinate and the most ventral of the thoracic basket. The coracoid and furcula articulate with the sternum cranially and the sternal ribs articulate laterally.

At the dorsal aspect of the cranial carinal margin there is in the midline a ventral manubrial spine, and just dorsal to this spine is a dorsal manubrial spine.

The manubrial foramen is continuous between the right and left coracoidal articular sulci. The craniolateral process from which the M. sternocoracoides originates has its base at the lateral extremity of the coracoidal articular sulcus and extends craniodorsally.

Four articular facets for sternal rib articulation are on the dorsal aspect of the craniolateral process.

The dorsolateral process caudal to the sternal rib facets is triangular shaped, whereas the caudolateral process is long and narrow.

At the level of the last sternal rib facet is a pneumatic fossa and foramen in the midline of the concave dorsal surface of the sternum.

STERNUM—RIGHT—LATERAL VIEW
PLATE 74

STERNUM AND STERNAL RIBS
PLATE 75

Femur

The femur articulates proximally with the acetabulum, distally with the tibiotarsus and the fibula.

The femur, seen from a medial view, has at its proximal end a prominent ball-like process, the head. At the base of the ball of the femoral head is the neck. Distally is a prominent medial (internal) condyle.

The lateral and medial epicondyles may be seen from the caudal view at the lateral aspect distally on the femur. The most lateral is the fibular condyle, medial to which is the lateral condyle. The fibular groove lies between these condyles. The intercondylar fossa lies between the lateral and medial condyles. The popliteal depression lies just proximal to the intercondylar fossa.

The rotular groove lies between the lateral and medial condyles.

Patella (not shown)

The patella lies cranial to the articulation of the tibiotarsus and femur but just proximal to the procnemial crest of the tibiotarsus. There are two articulating surfaces on the patella: the lateral articular surface that articulates with the lateral condyle of femur and the medial articular surface articulates with intercondyloid surface of the medial condyle of the femur.

On the dorsal surface of the patella a deep pectineal groove through which passes the tendon of M. ambiens.

CRANIAL VIEW

CAUDAL VIEW

FEMUR-RIGHT
PLATE 76

FEMUR - RIGHT
PLATE 77

Tibiotarsus and Fibula

This is a composite bone and is fused in the mature bird. It includes the tibia, the fibula, and elements of the tarsus.

The tibiotarsus articulates proximally with the condyles of the femur and distally with the tarsometatarsus. The fibula is styloform and slightly fused laterally to the tibiotarsal portion of the composite. It extends distally two-thirds of the length of the tibiotarsus.

The proximal part of the tibiotarsus is angular. The cranial cnemial crest, a sharp prominent ridge, extends cranially. Lateral to this crest is the ventrally-directed angular lateral cnemial crest. The head of the tibiotarsus is demarked by a rotular crest.

The fibular head articulates with the tibiotarsus caudal to the lateral cnemial crest. The lateral articular surface articulates with the intercondylar fossa of the femur and the medial articular surface articulates with the medial condyle of the femur.

The fibula is fused to the fibular crest of the tibiotarsus distally and cranially to the head of the fibula.

A definite intermuscular line extends from the cranial cnemial crest distally on the shaft of the tibiotarsus. Distally on the cranial face of the shaft there is a tendinal groove covered by a bony supratendinal bridge, through which the tendon of the M. extensor digitorum pedis passes.

Lateral and medial condyles are at the distal extremity of this bone. A condylar fossa lies between the cranial surfaces of the condyles.

Distal to the fibular crest on the caudal surface of the tibiotarsus is the medullary artery foramen. Between the lateral and medial condyles is the caudal intercondylar sulcus and on the lateral and medial surfaces of the condyles are ligamental prominences.

TIBIOTARSUS AND FIBULA -RIGHT
 PLATE 78

Tarsometatarsus

The proximal end of the tarsometatarsus articulates with the condyles of the tibiotarsus. At its distal end it has three trochlea for articulation with the second, third and fourth digits.

