

## CHAPTER III

### THE MUSCLES

THE description of the muscles here given is taken from Bronn (11), who, in turn, largely follows Gadow. The animal described is the crocodile, but while Bronn does not indicate the species, it is probable that the differences between the various members of the Crocodylia would be slight. The figures of the muscular system are mainly from the Florida alligator.

In his description Bronn gives for each muscle the various synonyms (often more than half a dozen) that are employed by different writers; in this work Bronn's nomenclature is given first and the synonyms follow in parentheses.

### THE CHEWING MUSCLES

*Temporalo-maxillaris* (Temporalis) (Masseter, Temporal, Aeussere ober Heber or Schlafmuskel). Arises in the temporal fossa, passes under the zygoma, and inserts itself on the inner and outer sides of the lower jaw.

*Pterygo-maxillaris* (Pterygoideus) (Pterygoidien, Aeusser Flügelmuskel, Pterygoideus externus, Pterygoideus internus). A large muscle which consists of two portions: the outer, weaker portion springs from the pterygoid process, the inner stronger part from the pterygoid fossa and pterygoid process; they run together around the angle of the lower jaw, where they form a large, bulging fold. They are the chief muscles of this part of the body since the masseter is lacking and the temporalis is weakly developed.

*Occipito-maxillaris* (Digastricus maxillæ) (Niederzieher des Unterkiefers, Abaisseur ou l'analogue du digastrique, Senker des Unterkiefers, Aristotelis apertor oris, Digastricus, Aperator oris). Arises from the hinder border of the lateral occipital and is inserted at the hinder end of the lower jaw. Its course is from front to back. If the skull be stationary this muscle drops the lower jaw; if the jaw be fixed it raises the skull.

#### MUSCLES OF THE VENTRAL SURFACE OF THE NECK

*Intermaxillaris* and *Sphincter Colli* (Intermaxillaire, Mylo-hyoideus, Zwischenkiefermuskel, Latissimus colli). This muscle consists chiefly of transversely running fibers, and has in its middle third a small, median, longitudinal raphe or aponeurosis. In the posterior part of the neck it

is very thin, but increases in thickness more and more as it passes cephalad. A short anterior and a long posterior portion may be distinguished. The former extends from the inner side of the right to that of the left half of the lower jaw, without a median aponeurosis. The hinder half of this muscle is united by a pair of aponeuroses to the lower jaw, on one hand (the smaller part), and to a fascia, on the other hand (the far larger part), that separates several of the neck muscles. The smaller part begins immediately behind the pterygoid on the inner side of the halves of the lower jaw but ends on the outer side of the two halves of the jaw.

*Latus Colli* (*Latissimus colli accessorius*). Lies underneath the preceding. Its muscle bundles lie between the collo-capitis muscle and the bodies of the first three cervical vertebræ, and form a broad band that extends from the hyoid bone to the backwardly directed cervical ribs of the first and second pairs.

*Coraco-ceratoideus* (*Omo-hyoideus*, *Coraco-hyoideus*). A long, narrow, and moderately thick muscle which takes its origin from the upper border of the coracoid, where the latter touches the scapula. It extends forward near the œsophagus and attaches itself to about the middle of the backwardly turned border of the horn of the hyoid of that side.

*Episterno-ceratoideus* (*Niederzieher des Zungenbeins*, or *Brustbeinzungenbeinmuskel*, *Sterno-hyoideus*). A flat and fairly broad muscle which

springs from the ventral surface of the episternum; behind, it is separated by a slight space from the corresponding muscle of the other side, with which it nearly covers the cervical part of the trachea. Towards its anterior end it divides into two heads; one of these inserts itself on the outer border and outer surface of the cornu of the hyoid; the other head, lying laterad to the former, is suddenly reduced to a short tendon by which it is attached to the following muscle.

*Maxillo-coracoideus* (Mylo-hyoideus anterior, Sterno-maxillare). This muscle arises from the upper border and inner surface of the caudal third of the lower jaw. In its further course it becomes tendinous and projects by a short tendon outwards from the hyoid cornu to unite with the head of the preceding muscle, as noted above; it then becomes fleshy again and is inserted on the medial part of the upper border of the coracoid.

*Maxillo-hyoideus* (Genio-ceratoidien, Hyomaxillaris, Hyoglossus, Hyomandibularis, Mylo-hyoideus posterior). This muscle arises, very thin, from the mandibular symphysis, goes thence immediately backward and inward to insert itself, by its broad end, on the whole anterior end of the horn of the hyoid and on the hyoid itself.

*Cerato-hyoideus*. Arises from the horn of the hyoid and inserts itself on the body of the hyoid.

*Costo-coracoideus*. This muscle arises from the distal ends of the first and second ribs and is

inserted on the ventral surface of the coracoid at the boundary of the scapula.

*Costo-scapularis* (*Collo-scapularis superficialis*, *Levator scapulæ superficialis*). See shoulder muscles.

*Costo-vertebralis Medialis* (*Scaleni*). Fairly large, flat, and long-drawn-out three-cornered muscle. Attached by its base to the most anterior sternal rib, by its upper border to the fifth cervical rib, and by its point to the end of the second cervical rib.

*Costo-vertebralis Lateralis* (*Longus colli*). Originates thin and sharp on the body of the fifth thoracic vertebra, increases in thickness slowly but decidedly cephalad, then again becomes thinner and inserts itself on the inner side of the ribs of the most anterior two cervical vertebræ.

*Collo-capitis* (*Rectus capitis anterior*). Arises, as a rule, from the cervical centra, at times from the second thoracic vertebra (*Gavialis*). It extends forward and is inserted on the basi-occipital and the hinder border of the pterygoid. For a greater part of their length the two muscles lie close together, but forward they separate somewhat from each other.

#### DORSAL NECK MUSCLES

*Occipito-cervicalis Medialis* (*Complexus cervicis*, *Biventer cervicis*, *Zweibäuchiger Strecker* or *Zwei-*

bäuchiger Nackenmuskel, *Splenius capitis*). It springs, by separate points, from the dorsal processes of the four anterior body vertebræ and the six posterior neck vertebræ; it is convex on its dorsal, weakly concave on its ventral surface; it leads cephalad as a short, strong tendon by which it is attached to the angle between the upper hinder border of the skull, *i.e.* to the superior and lateral occipital region.

*Squamoso-cervicalis Medialis* (Kopfbäuchmuskel [Splenius] or durchflochtener Muskel [Complexus], Trachelo-mastoideus, Complexus). This muscle lies laterad and ventrad to the preceding and is at times partly covered by it in its posterior half. It arises from separate heads from the spinal processes of the two anterior and six posterior cervical vertebræ; beginning caudad, thin and sharp, it gradually becomes thicker as it passes cephalad until it becomes partially tendinous and inserts itself on the hinder border of the squamosal, laterad to the occipito-cervicalis medialis muscle.

*Epistropheo-vertebralis* (*Splenius colli*). This muscle springs from the spinous processes of the most anterior three body vertebræ and the last cervical vertebra; it receives fibers from the articular processes and intermediate parts of the six posterior cervical vertebræ and is inserted on the second cervical vertebra.

*Collo-squamosus* (*Splenius capitis*, Nackenwarzenmuskel, Trachelo-mastoideus). Springs from

the upper transverse processes of the last three neck vertebræ, and, becoming tendinous, is inserted on the hinder border of the squamosal.

*Collo-occipitis.* Arises from the transverse processes of the posterior five cervical vertebræ, extends directly forwards on the ribs of the vertebræ, and is inserted under the articular surface of the lateral occipital.

*Occipito-epistropheus* (short, straight, hinder head-muscle, or extensor). This muscle springs from the lateral surface of the body of the second neck vertebra and inserts itself on the basi-exoccipital, under the preceding muscle.

*Cervicalis Adscendens.* Arises in great part from the angles under the most anterior ribs; a smaller part appears farther above where it is covered by the rhomboideus muscle. It is inserted on the upper side of the five posterior cervical ribs and on the distal ends of the long second cervical rib.

#### THE MUSCLES OF THE SCAPULA

*Capiti-sternalis* (Sterno-mastoideus). This is a fairly large muscle, on the side of the neck, that extends from the skull to the breast and from the middle of the neck is divided into two portions: (a) an anterior part or atlanti-mastoideus (Plate I., Figs. 1 and 2, *cs*<sup>1</sup>) (upper end of the "head nodder," sterno-mastoideus, anterior part of

sterno-mastoideus, anterior part of atlanti-mastoideus); (b) a posterior part or sterno-atlanticus (Plate I., Figs. 1 and 2, cst<sup>2</sup>) (sterno-mastoideus, inner belly of the "head-nodder," posterior part of the sterno-atlanticus). The former part is a rather short but not weak muscle that arises from the squamosum and inserts itself on the rib of the atlas (alligator) or of the atlas and epistropheus (crocodile).

The latter part is fairly strong and exceeds the anterior part in length; it springs from the rib of the first cervical vertebra, opposite the insertion of the anterior part, and inserts itself on the anterior border of the outer surface near the episternum. At times superficial fibers pass into the pectoral fascia.

*Dorso-scapularis* (Cucullaris) (Plate I., Figs. 1 and 2, Cu) (Trapezius). A broad but thin muscle that begins as an aponeurosis from the dorsal fascia in the middle line of the hinder part of the neck and beginning of the back; with converging fibers it passes within to insert itself partly on the spine of the scapula and partly by superficial fibers in the fascia that cover the deltoideus scapularis inferior muscle.

*Collo-scapularis Superficialis* (Plate I., Fig. 1, cssp) (Levator scapulæ superficialis, Levator scapulæ, Heber des Schulterblatts, Acromio-trachélien, Teil des Serratus magnus, Levator anguli scapulæ). A considerable muscle on the side of the



neck. It arises from the tips of the ribs of the first and second cervical vertebræ (where it is fused with the sterno-atlanticus muscle), and also from the transverse process of the third and fourth cervical vertebræ; it goes with diverging fibers to the entire anterior border of the scapula.

*Thoraci-scapularis Superficialis* (Serratus superficialis, Pectoralis minor, Hinterer Theil des inneren grösseren Rückwärtsziehers, Pars posterior m. serrati antici majoris, Theil des Grand dentelé, Serrati posteriores, Latissimus dorsi scapulo-costalis). A strong muscle of three prongs that go directly, by superficial fibers, over into the oblique abdominal muscle and meet the ribs. The first and smallest prong arises from the under end of the rib of the ninth vertebra (last cervical); the second and medium-sized prong comes from the uncinæ process of the tenth rib (first thoracic) and from beneath the uncinæ process of the second thoracic rib; the third and strongest prong takes its origin from the uncinæ processes of the second and third thoracic ribs. All three prongs unite to form a broad, homogeneous muscle which passes forward and above to the hinder border of the scapula, upon whose entire surface, except at the lower end, it is inserted.

*Collo-thoraci-suprascapularis Profundus* (Plate I., Fig. 3, cthspr) (Levator scapulæ et serratus profundus, Serrati anteriores, Serratus anticus major, Vorderer Theil des inneren grösseren Rückwärts-

ziehers or vorderen grossen gezahnten Muskels, Pars anterior m. serrati antichi majoris, Theil des Grand dentelé, Theil des Serratus magnus). This muscle arises in varying extent from the transverse process of the fifth cervical vertebra to the first (crocodile) or second (alligator) ribs. It is inserted on the inner surface of the suprascapula, except on its forward part, and is made up of two layers—a superficial and a deep one. The former layer (Fig. 3, cthspr<sup>1</sup>) is weakly developed and is composed of two or three thin, distinct bundles, that extend from the ribs of the eighth, ninth, and eleventh vertebræ (alligator) or from the transverse process of the seventh vertebra and the rib of the tenth. The deeper layer is considerably developed; its bundles come, in the alligator, from the fifth to tenth vertebræ; in the crocodile from the fifth to ninth.

*Rhomboideus* (Plate I., Fig. 3, rh) (Rautenmuskel, Angulaire de l'omoplate). This is a very small, independent muscle that springs, by two or three distinct bundles, from the fascia covering the longissimus dorsi muscle, in the region of the eighth and ninth vertebræ; after a short course it inserts itself on the antero-dorsal angle of the suprascapula.

*Costo-coracoideus* (Plate I., Fig. 3, cc) (Subclavius et Triangularis sterni and Levator secundæ superioris costæ, Petit dentelé, Pectoralis minor, Pectoralis). This is a broad muscle of considerable

size on the ventral side of the breast; it consists of a lateral and of a medial portion, the former springing from the last cervical rib, the latter from the anterior border of the first sternocostal ridge. The two parts unite and are inserted on the whole posterior border of the coracoid.

*Pectoralis minor* (*Pectoralis*, *Costo-coracoideus*). A broad, considerable muscle on the under side of the breast, which is made up of two parts, of which the lateral springs from the anterior border of the last (ninth) cervical rib, and the medial from the anterior border of the first sternocostal ridge. Both parts unite into a homogeneous layer which is inserted broadly on the whole hinder border of the coracoid.

*Pectoralis* (Plate I., Figs. 1 and 2, p) (*Pectoralis major*, *Grosser Brustmuskel*). A broad muscle on the under side of the breast, bounded behind by the *rectus abdominis* and *obliquus abdominis externus* muscles, with which it is united. It arises from the whole episternum, from the whole sternum, except from the median line of its posterior part, from the sternal ends of the first six thoracic ribs, from all six sternocostal ridges, and, with a small prong, from the eighth rib. It is inserted on the distal part of the convex surface of the *processus lateralis humeri*.

*Supracoracoideus* (Plate I., Figs. 1 and 2, spc) (*Supracoracoscapularis*, *Deltoideus*, *Schlüsselbeinhälfte*, *Theil der Schulterblatthälfte des Hebers*

des Armes, Obergrätenmuskel, Hebemuskel des Oberarmes, Epicoraco-humeralis). A muscle of considerable size at the anterior region of the coracoid and the under region of the scapula, which is divided into two parts: (a) the coracoid (inferior) division is the stronger and arises from the whole anterior half of the coracoid, from its outer and inner surfaces; it is inserted, together with the second part, on the proximal, little-developed part of the processus lateralis humeri; (b) the scapularis (superior) division is the weaker of the two and is covered by the deltoïdes scapularis inferior muscle; it arises from the surface of the under third of the scapula, behind the spine; it unites with the preceding part to form a single muscle and inserts itself, as said above, on the proximal part of the processus lateralis humeri.

*Coraco-brachialis* (Brevis) (Plate I., Figs. 4, 5, and 6, cbb) (Theil des grossen Brustmuskels oder Hakenarmmuskel, Pectoralis II., Pectoralis minor). A fairly strong muscle. It arises from the outer surface of the coracoid, except the median edge and the anterior section, and runs to the flexor surface of the upper arm where it is inserted on the proximal third between the lateral and median processes.

*Coraco-antebrachialis* (Plate I., Figs. 2 and 5, b<sup>1</sup>) (Biceps, Coracoideus, Langer Kopf des langen Beugers, Langer Kopf des Biceps, Biceps humeri, Biceps brachii, Coraco-radialis). A slender and

rather weak muscle on the flexor side of the upper arm. It arises by a fairly broad but thin tendon from the outer surface of the coracoid immediately before the coraco-brachialis. As a weak bundle it passes between the lateral and median processes, lying medially near the brachialis inferior muscle, with which, at the end of the upper arm, it unites; after their union the two muscles continue as a broad tendon that splits into two parts, which are inserted on the proximal end of the radius and of the ulna.

*Humero-antebrachialis Inferior* (Plate I., Figs. 2 and 6, hai) (Brachialis inferior, Caput breve m. bicipitis, Kurzer Kopf des Biceps, Brachial interne, Brachialis anticus, Erster vom Oberarm ausgehender Beuger, Portion of Brachiaëus). Springs from the lateral flexor side of the humerus, from the distal end of the lateral process to the distal end of the bone, except the epiphysis; at the end of the upper arm it unites with the biceps and with it is inserted, by two tendons, to the radius and ulna.

*Dorso-humeralis* (Plate I., Fig. 1, dh) (Latissimus dorsi, Breiter Rückenmuskel, Humero-dorsalis). It springs as an aponeurosis from the back at the level of the first four or five dorsal vertebræ, and passes, with converging fibers, cephalo-ventrad to unite with the teres major muscle; in common with the latter it extends along the extensor surface of the humerus to be inserted between the lateral and median processes.

*Dorsalis Scapulae* (Plate I., Fig. 1, dss) (*Deltoides scapularis superior*, Unterer Theil des äusseren Schulterblattmuskels, Untergrätenmuskel, *Suprascapularis*, *Infraspinatus*, *Supraspinatus*). Springs from the anterior half of the outer surface of the scapula, passes between the *deltoides scapularis inferior* and the *caput scapulare laterale externum m. anconæi*, as a narrow band, to be inserted on the lateral side of the humerus.

*Deltoides scapularis Inferior* (Plate I., Figs. 1 and 2, dsi) (*Deltoides superior*, *Supra- and Infraspinatus*, Theil der Schulterhälfte des Hebers des Armes, Theil der oberen [Schulterblatt-] Abtheilung des *Deltoides*, Zweiter Hebermuskel des Oberarmes, Theil des *Deltoides*). A strong muscle on the side of the shoulder. It springs from the spine of the scapula, passes back with slightly converging fibers, and ends chiefly on the outer surface of the *processus lateralis humeri*, while a number of superficial fibers end in the *humero-radialis* muscle.

*Scapulo-humeralis Profundus* (Plate I., Fig. 4, shpr) (*Teres minor*, *Erster Teres major*, *Scapulo-humeralis*). A small muscle that springs from the posterior border of the lower third of the scapula, and passes, with converging fibers, to its insertion on the humerus just distal to the medial process.

*Teres Major* (*Grosser runder Muskel* oder *kleiner Rückwärtszieher* des Oberarmbein, *Zweiter teres*

major). Springs from the posterior half of the upper region of the outer surface of the scapula. It passes down, with converging fibers, to unite with the latissimus dorsi muscle to form a strong tendon that is inserted on the extensor surface of the humerus.