The tarsometatarsus is a single bone; its proximal end is formed by the fusion of the lower row of embryonic tarsals and the remaining distal portion by fusion of the three embryonic metatarsals.

The hypotarsus is a caudal ridged process at the proximal extremity of the tarsometatarsus. In the mature turkey an ossified tendon continues from the achilles tendon and is inseparably fused at the medial ridge of the hypotarsus. It continues two-thirds distally to a free point just beyond the spur in males. This ossified tendon is concave-convex and the lateral concave surface forms a groove for the M. flexor digiti pedis profundus. A hypotarsal canal is formed by a bridge of bone lying between the medial and the next lateral ridge of the hypotarsus. There are two nutrient foramina, one each lying lateral and medial to the hypotarsus caudally. Two other nutrient foramina lie in the interosseal fossa at the proximal extremity of the tarsometatarsus cranially.

There are three trochlea distally, one for each of the three fused metatarsals: II, III and IV. Metatarsal I is free. The most medial trochlea is the smallest and articulates with digit II. The trochlear wing forms a slight caudal process. The second and third trochlear are similar in shape; however, the lateral is the smaller.

The second trochlea articulates with the digit III and the third trochlea with the digit IV. The metatarsal of digit I articulates medially and caudally one-half the distance between the spur and medial trochlea. This metatarsal is concave plantarly and slightly convex dorsally. It is narrow at its tarsometatarsus articulation and broad at its articulation with the phalanx.

Just proximal to the lateral intertrochlear notch is the large distal foramen. A foramen also is sometimes found in younger birds proximal to the median intertrochlear notch.

TARSOMETATARSUS -RIGHT-(FEMALE)

Hypotarsal Sesamoid

This sesamoid is found caudal to the trochlea of the tarsometatarsus. The articulating surface faces dorsally and cranially. Its medial surface is grooved for the passage of tendons. Its lateral surface is smooth and it is broader at its distal than its proximal end.

TARSOMETATARSUS - RIGHT - (FEMALE)
 PLATE 80

Digits I, II, III, and IV

Digit I (the hallux) is directed obliquocaudally and articulates with the free metatarsal I. It is composed of two phalanges. The first phalanx of all digits is similar.

The articular fossa, proximal articulating surface, of the first phalanx is concave and enlarged. The distal articulating surface has a lateral and a medial condyle between which lies the intercondyloid sulcus. The second (ungual) phalanx of the hallux is claw-shaped and is typical of the terminal phalanges of the remaining digits.

All phalanges are convex dorsally and are flat to concave on their plantar surface.

Digit II has three phalanges and is directed cranially; its first phalanx articulates with the medial trochlea of the tarsometatarsus.

Digit III (middle toe) has four phalanges, is directed cranially and its first phalanx articulates with the third trochlea of the tarsometatarsus.

Digit IV has five phalanges and is directed craniolaterally. Its first phalanx articulates with the lateral trochlea of the tarsometatarsus.

FOOT AND DIGITS —RIGHT —(MALE)
PLATE 81

Scapula

The scapula lies over the thoracic ribs and its medial surface faces the lateral surface of these ribs near their thoracic vertebral articulation.

The head of the scapula articulates with the coracoid, humerus and the furcula. The caudal border of the blade of the scapula is near the cranial border of the ilium.

Viewed ventromedially, the scapula appears as a long narrow blade. The dorsal angle of the head is the furcular articulating process, whereas, its ventral angle is the coracoidal articulating process.

Along the dorsal edge of the blade, about three-fourths caudally, there is a convex angle (dorsal angle). Ventral to this is a concave angle (ventral angle). A pneumatic fossa is present in the scapula dorsolaterally just caudal to the furcular articulating process.

The glenoid facet ventral to the pneumatic fossa articulates with the humerus and the coracoid. The glenoid facet of the scapula and of the coracoid forms an articular socket for the head of the humerus.

SCAPULA - RIGHT
PLATE 82

Humerus

The humerus lies in a horizontal plane; its head articulates with the glenoid fossa formed by the glenoid facets of the coracoid and scapula. The humerus articulates distally with the ulna and the radius.