*Subscapularis* (Unterschulterblattmuskel). Springs from the inner surface of the scapula, except from the suprascapula, goes with converging fibers directly over the capsule of the shoulder joint to be attached to the medial process of the humerus.

*Anconæus*. This strong muscle lies on the extensor side of the upper arm. It is made up of two layers: the superficial comes from the pectoral girdle in two heads: (a) the caput scapulare laterale externum and (b) caput coraco-scapulare; the deeper layer originates on the humerus by three heads, (c) caput humerale laterale, (d) caput humerale posticum, and (e) caput humerale mediale. These five heads of the anconæus muscle with their synonyms will now be described.

(a) *Caput Scapulare Laterale Externum* (Plate I., Figs. 1 and 4, as1) (Brevi proximum caput m. tricipitis, Gewöhnlicher [äusserer] langer Kopf des dreiköpfigen Streckers, Portion scapulaire externe du triceps-brachial, Erster langer Kopf des Triceps, [Zweiter] abducirender vom Schultergerüst entstehender Kopf des Streckmuskels des Vorderarmes, Triceps Nr. 1, Triceps longus).

This muscle springs as a tendon from the hinder border of the scapula directly beneath the articular cavity, and extends back, between the scapulo-humeralis profundus and the dorsalis scapulae muscles, into the muscle belly.

(b) *Caput coraco-scapulare* (Plate I., Figs. 2, 4, 5, 6, acs) (Externum caput m. tricipitis, Innerer langer Kopf des dreiköpfigen Streckers, Portion scapulaire interne du triceps-brachial, Zweiter langer Kopf des Triceps, [Erster] abducirender vom Schultergerüst entstehender Kopf des Streckmuskels des Vorderarmes, Triceps Nr. 2, Triceps longus secundus). Arises by two distinct tendinous tips—the upper, weaker one from the hinder border of the scapula, the lower, broader one from the hinder border of the coracoid.

(c) *Caput Humeri Laterale* (Plate I., Figs. 1 and 4, ah1) (Brevius caput m. brachiei interni, [Aeusserer] kurzer Kopf des dreiköpfigen Streckers, Portion huméral externe du triceps brachial, Aeusserer vom Humerus ausgehender Kopf des Streckmuskels des Vorderarmes, Theil des Triceps Nr. 3, Triceps externum). Springs from the lateral part of the extensor surface of the humerus dorsal to the lateral process and the origins of the humero-radialis and brachialis superior.

(d) *Caput Humerale Posticum* (Plate I., Fig. 4, ahp) (Longissimum caput m. brachiei internum, Theil des inneren [kurzen] Kopfes des dreiköpfigen Streckers, Theil des Triceps Nr. 3, Theil des



Triceps internus, Theil der Portion humérale interne du triceps brachial, [Mittler] vom Humerus ausgehender Kopf des Streckmuskels des Vorderarmes). Springs from the middle of the extensor surface of the humerus between the lateral and medial heads.

(e) *Caput Humerale Mediale* (Longius caput m. brachiei interni, Theil des [inneren] kurzen Kopfes des dreiköpfigen Streckers, Theil der Portion humérale interne du triceps brachial, [Innerer] vom Humerus ausgehender Kopf des Streckmuskels des Vorderarmes, Theil des Triceps Nr. 3, Theil des Triceps internus). This head originates on the medial part of the extensor surface of the upper arm at the end of the medial process where it is united with the scapulo-humeralis profundus muscle.

The muscle mass formed by the union of all the above heads goes over, as a broad and somewhat thick tendon, to become inserted on the proximal part of the ulna.

*Humero-radialis* (Plate I., Figs. 1 and 4, hr) (Caput longum m. bicipitis, Eigener kurzer Beuger, [Zweiter] vom Oberarm ausgehender Beuger, Brachialis externus, Portion *a* of Brachiaëus). A fairly large muscle on the outer side of the upper arm, lying between the brachialis inferior and caput humerale laterale muscles, with both of which it is, at the beginning, united. It originates with its deeper and chief mass from the outer

surface of the humerus, just distal to the lateral process; while its superficial layer, especially the upper fibers, come directly from the *deltoides scapularis inferior* and therefore have their origin on the scapula. In the middle of the upper arm it becomes a slender round tendon that extends, through a tendinous loop, to the radius, on whose outer side, at the end of the proximal third, it is inserted.

#### MUSCLES OF THE FOREARM

*Humero-radialis Internus* (*Radialis internus*, Lange Vorwärtswender, Pronateur, Pronator teres, Pronator quadratus, Oberflächlich gelegener, langer runder Einwärtsdreher). This muscle arises from the *condylus internus* (*C. ulnaris s. medialis*) and attaches itself to the radius throughout almost its entire length. It is a fairly strong muscle.

*Ulna-radialis* (*Carré pronateur*, Pronator teres, Pronator quadratus, Muskel welcher dem Pronator quadratus entsprecht). A strongly developed muscle. It springs from the upper part of the flexor surface of the ulna and is inserted on the lower part of the flexor surface of the radius.

*Humero-radialis Longus* (Plate II., Figs. 1 and 2, 1) (*Supinator longus*, Long supinateur, Lange Rückwärtswender, *Supinator radii longus*). Among the *Crocodilia* this and the following muscle are well developed. This one springs from the con-

dylus externus humeri and is inserted on the outer side of the entire length of the radius.

*Humero-radialis Brevis* (Plate II., Fig. 4, *d*) (Supinator brevis, Kurze Rückwärtswender, Extensor carpi-radialis brevis [?]). Arises near the preceding from the external condyle of the humerus and is inserted at the upper end of the radius.

*Humero-carpi-radialis* (Plate II., Fig. 2, *a*) (Aeusserer oder langer Speichenmuskel, Musculus quem parti superiori extensoris digitorum communis respondere videbat, Extensor carpi-radialis longus, Abductor pollicis longus). Towards the ulna, near the supinator longus muscle. It springs from the external condyle of the humerus, covers the supinator brevis muscle, and is inserted on the proximal end of the carpi-radialis.

*Humero-carpi-ulnaris* (Plate II., Fig. 2, *c*) (Extensor carpi-ulnaris, Ulnaris externus). Originates on the external condyle of the humerus, is inserted on the proximal end of the os carpi-ulnare.

*Humero-metacarpalis III., IV., V.* (Plate II., Fig. 2, *b*) (Extensor digitorum longus, Aeusserer Speichenmuskel or Speichenstrecker der Hand, Extenseur commun, Extensor radialis longus, Extensor digitorum communis). This muscle lies between the humero-carpi-radialis and the humero-carpi-ulnaris muscles. It springs from the condylus externus humeri and divides, on reaching the carpus, into three thin, flat tendons, which in part fuse with the carpo-phalangei muscle, and in

part are inserted on the carpal bones of the third, fourth, and fifth fingers.

*Carpo-phalangei* (Plate II., Fig. 2, *d*). (Extensor digitorum brevis, Extenseurs courts, Gemeinschaftlicher Strecker der Hand, Extensor digitorum communis brevis). Springs from the carpal and, in part, from the metacarpal bones and is inserted on the terminal phalanges of the five fingers.

*Ulna-carpi-radialis* (Ein dem Strecker und Abzieher des Daumens analoger Muskel, Extensor pollicis longus, Extensor carpi-radialis brevior[?]). Springs from the under half of the ulna, and is inserted on the os carpi-radiale.

*Carpo-phalangeus I* (Extensor pollicis brevis). This is a small, thick muscle that originates on the distal part of the os carpi-radiale and is inserted on the phalanx of the thumb.

*Humero-radialis Lateralis* (Plate II., Fig. 1, *o*) (Flexor carpi-ulnaris, Innerer Ellenbogenmuskel, Ulnaris internus). A fairly strongly developed muscle. It springs from the internal condyle of the humerus, extends along the ulna, and is inserted on the proximal part of the os carpi-ulnare, and the nearby pisiform bone.

*Humero-radialis Medialis* (Plate II., Fig. 1, *2*) (Flexor carpi-radialis, Radialis internus). A strongly developed muscle. It springs from the internal condyle of the humerus, receives fibers from almost the entire length of the radius, and is inserted on the proximal end of the os carpi-

radiale and with a thin tendon to the metacarpal bone of the thumb. Rüdinger was not able to find this muscle in *Alligator cynocephalus*.

*Carpo-phalangei* (Plate II., Fig. 1, 4) (Flexor digitorum communis brevis, Oberflächlicher gemeinschaftlicher Fingerbeuger, Fléchisseur sublime, Flexores sublimis a profundo perforati, Lange Flexoren der Finger, Flexor digitorum communis sublimis s. brevis, Flexor digitorum sublimis). A small thick muscle. It springs from the ligamentum carpi-volare proprium and from the ulnar border of the distal end of the os carpi-radiale and is divided into eight muscle-bellies which pass over to the proximal ends of the first phalanges as thin tendons that are penetrated by those of the humero-ulno-phalangei muscle.

*Humero-ulno-phalangei* (Plate II., Figs. 1 and 2, 5) (Flexor digitorum communis profundus, Fléchisseur profond, Tiefer gemeinschaftlicher Fingerbeuger, Flexor digitorum profundus, Flexor profundus). Arises with three heads. The first head takes its origin from the internal condyle of the humerus, runs between the humero-radialis lateralis muscles, and passes as a tendon over to the carpus where it unites with the other two heads of this muscle. The second, deep head comes from almost the entire length of the ulna. These two heads may be called the long heads. The third, short head springs from the proximal ends of the two large carpal bones of the first row,

and becomes united radially with the thick flat tendon ending the first two heads. The common terminal tendon splits into four points which pass among the tendons of the carpo-phalangei muscle and are inserted on the terminal phalanges. From the terminal tendons of this muscle spring the lumbricales muscles.

*Carpo-phalangeus* (Plate II., Fig. 1, 8) (Abductor pollicis). Springs from the os carpi-radiale; is inserted on the first phalanx of the thumb.

*Carpo-metacarpalis I.* (Plate II., Fig. 1, 9) (Opponens pollicis). Originates from the os carpi-radiale and is inserted on the radial side of the entire first metacarpus.

*Metacarpo-phalangeus I.* Originates from the base of the metacarpus of digit III.; is inserted on the ulnar side of the first phalanx of the thumb.

*Pisiformi-phalangeus primus digiti V.* (Plate II., Fig. 1, 7) (Abductor digiti minimi, Abducteur du petit doigt, Abductor digiti quinti). Springs from the pisiform bone, and is inserted on the medial border of the first phalanx of the fifth finger.

*Carpo-metacarpalis V.* (Opponens digiti minimi, Opponens primus). Springs from the carpi-ulnare bone and is inserted on the metacarpal bone of the fifth digit.

*Carpo-phalangeus primus digiti V.* (Plate II., Fig. 1, 3) (Flexor digiti minimi brevis, Opponens secundus). Arises from the ulnar border of the proximal part of the carpi-radiale bone and is

inserted on the proximal end of the first phalanx of the fifth finger.

*Metacarpo-phalangeus I. digiti V.* (Adductor digiti minimi). Springs from the metacarpal bones of the second and third fingers and is inserted on the radial side of the first phalanx of the fifth finger.

### THE ABDOMINAL MUSCLES

*Obliquus Abdominis Externus* (Grand oblique, Aeusserer schiefer Bauchmuskel, *Obliquus externus*, *Obliquus externus + internus + Serrati*, *Oblique descendens*). Springs, with a flat prong, from the uncinatæ processes of the true ribs, thence it extends as a tendinous aponeurosis, near the lateral boundary of the ileo-costalis muscle, caudalward to the region of the twenty-third (crocodile) vertebra. From this fairly straight line of origin the muscle takes a sharply distoventral course and is inserted, at least in part, on the outer surface of the sternal part of the ribs of the tenth to sixteenth vertebræ, but does not reach the mid-ventral line. Under this chief part of the outer layer of the abdominal muscle lies a second, more band-like muscle mass which is also strong but of considerably less extent. It takes its origin from the outer surface of the middle third of the ribs. In the region of the twentieth vertebra it fuses with the upper layer, but inwardly reaches nearer the median line than the upper layer.

*Obliquus Abdominis Internus* (Petit oblique, Obliquus internus, Subcostalis). Arises as a flat muscle layer first with a strong tendinous portion from the anterior dorsal border of the os pubis and from the there-located cartilaginous inscriptio tendinea of the rectus; second, by a dorsal portion, with a short tendon, from the anteromedial surface of the pubo-iliac articulation from the pubis and ilium equally; third, from the dorsal anterior ends of the last named bones. It is inserted somewhat mediad to the lateral border of the rectus ventralis muscle that covers it on the outside.

*Transversus Abdominis* (Transverse, Oblique Bauchmuskel, Innerer Bauchmuskel, Transversus ventralis). This muscle springs by short, flat, indistinct forks from the inner surface of the proximal ends of the dorsal ribs but does not reach the centra of the vertebræ because of the long, broad transverse processes. Caudally the origin passes dorsalward to the lateral border of the quadratus lumborum muscle between which and the ileo-costalis muscle it is attached to the end of the transverse process.

*Rectus Abdominis* (Gerader Bauchmuskel + pyramidenförmiger Muskel, Pyramidalis, Rectus abdominis + pyramidalis). This muscle consists, in the Crocodilia, of several very distinct parts:

I. The rectus ventralis, the chief part, arises as a fleshy tendon from the sternum and from the



ventral part of the last rib that reaches the sternum, and extends with direct longitudinal fiber-bundles of equal mass over the ventral third of the body back to the pelvis. It is inserted as a fleshy tendon on the anterior border of the pubis and more laterally is united, together with the obliquus internus muscle, chiefly to the last abdominal ribs which arise as an ossification of the last strongly developed inscription tendinea. This muscle-band, which unites with that of the opposite side to form the linea alba, is divided metamERICALLY by seven distinct inscriptions tendinea. These inscriptions are the above described abdominal ribs which consist of bony connective-tissue without a trace of cartilage cells. These so-called abdominal ribs, then, are not true ribs but are ossifications of the tendinous structures.

II. From the anterior border of the os pubis and the last strong inscription, also, to some extent, as a process of the preceding part, begins a new fleshy layer which, extending in diminishing size backward, is inserted by a strong tendon on the distoventral end of the ischium somewhat laterad to the symphysis. It is the muscle that is called by different authors the pyramidalis.

III. Rectus lateralis. About in the region of the twentieth vertebra, or at the level of the fifth inscription, a fleshy band-like muscle separates itself from the edge of the rectus muscle and the obliquus internus muscle and passes over to fuse with the ischio-coccygeus muscle.

IV. *Rectus internus*. On the inner surface of the *rectus ventralis*, from which it is separated by the intervening aponeurosis of the *rectus* muscle, appears a muscle lying on the outside of the diaphragmatic muscle. It extends as a broad band from the breast to the anterior border of the os pubis, with longitudinally directed fibers, to half the width of the *rectus ventralis* muscle.

*Intercostales* (Zwischenrippenmuskeln). The intercostal muscles in the *Crocodilia* are, in proportion to the strength of the ribs, of slight structure; they extend only from rib to rib and are, therefore, very short, though fairly thick. They, as usual, consist of the outer muscles with a direction like that of the external oblique, and of an inner muscle extending in the opposite direction, *i.e.*, at right angles. The internal muscles are especially well developed in the breast region and pass over into the internal oblique muscle.

*Quadratus Lumborum* (Carré des lombes, Viereckiger Lendenmuskel, Psoas major). A strong, thick muscle that springs from the inner surface of the transverse processes and bodies of the last six presacral and the first sacral vertebræ. The muscle diminishes as it passes in a caudoventral direction and is inserted with a strong tendinous band to the trochanter femoris.

*The Diaphragm* (Diaphragmaticus, Zwerchfell, Bauchfellmuskel). Closely inclosed between the skin and muscle of the abdomen, in the *Crocodilia*,

is a pair of muscles; they are, as a whole, thin muscles that are widely separated and extend in an anteroposterior direction. Each arises by two parts which, however, are united at the pelvis. One of these parts is small at its beginning, is fairly thick, and is attached by a short tendon, immediately over the pubis in front of the hip joint, to the ilium. The other part is not a very thick layer, and is attached, by a fairly long line, partly on the inner surface of the hindermost abdominal rib and partly on the outer border of the pubis. After the union of these two portions the muscle extends farther forwards and the fibers of the stronger portion spread out like a fan, becoming wider and thinner as they go forward and are at last attached partly to the pericardium, partly to the lobes of the liver of that side of the body. To be more exact, the fibers of the diaphragmaticus that lie nearest the middle line of the belly-wall extend forward as a fairly broad band to fuse with the pericardium. Most of the fibers of this muscle, however, are in close connection with a fibrous membrane which surrounds the liver parenchyma; this membrane is mostly very thin but it gradually becomes thicker towards the hinder border of the liver. Other muscle bands do not reach so far as the liver but are located near the middle line of the back; they are all, however, attached to an aponeurosis which passes over the upper, hinder border of the liver lobes to fuse with the fibrous capsule of the liver.

To the sternum as to the ribs is only a small part of this muscle attached.

Between the two above described muscles is found a space which is filled, in great part, with a fibrous membrane that binds the two muscles together. This membrane begins very thin and without a marked boundary behind the kidneys; it runs forward directly under them and the dorsal wall of the body, becoming gradually thicker, though never very thick, and fuses, laterad to the kidneys, with the above-mentioned aponeurosis of the two diaphragmaticus muscles. Thence this aponeurosis goes to the upper, hinder side of the liver where it becomes fairly thick. One thus finds in front of the stomach a fibrous membrane, belonging to the diaphragmaticus, which is pierced by the œsophagus and by a fairly large space that extends around the œsophagus and between it and the liver. This membrane fastens the liver to the œsophagus.