Three sections of this bone may be seen from a lateral view: (1) the proximal expansion, (2) the shaft, and (3) the distal expansion.

The proximal expansion has a deltoid crest dorsally, a bicipital surface ventrally and a bicipital furrow between these two. A ligamental groove lies between the head and bicipital surface.

A well-marked brachial depression (origin for the M. brachialis) is on the laterodistal surface of the shaft.

The distal expansion has a trochlea formed dorsally by an external condyle and ventrally by an internal condyle, each have a roughened epicondyle externally. An ectepicondylar prominence is proximal to the external epicondyle.

From a medial view, the proximal expansion of the humerus has the following structures: proximally, the articular surface of the head, the bicipital ridge with a semicircular periphery, a pneumatic foramen dorsal to the bicipital ridge lies caudally to a prominent dorsoventral ridge which forms the caudal lip of the capitular groove.

The distal expansion is convex medially. The internal epicondylar ridge is seen distinctly in medial view. The olecranon fossa is a slight depression lying between the ridge and the epicondyle.

HUMERUS - RIGHT
PLATE 83

Radius

The radius articulates proximally with the external condyle of the humerus, ventrally with the ulna, and distally with the radial carpal.

It is long and cylindrical with a round proximal articulating head, a shaft, and a flattened concave-convex distal articulating head. The radius is concave on its ulnar face and convex dorsally.

Ulna

The ulna articulates proximally with the internal condyle and to some extent with the external condyle of the humerus and with the head of the radius. Distally the ulna articulates with the radius, the ulnar carpal and the carpometacarpus.

The olecranon process is proximal. Just distal to this process or at its base is the internal cotyla (humeral articular surface). The external cotyla is a small area distal and lateral to the internal cotyla. A pronounced brachial depression lies distal to the internal cotyla.

At the distal extremity of the ulna the internal and external condyles form a trochlear surface. Just proximal to the internal condyle is a carpal tuberosity.

The external condylar ridge is prominent and extends from the concave to the convex surface where it forms a definite proximally directed process.

RADIUS AND ULNA
PLATE 84

Carpometacarpus

The carpometacarpus articulates with the ulnar carpal, radial carpal and ulna proximally and with digits II, III and IV distally.

The intermetacarpal process extends from metacarpal III over the inter-metacarpal space and rests on metacarpal IV.

Metacarpal III is long and cylindrical and is thicker than the more flattened metacarpal IV. These two bones are separated by an inter-metacarpal space but meet proximally at the proximal metacarpal symphysis and distally at the distal metacarpal symphysis. Metacarpal II is present as only a process fused to the proximal end of metacarpal III. At the distal extremity of metacarpal II is a facet for the articulation of digit II. Articular facets for digits III and IV are present at the distal extremities of metacarpals III and IV.

Digit II, III and IV

Digit II is composed of one phalanx that articulates at its proximal end with metacarpal II. The phalanx is three-sided and tapers to a point at its distal extremity.

Digit III is composed of two phalanges. The first is short and flat and has a semicircular wing-like process that extends caudally. The second phalanx is similar in shape to the phalanx of digit II.

Digit IV is composed of one short sturdy phalanx that articulates with metacarpal IV.

SesamoidsCarpometacarpal Sesamoid

This sesamoid is long and splint-shaped and is located cranially on metacarpal III.

Ulnar Carpal

The ulnar carpal is distal to the ulna and along the convex surface just proximal to the external condyle of the ulna. It articulates with the ulna and carpometacarpus only.

The ulnar carpal is V-shaped, the internal surface articulating with the carpometacarpus. The medial or anconal articulates with the ulna.

Radial Carpal

The radial carpal lies between the distal ends of the radius and ulna at the proximal end of the carpometacarpus and has three articular surfaces. The cotyloid, the most concave surface, articulates with the radius. On the opposed side is the carpometacarpal articulating surface. The third articulating surface, the trochlear surface, is convex and articulates with the trochlea of the ulna.

DORSAL VIEW

VENTRAL VIEW

CARPOMETACARPUS AND PHALANGES—RIGHT

PLATE 85

BIBLIOGRAPHY

1. Anderson, R. J. (1900). "The crookedness in the sterna of certain breeds of domestic fowls," Irish Nat., 9:150-52.
2. Asmundson, V. S. (1934). "The turkey as an experimental animal," Am. Nat., 68:466-67.
3. Beddard, F. E. (1898). "The Structure and Classification of Birds," Longmans, Green, New York.
4. Berger, A. J. (1956). "Anatomical variation and avian anatomy," Condor, 58:433-41.
5. Berger, A. J. (1959). "Leg-muscle formulae and systematics," Wilson Bull., 71:93-94.
6. Camper, P. (1773). "Memoire sur la structure des os dans les oiseaux et de leurs diversites dans les differentes especes," Mem. math. phys. inst. fr., 7:328-35.
7. Chamberlain, F. W. (1943). Atlas of the Avian Anatomy. East Lansing, Michigan. Michigan State University Press.
8. Du Petit, F. (1738). "Description anatomique de l'oeil du coq d'inde," Mem. acad. roy. sci. for 1735, Paris, 123-53.
9. Elliot, D. G. (1872). A Monograph of the Phasianidae or Family of the Pheasants, Vol. I, New York.
10. Fisher, H. I. and D. C. Goodman (1955). "The Myology of the Whooping Crane, Grus americana," Illinois Biol. Monographs 24, (2).
11. Furbringer, M. (1886). "Uber Deutung und Nomenklatur der Muskulatur des Vogel-flugels," Morphol. Jahrb., 11:121-25.
12. Furbringer, M. (1888). "Untersuchungen zur Morphologie und Systematik der Vogel, zugleich ein Beitrag zur Anatomie der Stutz- und Bewegungsorgane," 2 vols. Van Hokema, Amsterdam.
13. Gadow, H. (1880). "Zur vergleichenden Anatomie der Muskulatur des Beckens und der hinteren Gliedmassen der Ratiten," Fischer, Jena.
14. Gadow, H. and E. Selenka (1891). Aves In Bronn's "Klassen und Ordnungen des Thier-Reichs, in Wort und Bild," 2 vols., Anatomischer Theil, 1891, Systematischer Theil, 1893. Leipzig.
15. Garrod. A. H. (1881). "The Collected Scientific Papers of the Late Alfred Henry Garrod," (W. A. Forbes, ed.). R. H. Porter, London.
16. George, J. C. and A. J. Berger (1966). "Avian Myology," Academic Press, New York and London.
17. Howell, A. B. (1936a). "Morphogenesis of the shoulder architecture IV. Reptilia," Quart. Rev. Biol., 11:183-208.
18. Howell, A. B. (1936b). "Phylogeny of the distal musculature of the pectoral appendage," Jour. Morph., 60, (1) 287-315.