The muscle of the right side is covered, on almost its entire inner surface (from its hinder end to the liver) by the belly-like skin, and is fairly closely united with it. The left muscle, on the other hand, is only covered by this skin from the hinder border of the stomach forwards; farther forward it lies immediately on the under and left side of the stomach and is united with it by loose connective-tissue. Outwardly both muscles are united by a thin layer of connective-tissue to the true abdominal muscles.

So far as yet known this muscle is not present in other reptiles.

#### MUSCLES OF THE POSTERIOR APPENDAGES

*Ambiens* (Plate III., Figs. 1 and 2, amb, Plate IV., Figs. 2 and 4, amb, Plate V., Figs. 2 and 3, amb) (Part I., Rectus femoris and Sartorius partim, Vastus internus, Innere Streckmuskelmasse) (Part II., Gracilis, Rectus femoris, Sartorius). Arises by a short tendon from the anterior spine of the ilium, near its union with the pubis. The muscle swells quickly to a thick belly which, lying under the skin on the forward and inner side of the upper thigh, is again reduced to a small, flat tendon which extends abruptly over the anteromedial surface of the knee joint to its outer side; it then passes through the complex of tendons of the femoro-tibialis muscle, beneath which it unites with the tendon of origin for the peroneus posterior muscle.

To this muscle is the following strange muscle to be ascribed (Part II): it springs, small in extent, from the inner surface of the os pubis near the acetabulum, extends thence forward around the pubis, and runs into a long, thin tendon which unites with the insertion tendon of the subcutaneous extensor ilio-tibialis muscle.

*Extensor Ilio-tibialis* (Plate III., Fig. 2, ex. il. tb.) (Part I., Rectus femoris, Adductor flexor, Glutæus maximus; M. du fascia lata, Vastus externus,

Tensor faciae latae, Tensor femoris vaginae, Glutæus minimus, Tensor faciae femoris). This muscle, in the Crocodilia, consists of two parts:

I. The chief part is long and broad, and springs as a tendon from more than the anterior half of the lateral border of the dorsal crest of the ilium, covering the origin of the ilio-fibularis muscle. Its insertion, by a broad, flat tendon, overlying the femoro-tibialis muscle, together with the tendon of this muscle, is on the anterior surface of the head of the tibia.

II. The second, significantly smaller and narrower, part arises outside of the quadratus lumborum by a short tendon from the most dorsal end of the ilium; it goes over, medially, along the nearer head of the ambiens muscle, then to the anteromedial side of the upper leg, into the deeper-lying femoro-tibialis muscle.

*Femoro-tibialis* (Plate III., Fig. 1, fm. tb., Plate IV., Fig. 2, fm. tb., Plate V., Figs. 1 and 3, fm. tb.) (Cruræus et Vasti, Cruralis). Arises by an anterior inner and a posterior outer head; both heads arise from the outer-anterior and inner surfaces of the femur, and unite with each other and with the extensor ilio-tibialis and ambiens muscles as a strong tendon, which extends over the knee and is inserted on the anterior border of the head of the tibia; this tendon incloses, like a sheath, the end-tendon of the ambiens muscle.

*Ilio-fibularis* (Plate III., Fig. 2, il. fib., Plate IV.,

Fig. 2, il. fib., Plate V., Fig. 3, il. fib.) (Biceps cruris, Semitendinosus+Semimembranosus, Glutæus maximus, Abductor fibularis, Flexor abductor cruris). This consists, in the Crocodilia, of two entirely separate small, band-like muscles. The first springs by a short tendon from the lateral surface of the middle ilium, very near the origin of the caudali-ilio-femoralis and extensor ilio-tibialis muscles. The chief part of the end-tendon is inserted at the end of the first sixth of the fibula, on its outer-forward corner near the origin of the peroneus anterior muscle; a shorter tendon-branch goes to the tendon of the peroneus posterior muscle; and a third, still smaller branch goes to the caput femorale of the gastrocnemius muscle, by which it contributes to the structure of the lateral part of the tendo-communis externus.

The second part springs, by an equally short tendon, very near the first, from the hinder end of the dorsal crest of the ilium, goes directly over the preceding to the knee, where its tendon unites with that of the extensor ilio-tibialis muscle.

*Ilio-femoralis* (Plate III., Fig. 2, il. fm., Plate IV., Fig. 2, il. fm., Plate V., Fig. 1, il. f.) (Glutæus, Quadratus femoris [?], Glutæus medius). This muscle is inwardly fused with the caudali-ilio-femoralis, whose anterior part it forms.

*Caudali-ilio-femoralis* (Plate III., Fig. 2, cd. il. fm., Plate IV., Fig. 1, cd. il., fm.) (Zweiter Auswärtsroller, Extensor femoris caudalis accessorius,

Glutæus minimus). This forms a thick mass that springs directly from the lateral surface of the anterior and middle parts of the ilium, is covered outside by the ilio-fibularis muscle, and, pushing between the two heads of the femoro-tibialis muscle, is inserted on the whole outer surface of the middle third of the femur.

*Caudi-femoralis* (Plate III., Figs. 1 and 2, cd. fm., Plate IV., Fig. 1, cd. fm.) (Pyriformis, Pyriformis + Subcaudalis, Femoro-peroneo-coccygeus, Extensor femoris caudalis). This muscle in the Crocodilia consists of two parts:

I. The chief part extends from the first postsacral (the twelfth) vertebra caudad; it springs from the roots of the caudal ribs (transverse processes) and the whole lateral surface of the vertebral arches. Since the first postsacral vertebra has no ventral process, the muscles of the opposite sides fuse in the mid-line. Towards the caudal region it gradually increases in strength. Its fibers converge in a lateroventral direction to form a short, thick tendon which attaches itself to the inner surface of the femur mediad and somewhat below the trochanter. At right angles from this tendon extends a round, long tendon which, lying parallel to the hinder side of the thigh, pushes in between the chief parts of the ischiadicus and later between the origin-tendon of the gastrocnemius and peroneus posterior muscles, and is inserted on the posterior surface of the head of the fibula.



II. This is a more anterior and inner muscle, small in size, which has a fleshy origin from the bodies and ribs (transverse processes) of the second sacral and first caudal vertebræ at a distance from the posteromedian border of the ischium. It extends caudad, lying near the hinder part of the pubi-ischio-femoralis externus, and is inserted on the trochanter.

*Flexor Tibialis Externus* (Plate III., Figs. 1, 2, 3, fl. tb. ext. or f. t. ext., Plate IV., Fig. 4, fl. tb. ext., Plate V., Figs. 1 and 3, fl. tb. ext. and f. t. ext.) (Triceps flexor cruris partim, Biceps). A strong, spindle-shaped muscle that arises, together with the ilio-fibularis, by a short tendon, from the side of the portio dorsalis of the ilium, and in the neighborhood of the bend of the knee is split into two tendons, of which the short one is inserted on the fibular side of the neck of the tibia, while the other, running along near the caput femoris of the gastrocnemius muscle, unites with the tendon of the caput tibiæ of the gastrocnemius muscle just beyond the ankle joint.

*Flexor Tibialis Internus* (Plate III., Figs. 1, 2, 3, fl. tb. int., or f. t. int., Plate IV., Fig. 4, fl. tb. int., Plate V., Fig. 1, fl. tb. int.) (Demi-nerveux + Demi-membraneux, Triceps flexor cruris partim, Gracilis, Adductor flexor tibialis, Semimembranosus, Semitendinosus + Gracilis partim, Gracilis + Semimembranosus + Semitendinosus). A three-headed muscle whose heads arise separately and

first unite in the region of the lower leg as a short, strong tendon. Their origins are as follows: (1) As a band from the anterior margin of the ischium, pushing between the ischio-femoralis and the pubi-ischio-femoralis externus muscles; (2) From the posterior margin of the ischium as a narrow, tendinous band near the insertion of the ischio-caudalis muscle; (3) from the portio-dorsalis posterior of the ilium, ventralward, near the origin of the flexor tibialis externus muscle.

*Ischio-femoralis* (Plate III., Fig. 1, is. f.) (Adductores, Adductor longus, Adductor primus). Springs directly (without tendon) from the entire anterior border of the ischium. It is band-like and, running over the tendon of the pubo-femoralis internus and externus muscle, is inserted as a broad, fleshy tendon on the middle third of the inner, posterior surface of the femur.

*Pubi-ischio-femoralis Externus* (Plate III., Fig. 1, p. is. f. int., Plate IV., Fig. 1, p. is. f. int.) (as a whole: Quatuor pectinei [partim]; in parts: I. Marsupialis externus, Obturator externus; II. Quadratus femoris). This muscle arises in two parts. The anterior part is broad and comes from the entire ventral and inwardly turned outer surface of the pubis. Its insertion is on the femur in conjunction with the first part of the pubi-ischio-femoralis internus. The second part is shorter but thicker than the first and springs from almost all of the outer surface of the ischium that is not cov-

ered by the origins of the ischio-femoralis, pubi-ischio-tibialis, and flexor tibialis internus muscles. It is inserted, by a strong, short tendon, on the trochanter, somewhat caudad to the insertion of the pubi-ischio-femoralis internus.