19. Howell, A. B. (1936c). "The phylogenetic arrangement of the muscular system," Anat. Rec., 66, (3) 295-316.
20. Howell, A. B. (1937). "Morphogenesis of the shoulder architecture: Aves," Auk, 54:363-75.
21. Howell, A. B. (1938a). "The muscles of the avian hip and thigh," Jour. Morph., 62:177-218.
22. Hudson, G. E., Lanzillotti, P. J., and Edwards, G. D. (1959). "Muscles of the pelvic limb in galliform birds," Am. Midland Naturalist, 61:1-67.
23. Jackson, J. B. S. (1895). "Malformed sternum of a turkey," Proc. Boston Soc. Nat. Hist. for 1874-75, 17:454.
24. Kaupp, B. F. (1918). Anatomy of the Domestic Fowl. Philadelphia, Saunders.
25. Latimer, H. B. (1926). "A quantitative study of the anatomy of the turkey hen," Anat. Rec., 34:15-23.
26. Latimer, H. B. (1927). "Correlations of the weights and lengths of the body, systems and organs of the turkey hen," Anat. Rec., 35:365-77.
27. Montagna, W. (1945). "A reinvestigation of the development of the wing of the fowl," Jour. Morphol., 76:87-113.
28. Nelson, E. W. (1900). "Description of a new subspecies of *Meleagris gallopavo* and proposed changes in the nomenclature of certain North American birds," Auk, 17:120-23.
29. Newton, A. and Gadow, H. (1893-1896). "A Dictionary of Birds," Adam & Charles Black, London.
30. Owen, R. (1837). "Dissection of the head of the turkey buzzard and that of the common turkey," Proc. Zool. Soc. London, 5:34-35.
31. Parker, W. K. (1866). "On the osteology of gallinaceous birds and tinamous," Trans. Zool. Soc. London, 5:149-241.
32. Retterer, E. and A. Lelievre (1911). "Phenomenes cytologiques des tendons en voie d'ossification," Comp. rend. soc. biol., Paris, 71:596-99.
33. Romer, A. S. (1927). "The development of the thigh musculature of the chick," Jour. Morphol. Physiol., 43:347-385.
34. Shorger, A. W. (1963). "The domestic turkey in Mexico and Central America in the Sixteenth Century," Wis. Acad. Sci., 52:133-52.
35. Shorger, A. W. (1966). "The Wild Turkey: Its History and Domestication," University of Oklahoma Press, Norman, Oklahoma.
36. Shufeldt, R. W. (1887a). "A critical comparison of a series of skulls of the wild and domesticated turkeys," Jour. Comp. Med. and Surg. New York, 8:207-22.
37. Shufeldt, R. W. (1887b). "The turkey skull," Am. Nat., 21:777.

38. Shufeldt, R. W. (1890). "The Myology of the Raven (Dorvus corax sinuatus)."
39. Shufeldt, R. W. (1909). "Osteology of Birds," N. Y. State Mus. Bull., 130.
40. Shufeldt, R. W. (1914). "On the skeleton of the ocellated turkey (Agriocharis ocellata), with notes on the osteology of other meleagridae," Aquila, 21:1-52.
41. Stressman, E. (1959). "The status of avian systematics and its unsolved problems," Auk, 75:269-80.
42. Tiedemann, D. F. (1814). Anatomie und Naturgeschichte der Vogel. Vol. II. Heidelberg.
43. Wagner, R. (1837). "Beitrage zur Anatomie der Vogel," Abh. Akad. d. Wiss. Munich, 2:271-308.
44. Wetmore, A. (1956). "A check-list of the fossil and prehistoric birds of North America and the West Indies," Smith. Mis. Colls., 131(5).

INDEX

A. Myology

	<u>Plates</u>	<u>Page</u>
abductor digiti quarti pedis	<u>44</u> , 50-52	113
abductor digiti secundi manus	53- <u>56</u>	145
abductor digiti secundi pedis	45-46, <u>48</u> , 50, 52	121
adductor digiti secundi manus	53- <u>56</u>	145
adductor digiti secundi pedis	<u>45</u> , 49	115
adductor longus	33- <u>35</u>	93
adductor magnus	26, 33, <u>34</u>	91
ambiens	26, <u>34</u>	91
anconeus lateralis	53, <u>54</u> , 58	137
anconeus medialis	<u>57</u>	147
articulohyoideus	1- <u>3</u>	13
articulomylohyoideus	1, <u>3</u> , 9	13
basientoglossus	<u>5</u>	17
basirectricales	<u>20</u> , 21, 29	55
biceps brachii	17, <u>54</u> , 56, 57	137
biceps flexor cruris	<u>32</u> , 34-39	85
biventer cervicis	<u>7</u> -11	23
biventer maxillae	1, <u>2</u> , 4, 9	11
brachialis	54, 56, 57, <u>58</u>	149
caudalis lateralis	20, 22-26, <u>30</u> , 31	79
ceratoentoglossus	<u>4</u>	15
circumconcha	not shown	
complexus	1, <u>7</u> , 9, 10, 13	23

	<u>Plates</u>	<u>Page</u>
coracobrachialis dorsalis	18, <u>19</u> , 22-25	51
coracobrachialis ventralis	<u>19</u> , 21, 24-26	51
coracohumeralis	<u>19</u>	51
crureus	<u>32</u>	85
cutaneus cleidodorsalis	<u>7</u> , 16, 25-26	23
cutaneus colli lateralis	1, <u>7</u>	23
cutaneus costohumeralis	<u>16</u> , 20, 26	43
cutaneus iliacus	<u>16</u>	43
cutaneus nuchalis	<u>7</u> , 12	23
cutaneus pectoralis caudalis	<u>20</u>	55
cutaneus pectoralis cranialis	<u>20</u> , 26	55
cutaneus spinalis dorsalis	<u>16</u>	43
deltoidaeus	16, <u>17</u> , 25, 53, 54	45
depressor caudae	20- <u>22</u> , 23-27, 29, 30, 31	61
depressor glossi	<u>5</u>	17
depressor palpebrarum ventralis	not shown	
depressor rectricum	20, <u>22</u> , 27, 29, 30-31	61
diaphragma	<u>23</u>	65
entotympanicus	2, <u>4</u>	15
eversor urodeum	20, 21, <u>30</u> , 31	79
extensor carpi obliquus	55, 56, <u>58</u>	149
extensor carpi radialis profundus	53, <u>54</u> -57	137
extensor carpi radialis superficialis	<u>53</u> -57	133
extensor digiti quarti pedis brevis	46, <u>48</u>	121

	<u>Plates</u>	<u>Page</u>
extensor digiti secundi manus	53- <u>55</u>	141
extensor digiti terti manus distalis	<u>53</u> -57	133
extensor digiti terti manus lateralis	53-55, 57, <u>58</u>	149
extensor digiti terti manus medialis	55, <u>56</u> , 57, 58	145
extensor digiti terti pedis brevis	45, 46, <u>48</u>	121
extensor digitorum pedis longus	33, 38, <u>39</u> , 40-43, 45, 47	101
extensor femoris	<u>32</u>	85
crureus	<u>32</u> -36, 42	85
subcrureus	<u>32</u> , 33	85
vastus internus	<u>32</u> , 34, 35	85
vastus externus	<u>32</u> , 33, 36	85
extensor hallucis longus	<u>45</u> , 46, 48	115
externus abdominis	14, 20, 21, <u>25</u> , 26	69
flexor carpi ulnaris caudalis	<u>56</u> , 57	145
flexor carpi ulnaris cranialis	<u>56</u>	145
flexor digiti quarti manus longus	<u>55</u> -57	141
flexor digiti secundi et digiti terti manus	53- <u>55</u>	141
flexor digiti secundi manus	55, <u>56</u> , 57	145
flexor digiti secundi perforatus et perforans	37, <u>38</u> , 42, 44, 45, 49, 50	99
flexor digiti terti perforatus et perforans	37, <u>38</u> , 42, 44, 45, 50	99

	<u>Plates</u>	<u>Page</u>
flexor digitorum pedis profundus	32, 33, 35- <u>40</u> , 41-44, 50, 51	103
flexor digitorum pedis superficialis	32, 33, 35, 36, <u>42</u> , 50	109
flexor digiti secundi perforatus	38, <u>42</u> , 49	109
flexor digiti tertii perforatus	37-39, <u>42</u> , 49, 50	109
flexor digiti quarti perforatus	37-39, <u>42-43</u> , 44, 49, 50	109
flexor et abductor digiti quarti manus	<u>55</u>	141
flexor hallucis brevis	<u>45</u> , 49, 50-52	115
flexor hallucis longus	32, <u>37-39</u> , 45, 50	97
flexor metacarpi brevis	<u>55</u>	141
flexor metacarpi caudalis	54, <u>55</u> , 57	141
flexor metacarpi longus	<u>53-55</u>	133
gastrocnemius	<u>41</u>	105
caput caudale	34, 36, <u>41</u>	105
caput craniale	34, <u>41</u>	105
caput mediale	32, 33, <u>41</u>	105
gemellus	<u>34</u>	91
geniohyoideus	1, <u>2</u> , 3, 4, 9	11
gluteus medius	23, 24, 26, 27, <u>29</u> , 32, 33-36	77
gluteus minimus	<u>29</u> , 32-36	77
gluteus primus	<u>27</u> , 32, 35, 36	73
gluteus superficialis	27, <u>29</u> , 33, 34	77
hyoideus transversus	<u>4</u>	15