*Pubi-ischio-femoralis Internus* (Plate III., Fig. 1, p. is. f. int., Plate IV., Figs. 1 and 2, p. is. f. int.) (as a whole: Iliacus internus+Quatuor pectinei [partim]; in parts: I. and II.: Kamm-Muskeln, Pectineus inferior [I.] + superior [II.], Marsupialis internus, Obturator internus; III., Iliacus [Darmbeinmuskeln], Iliacus internus). This muscle arises by two or three parts: I. The anterior arises, without tendon, from the greater part of the inner and anteriorly directed surface of the pubis; median to this, in the alligator, is a small bundle, II., which unites with part I. These unite with the pubi-ischio-femoralis externus to form a strong tendon that is inserted on the trochanter.

III. This is a larger muscle that springs without tendon from the inner surface of the body and transverse processes of the twenty-fifth and twenty-sixth (in alligator) vertebræ, from the part of the ilium that lies between these transverse processes and the ischium, and from a small part of the ischium. It is inserted on the whole inner surface of the proximal third of the femur.

*Pubi-ischio-femoralis Posterior* (Plate III., Fig. 1, p. is. f. post., Plate IV., Figs. 1 and 4, p. is. f.

post. and pb. is. f. m. post.) (Adductus [partim], Gemellus, Obturator internus). Springs without tendon from the whole caudally directed border of the ischium. It is inserted, by a short tendon, near and laterad to the tendon of the ischio-femoralis muscle, on the hinder surface of the upper leg.

*Extensor Longus Digitorum* (Plate V., Figs. 2 and 3, ext. 1. [long.] dig.) (Long extenseur commun, Gemeinschaftlicher Fussheber oder Beuger, Extensor communis digitorum). Springs, together with the tibialis anticus, from the external condyle of the femur, goes with this muscle under the ligamentum tibio-fibulare and after union with this divides into four short tendons. Three of these tendons are inserted on the fibular side of the bases of the first three metatarsal bones; the fourth goes over into the muscle of the third toe.

*Tibialis Anticus* (Plate III., Fig. 1, tib. ant., Plate IV., Fig. 4, tib. ant., Plate V., Figs. 2 and 3, tib. ant.) (Jambier antérieur, Vorderer Schienbeinmuskul). Springs by a fleshy tendon from the anterior surface of the head and neck of the tibia and quickly unites with the following muscle.

*Peroneus Anterior* (Plate V., Figs. 2 and 3, peron. ant.) (Peroneus longus). In the alligator. Its origin: it extends from the insertion of the ilio-fibularis muscle distalwards by the whole outer surface of the fibula, under the skin and over the ligamentum tibio-fibulare, and gives off a broad, tendinous portion to help strengthen the tendon

Achilles, which portion may be followed to the rudiment of the fifth toe. On the outer side of this toe rudiment is attached a tendon from the tibial border of the muscle.

In the crocodile. This muscle is here divided into two parts, of which the one that springs from the anterior surface of the fibula is inserted on the toe rudiment, while the greater and outward part extends over the calcaneum bone and has the same distribution as in the alligator.

*Peroneus Posterior* (Plate IV., Figs. 3 and 4, peron. post., Plate V., Figs. 2 and 3, peron. post.) (Plantaris). Springs chiefly from the tendon of the ambiens muscle running over the knee and forms the direct continuation of this muscle. Besides this come tendinous fibers from the insertion tendons of the femoro-tibialis and extensor ilio-tibialis muscles; and finally supporting fibers from the outer, end-tendon of the ilio-fibularis muscle. The fibers of this muscle pass partly into the fibular portion of the caput femoralis of the gastrocnemius, while the chief mass of the muscle is inserted on the posterior surface of the calcaneum.

*Gastrocnemius* (Plate III., Figs. 1 and 3, cap. int. gastr., Plate IV., Fig. 4, cap. int. gastr. and cap. ext. gastr., Plate V., Figs. 2 and 3, cap. ext. gastr. and cap. int. gastr.) (Solenmuskel, Outer head of gastrocnemius). This is the strongest superficial flexor muscle on the posterior surface of the lower leg; it consists of two heads: I.

The caput femorale (externum) originates by a strong, short tendon from the lateral and posterior surface of the external condyle of the femur. This head has a double insertion: (1) from the outer, fibular border of the muscle separates off a tendon that spreads out in the first layer of the plantar tendon-muscle; (2) the chief part of caput I. becomes a broad, flat, subcutaneous tendon which is covered by the tendon Achilles and serves as the origin of the short flexors of the toes.

II. The caput tibiale (internum) springs without a tendon from the posterior surface of the head and the proximal third of the tibia. The broad and somewhat flat muscle has two insertions: (1) on the plantar and medial border of the first basis metatarsi; (2) the chief insertion on the outer border of the rudimentary fifth toe, after forming, with the tendon of the flexor tibialis externus, the tendon Achilles.

*Flexor Longus Digitorum* (Plate IV., Fig. 4) (Langer durchbohrender gemeinschaftlicher Zehenbeuger). A many-headed muscle visible on the posterior side of the lower leg after removal of the preceding muscle. (a) Caput externum: a flat, fairly broad muscle which springs from the outer and posterior surface of the fibula. Arriving at the astragalo-scapoid bone, it forms a very strong tendon which unites with the still stronger tendon of the other head and both together form the broad initial tendon of the flexor digitorum communis brevis

muscle. (b) *Caput internum*: this springs without a tendon from the whole posterior surface of the upper half of the tibia, sometimes, as in crocodiles, uniting with the *caput femoralis* of the *gastrocnemius* muscle. The common tendon splits into three points for the first, second, and third toes.

*Tibialis Posticus* (Plate V., Fig. 2, tib. post.) (*Jambier postérieur*, *Hinterer Schienbeinmuskel*). Originates without tendon from the whole fibular side of the tibia, on the one hand, and from the whole inner and forward side of the fibula on the other hand, occupying the whole space between these two bones on the hinder side of the lower leg. At its proximal end it is united with the *caput internum* of the preceding muscle which completely covers it from behind. It narrows down to a very strong tendon which divides into two equally strong, round tendons; of these the one on the tibial side is inserted on the *basis ossis* of the first metacarpal, the one towards the fibula goes immediately to the second metacarpal.

*Interosseus Cruris* (*Kniekehlmuskel*). A small muscle stretching between the distal ends of the fibula and tibia with almost transverse fibers; it is covered dorsally by the *tibio-fibulare* ligament and appears as a distal division of the *tibialis posticus* muscle.

*Flexor Digitorum Brevis* (*Flexor longus accessorius*, *Flexor brevis perforatus*). Springs from the bones of the foot and from the strong tendon of the

flexor digitorum longus muscle. It divides into three bellies for the second, third and fourth toes. The first two are pierced by the above-mentioned tendon of the flexor digitorum longus and are inserted on the next to last phalanx of the second and third toes; the third, on the contrary, is inserted on the claw joint of the fourth toe and is not perforated; there is no tendon to the fourth toe from the flexor digitorum longus muscle.

*Extensor Hallucis Proprius* (Plate V., Fig. 3) (Kurzer gemeinschaftlicher Zehenstrecker, Extensor hallucis). This muscle springs by a short, flat, fairly strong tendon from the outer dorsal border of the distal half of the fibula. It is inserted: (1) on the proximal half of the first metatarsal bone, (2) a second much weaker part is united with the tendon of insertion of the tibialis anticus extensor longus digitorum to the first metatarsal bone.

#### THE TAIL MUSCLES

The muscles of the tail have, as shown by Gadow, the character of the primitive body muscles, with their primitive metameric division, fairly plainly preserved. This musculature is arranged in four rows of trumpet-shaped cones, one projecting into the other, by which arrangement each metamere exhibits a transverse zigzag line of four anteriorly and three posteriorly directed points.



*Ilio-ischio-caudalis* (Plate III., Figs. 1 and 2, is. cd., Plate IV., Figs. 1 and 2, is. cd.) (Ischio-coccygeus). The crocodile is the nearest to the typical condition in the musculature of the tail. The lateral and ventral part of the tail musculature forms a broad mass that extends to the end of the tail; it lies immediately under the skin and springs from the caudal ribs (transverse processes—Gadow) and from the spinous processes of all the caudal vertebræ. The entire side musculature of the tail ends cephalad in several portions; the most ventral and medial of these bound the cloaca as an at least slightly developed, morphological sphincter; the lateral portion is attached to the posteroventral border of the ischium; while the dorsal portion is inserted by two heads on the first caudal rib and on the posterior spine of the ilium.

PLATE I.

SHOULDER MUSCLES OF CROCODILUS ACUTUS. (From Bronn after Fürbringer.)

FIG. 1. SHOULDER MUSCLES AFTER REMOVAL OF THE SPHINCTER COLLI MUSCLE (*sphr*).

FIG. 2. SHOULDER MUSCLES AFTER REMOVAL OF THE SPHINCTER COLLI MUSCLE (*sphc*).

FIG. 3. DEEP LAYER OF THE INNER SHOULDER MUSCLES AFTER REMOVAL OF THE HUMERUS AND ITS MUSCULATURE AS WELL AS THE COLLO-SCAPULARIS SUPERFICIALIS MUSCLES (*cssp*) AND THORACI-SCAPULARIS SUPERFICIALIS MUSCLES (*thcsp*).

FIG. 4. SHOULDER MUSCLES AFTER REMOVAL OF THE PARS SCAPULARIS OF THE SUPRA-CORACO-SCAPULARIS (*sps*) AND OF THE BICEPS MUSCLE (*b*).

FIG. 5. DIFFERENT VIEW OF FIG. 4.

FIG. 6. SHOULDER MUSCLES AFTER REMOVAL OF THE PARS CORACOIDEA OF THE SUPRA-CORACO-SCAPULARIS (*spc*) AND DELTOIDES SCAPULARIS SUPERIOR (*dss*) MUSCLES.

LETTERING FOR ALL FIGURES OF THIS PLATE.

*acs*, *ahl*, *ahp*, *asl*, coraco-scapular, humerale laterale, humerale posticum, and scapulare laterale externum heads of the anconæus muscle; *b*, coraco-antibrachialis (biceps); *c*, coracoid; *cbb*, coraco-brachialis; *cc*, costo-coracoideus; *Cl*, clavicle; *cssp*, collo-scapularis superficialis (levator scapulæ superficialis); *est*, capitasternalis (sterno-mastoideus); *thcsp*, collo-thoraci-scapularis profundus (levator scapulæ and serratus profundus); *cu*, dorso-scapularis (cucullaris); *dh*, dorso-humeralis (latissimus dorsi); *dsi*, deltoides scapularis inferior; *dss*, dorsalis scapulæ (deltoides scapularis superior); *Ec*, epicoracoid; *Est*, episternum; *esthy*, episterno-hyoideus; *H*, humerus; *hai*, humero-antibrachialis inferior (brachialis inferior); *hr*, humero-radialis; *p*, pectoralis; *PL*, processus lateralis humeri; *PM*, processus medialis humeri; *R*, radius; *rh*, rhomboideus; *S*, scapula; *sbsc*, subscapularis; *shpr*, scapulo-humeralis profundus; *sps*, supra-coraco-scapularis; *sphc*, sphincter colli; *SpS*, spina scapulæ; *SS*, suprascapulare; *St*, sternum; *Sta*, anterior part of sternum; *Stp*, posterior part of sternum; *thssp*, thoraci-scapularis superficialis (serratus superficialis); *U*, ulna; *V*<sub>5</sub>, *V*<sub>6</sub>, 5th and 6th vertebræ.

NERVES SHOWN IN THIS PLATE.

- |      |  |   |
|------|--|---|
| 3a.  | thoracicus VII.  | muscular branch of the supra-coracoideus.                                       |
| 7.   | posterior branch of the thoracicus superior VII for the collo-thoraci-suprascapularis profundus and rhomboideus muscles. | 19. pectoralis.   |
|      |  | 21. brachialis longus inferior.   |
|      |  | 29b. teres major.   |
|      |  | 31. dorsalis scapulæ (posterior).   |
| 7a.  | proximal.  | 32. cutaneus brachii and anti-brachii superior lateralis.                       |
| 7b.  | distal thoracicus superior VII.  | 32a. humero-radialis.   |
| 10a. | thoracicus inferior.   | 33. deltoides inferior, (25 and 42), cutaneus brachii and antibrachii medialis. |
| 12.  | supra-coracoideus.   |   |
| 15.  | integumental, (13 and 14),   |   |



PLATE II.

FIGS. 1-4. MUSCLES OF THE FOREARM OF THE ALLIGATOR.  
(From Bronn.)

FIGS. 5-7. (From Bronn after Rathke.)

FIG. 1. 1, humero-radialis longus (supinator longus); 2, humero-radialis medialis (flexor carpi radialis); 3, carpo-phalangei I digiti V; 4, carpo-phalangei (flexor digitorum communis brevis); 5, humero-ulno-phalangei (flexor digitorum communis profundus); 6, humero-radialis longus; 7, pisiforme-phalangeus primus digiti V; 8, carpo-phalangeus I; 9, carpo-metacarpalis I.

FIG. 2. 1-5 as in FIG. 1; a, humero-carpi-radialis; b, humero-metacarpalis III, IV, V (extensor digitorum longus); c, humero-carpi-ulnaris; d, carpo-phalangei (extensor digitorum brevis).

FIG. 3. a, b, humero-ulno-phalangei (flexor digitorum communis profundus).

FIG. 4. a, ulno-carpi-radialis; b, ulna; c, humero-ulnaris-lateralis (flexor carpi ulnaris); d, humero-radialis brevis (supinator brevis).

FIG. 5. HEAD, NECK, AND A PART OF THE BODY OF A CROCODILUS  
VULGARIS. (Ventral View).

a, lower jaw; b, upper jaw; c, arch of palate; d, fold of palate; h, pterygoideus internus (Rathke); i, pterygoideus externus (Rathke); k, longus colli (Rathke); m, rectus capitis anticus major (Rathke); n, sterno-mastoideus (Rathke); o, levator scapulæ (Rathke); p, scalenus (Rathke).

FIG. 6. PART OF A SIMILAR PREPARATION OF C. RHOMBIFER.

a, the hindermost of the superior maxillary teeth; b, lower jaw; c, wings of palate; d, pterygoid; e, quadrate; g, intertransversalis (Rathke); h, trachelomastoideus (Rathke); i, levator scapulæ (Rathke); k, longus colli (Rathke); m, pterygoideus externus (Rathke); n, rectus capitis anticus major (Rathke).

FIG. 7. A PART OF THE HEAD AND NECK OF ALLIGATOR LUCIUS.

a, pterygoideus externus (Rathke); b, digastricus (Rathke); c, rectus capitis anticus major (Rathke); d, sterno-mastoideus, anterior belly (Rathke); e, sterno-mastoideus, posterior belly (Rathke); f, levator scapulæ (Rathke); g, cervicalis ascendens (Rathke); h, longus colli (Rathke); i, intertransversalis (Rathke); k, trachelomastoideus (Rathke); l, biventer cervicis (Rathke); m, splenius colli (Rathke); n, splenius capitis (Rathke).

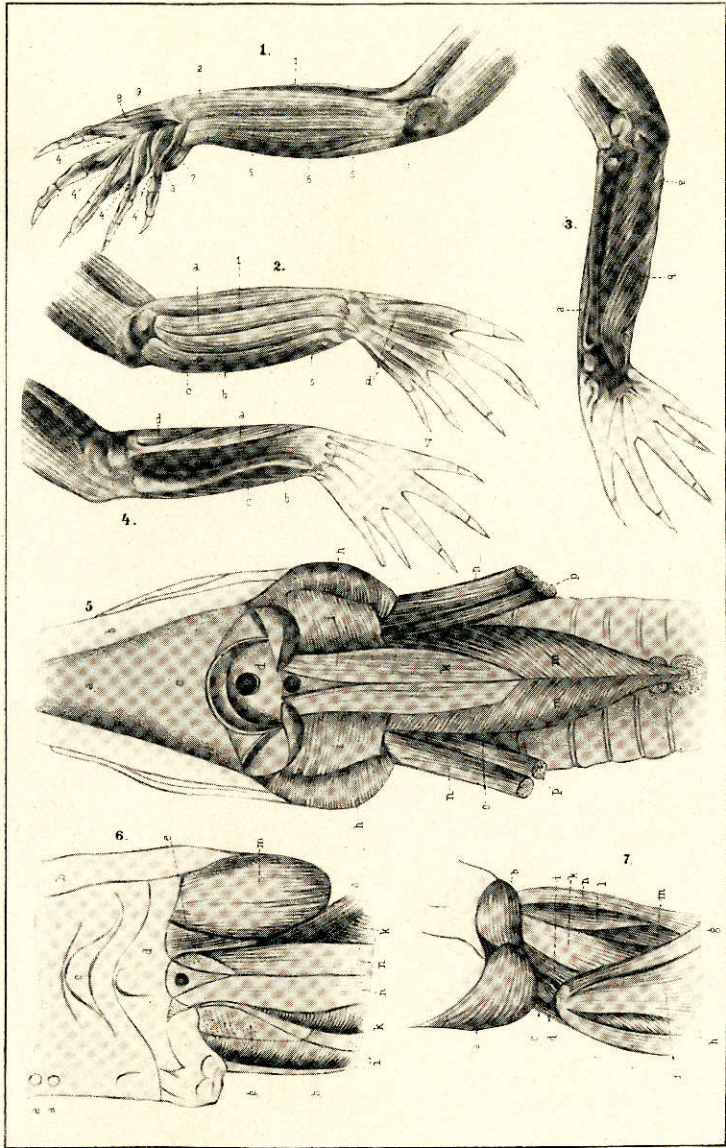


PLATE III.

FIG. 1. MUSCLES OF THE POSTERIOR EXTREMITY OF ALLIGATOR MISSISSIPPIENSIS. LEFT SIDE, VENTRAL (PLANTAR) SURFACE.

FIG. 2. THE SAME, DORSAL AND LATERAL SURFACES.