	<u>Plates</u>	<u>Page</u>
iliacus	26, <u>29</u> , 34, 36	77
interarticulares	<u>11</u>	33
intercostales externales	<u>15</u> , 19, 21, 25	41
intercostales internales	<u>22</u>	61
intercostales superficiales	<u>14</u> , 22, 25	39
interosseus dorsalis	<u>53-55</u> , 57	133
interosseus ventralis	54, <u>55</u> , 56	141
interspinales caudales	<u>28</u>	75
interspinales craniales	<u>8-10</u> , 17	25
intertransversales	<u>9</u> , 10	29
ischiofemoralis	32, <u>33</u> , 34	87
latissimus dorsi	<u>16</u> , 53-57	43
caput craniale	<u>16</u> , 18	43
caput caudale	<u>16</u> , 17	43
levator caudae	20, 21, 22, <u>27</u> , 28	73
levator rectricum	20, 21, <u>27-29</u> , 31	73
levatores costarum	14, 15, 19, 22, <u>24</u>	67
longissimus dorsi	9, 14, <u>15</u> , 27	41
longus colli dorsalis	<u>8-11</u> , 14, 15, 17	25
longi colli ventrales	9, <u>13</u> , 17, 23	37
longus colli ventralis caudalis	9, 10, <u>13-15</u> , 23	37
longus colli ventralis cranialis	9-11, <u>13</u>	37
longus colli ventralis medialis	9-11, <u>13-15</u>	37
mandibularis infraorbitalis	<u>2</u>	11

	<u>Plates</u>	<u>Page</u>
mandibulopalatinus	<u>2</u> , 4	11
mylohyoideus	1, <u>3</u>	13
obliqui colli	<u>9</u> , 14	29
obliquospinales	<u>11</u>	33
obliquus capitis caudalis	<u>10</u>	31
obliquus internus abdominis	<u>21</u> , 24	59
obliquus oculi dorsalis	<u>6</u>	21
obliquus oculi ventralis	<u>6</u>	21
obturator externus	<u>33</u> , 34	87
obturator internus	<u>23</u> , 24, 34	65
caput laterale	<u>23</u>	65
caput mediale	<u>23</u>	65
patagialis	17, <u>20</u> , 21, 53-57	55
pectoralis profundus	<u>18</u> , 19, 21, 25, 26, 54	51
pectoralis superficialis	12, 18, <u>20</u> -23, 25, 26, 53, 54	55
peroneus brevis	38- <u>40</u>	103
peroneus longus	35, <u>37</u> , 44	97
popliteus	<u>40</u>	103
pronator brevis	<u>56</u> , 57	145
pronator longus	<u>56</u>	145
pterygomandibularis	<u>2</u>	11
pyramidalis oculi	<u>6</u>	21
quadratomandibularis	1, <u>2</u>	11
quadratus oculi	<u>6</u>	21
rectus abdominis	<u>21</u> , 24	59

	<u>Plates</u>	<u>Page</u>
rectus capitis dorsalis	<u>11</u>	33
rectus capitis lateralis	1, <u>9</u>	29
rectus capitis ventralis	<u>9</u>	29
rectus oculi caudalis	<u>6</u>	21
rectus oculi cranialis	<u>6</u>	21
rectus oculi dorsalis	<u>6</u>	21
rectus oculi ventralis	<u>6</u>	21
rhomboideus	<u>18</u> , 19, 26	47
sacrolumbalis	9, <u>14</u> , 16-19, 22	39
sartorius	16-19, 26, 27, 29, <u>32-34</u>	85
scalenius	9, 21, 22, 24, <u>25</u>	69
scapulohumeralis maximus	<u>18</u> , 54	47
scapulohumeralis minimus	<u>19</u> , 24, 26	51
semimembranosus	26, 33, <u>34</u> , 37	91
semitendinosus	23-27, 29, 32, <u>33-35</u>	87
semitendinosus accessorius	<u>33</u> , 35	87
serratus dorsalis	19, 22, <u>24</u> , 26	67
serratus magnus	16- <u>18</u> , 19, 21, 26	47
serratus ventralis	<u>19</u>	51
sphincter ani	<u>21</u>	59
sternocoracoideus	<u>22</u> , 24	61
sternocostales	21, <u>23</u> , 24	65
sternothyrohyoideus	1, <u>3</u> , 4	13
sternotrachealis	<u>23</u>	65
subcoracoideus	19, <u>23</u>	65

	<u>Plates</u>	<u>Page</u>
subcostales	22, 23, <u>24</u>	67
subcrureus	(extensor femoris)	
subscapularis	<u>19</u> , 21-23	51
supinator brevis	<u>54</u> , 55, 57, 58	137
temporalis et masseter	<u>1</u> , 4	9
tensor patagi longus	18, <u>20</u> , 53, 54, 56	55
tensor patagi caudalis	<u>20</u> , 21, 56	59
teres	16, <u>17</u> , 18, 21, 24-26, 56	45
thyrobasihyal	<u>5</u>	17
tibialis caudalis	35, <u>42</u>	109
tibialis cranialis	32, 35- <u>38</u> , 48	99
trachelomastoideus	1, 9, <u>10</u> , 13	31
tracheolateralis	1, 3, <u>4</u>	15
transversus abdominis	<u>22</u> , 23	61
transversus perinei	20, 21, <u>30</u> , 31	79
trapezius	16- <u>18</u> , 25, 26	47
triceps	16, <u>17</u> , <u>18</u>	45
caput dorsale	<u>17</u> , 53, 54, 56, 67	45
caput ventrale	<u>18</u> , 20, 21, 56, 57	47
caput internale	<u>18</u> , 20, 21, 54, 56, 57	47
vastus externus	(extensor femoris)	
vastus internus	(extensor femoris)	
vastus medialis	(extensor femoris)	

INDEX

B. Osteology

	<u>Plates</u>	<u>Page</u>
atlas	66	191
axis	67	193
carpals	85	233
carpometacarpus	85	233
caudal vertebrae (coccygeal vertebrae)	69-71	199-205
cervical vertebrae	65-68	189-195
coracoid	73	209
costae	69-71	199-205
costae sterni	75	213
digits manus	85	233
digits pedis	81	225
ethmoid	60	177-181
femur	76-77	215-217
frontal	60	177-181
furcula	72	207
humerus	83	229
ilium	69-71	199-205
ischium	69-71	199-205
jugal	60-62	177-181
lacrimal	60-62	177-181
lumbar vertebrae	69-71	199-205
mandible	60-62	177-181

	<u>Plates</u>	<u>Page</u>
maxilla (zygomatic)	60-62	177-181
nasal	60-62	177-181
nasal septum	60-62	177-181
occipital	60-63	177-183
palatine	60-62	177-181
parietal	60-62	177-181
patella	not shown	214
phalanges	85	233
premaxilla	60-62	177-181
pterygoid	60-62	177-181
pubis	69-71	199-205
quadrate	60-62	177-181
quadratojugal	60-62	177-181
radius	84	231
sacral vertebrae	69-71	199-205
scapula	82	227
sesamoid bones	80	223
sphenoid	60-62	177-181
sternum	74-75	211-213
synsacrum	69-71	199-205
tarsometatarsus	79-80	221-223
temporal	60-62	177-179
thoracic vertebrae	69-71	199-205
tibiotarsus and fibula	78	219
ulna	84	231

	<u>Plates</u>	<u>Page</u>
vomer	60-62	177-181
caudal vertebrae	69-71	199-205
cervical vertebrae	65-68	189-195
6th thru the 12th cervical vertebrae	68	195
zygomatic (jugal, quadratejugal, maxilla)	60-62	177-181

* U S GOVERNMENT PRINTING OFFICE 1968 O-319-833