FIG. 3. A. MISSISSIPPIENSIS; THE TENDONS OF THE FLEXOR TIBIALIS MUSCLE IN THEIR RELATION TO THE GASTROCNEMIUS MUSCLE. RIGHT LEG, INNER SURFACE. (FIGS. 1-3 from Bronn, after Gadow.)

*amb*, ambiens; *cap, ext, gastr.*, external head of gastrocnemius; *cap, int, gastr.*, internal head of gastrocnemius; *cd, fm*, caudali-femoralis; *cd, il, fem*, caudi-ilio-femoralis; *ex, il, tb*, extensor ilio-tibialis; *ext, l (long), dig*, extensor longus digitorum; *fl, tb, ext*, flexor tibialis externus; *fl, tb, int*, flexor tibialis internus; *fm, tb*, femoro-tibialis; *il, cd*, ilio-caudalis; *il, cost*, ilio-costalis; *il, fib*, ilio-fibularis; *il, fm (il, f)*, ilio-femoralis; *il, s, cd*, ilio-sacro-caudalis; *is, cd*, ischio-caudalis; *is, f*, ischio-femoralis; *ob, ext*, obliquus externus; *pb, cd*, pubi-caudalis; *pb, is, tb*, pubi-ischio-tibialis; *pb, tb*, pubi-tibialis; *peron, ant*, peroneus anterior; *peron, post*, peroneus posterior; *p, is, f, ext*, pubi-ischio-femoralis externus; *p, is, f, int*, pubi-ischio-femoralis internus; *p, is, f, post*, pubi-ischio-femoralis posterior; *quadr, lb*, quadratus lumborum; *rect*, rectus abdominis; *tib, ant*, tibialis anticus; *tib, post*, tibialis posticus; *trans*, transversus abdominis; *tr, per*, transversus perinei; *m, post, il*, posterior border of ilium; *ob*, foramen in pubis for the obturator nerve; *o, il*, ilium; *o, is*, ischium; *o, pb*, pubis; *o, cl*, cloacal bone; *pr, l, pb*, lateral process of pubis; *pr, tr*, transverse process; *sp, ant, il*, anterior spine of ilium; *Sy, p*, symphysis pubis; *Sy, is*, symphysis of ischium; *tb, is*, tubercle of ischium.

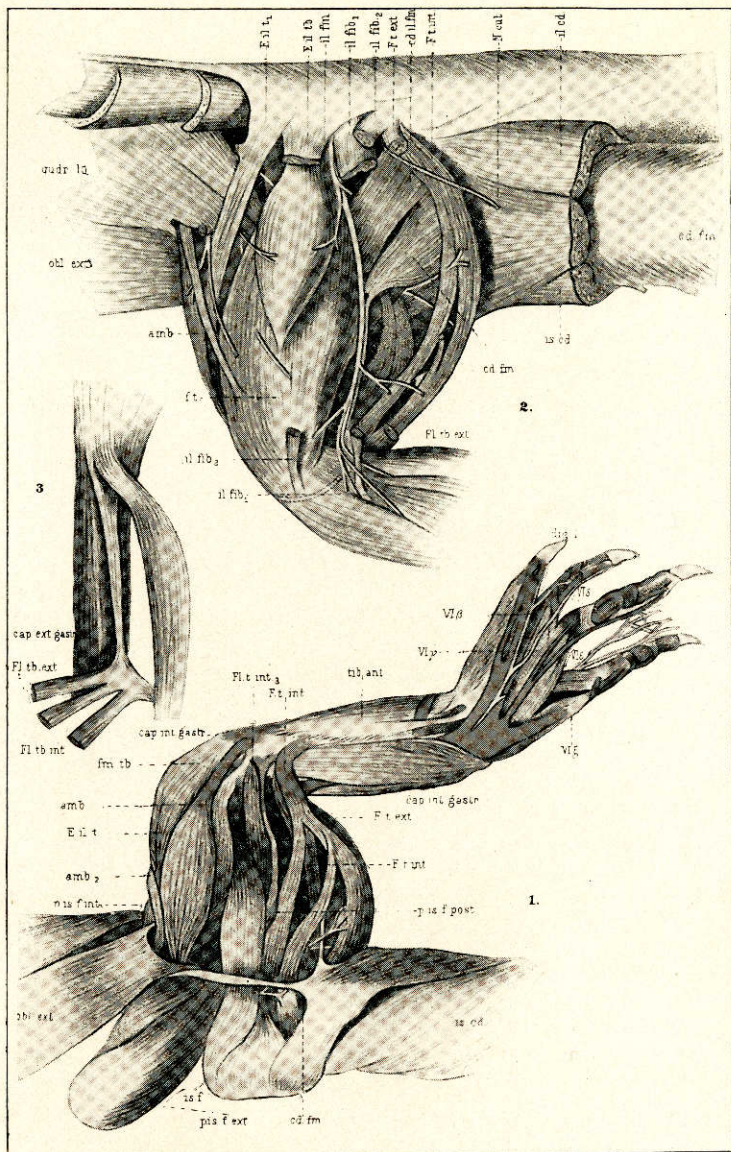


PLATE IV. (From Bronn, after Gadow.)

FIG. 1. ALLIGATOR MISSISSIPPIENSIS. INNER SURFACE OF THE PELVIC REGION, LEFT SIDE. THE PUBIS, ISCHIUM, AND VERTEBRÆ ARE CUT THROUGH THE MEDIAN PLANE, XXVIII, 28th VERTEBRA.

FIG. 2. HATTERIA PUNCTATA.

FIG. 3. A. MISSISSIPPIENSIS. THE DEEPEST MUSCLES ON THE PLANTAR SURFACE OF THE LEFT HIND FOOT. ROMAN NUMERALS IX-XII, SHORT TOE MUSCLES.

FIG. 4. A. MISSISSIPPIENSIS. LEFT LEG FROM THE POSTERO-MESIAL ASPECT. THE PLANTAR FLEXOR MUSCULATURE IN SITU, AFTER REMOVAL OF THE GASTROCNEMIUS MUSCLE AND THE ASSOCIATED MUSCLES. ROMAN NUMERALS, VI-X, SHORT TOE MUSCLES.

*amb*, ambiens; *cap, ext, gastr*, external head of gastrocnemius; *cap, int, gastr*, internal head of gastrocnemius; *cd, fm*, caudali-femoralis; *cd, il, fem*, caudi-ilio-femoralis; *ex, il, tb*, extensor ilio-tibialis; *ext, l (long), dig*, extensor longus digitorum; *fl, tb, ext*, flexor tibialis externus; *fl, tb, int*, flexor tibialis internus; *fm, tb*, femoro-tibialis; *il, cd*, ilio-caudalis; *il, cost*, ilio-costalis; *il, fib*, ilio-fibularis; *il, fm (il, f)*, ilio-femoralis; *il, s, cd*, ilio-sacro-caudalis; *is, cd*, ischio-caudalis; *is, f*, ischio-femoralis; *ob, ext*, obliquus externus; *pb, cd*, pubi-caudalis; *pb, is, tb*, pubi-ischio-tibialis; *pb, tb*, pubi-tibialis; *peron, ant*, peroneus anterior; *peron, post*, peroneus posterior; *p, is, f, ext*, pubi-ischio-femoralis externus; *p, is, f, int*, pubi-ischio-femoralis internus; *p, is, f, post*, pubi-ischio-femoralis posterior; *quadr, lb*, quadratus lumborum; *rect*, rectus abdominis; *tib, ant*, tibialis anticus; *tib, post*, tibialis posticus; *trans*, transversus abdominis; *tr, per*, transversus perinei; *m, post, il*, posterior border of ilium; *ob*, foramen in pubis for the obturator nerve; *o, il*, ilium; *o, is*, ischium; *o, pb*, pubis; *o, cl*, cloacal bone; *pr, l, pb*, lateral process of pubis; *pr, tr*, transverse process; *sp, ant, il*, anterior spine of ilium; *Sy, p*, symphysis pubis; *Sy, is*, symphysis of ischium; *tb, is*, tubercle of ischium.





PLATE V. (From Bronn, after Gadow.)

FIG. 1. HATTERIA PUNCTATA. (Ventral View.)

FIG. 2. ALLIGATOR MISSISSIPPIENSIS. LEFT POSTERIOR EXTREMITY;  
FOOT IN PRONATION, HENCE SEEN FROM THE DORSAL SIDE.

*lg, t, f*, LIGAMENTUM TIBIO-FIBULARE.

FIG. 3. A. MISSISSIPPIENSIS. MUSCLES OF THE DORSAL SURFACE  
OF THE LOWER LEG AND FOOT.

*amb*, ambiens; *cap, ext, gastr*, external head of gastrocnemius; *cap, int, gastr*, internal head of gastrocnemius; *cd, fm*, caudali-femoralis; *cd, il, fem*, caudi-ilio-femoralis; *ex, il, tb*, extensor ilio-tibialis; *ext, l (long), dig*, extensor longus digitorum; *fl, tb, ext*, flexor tibialis externus; *fl, tb, int*, flexor tibialis internus; *fm, tb*, femoro-tibialis; *il, cd*, ilio-caudalis; *il, cost*, ilio-costalis; *il, fib*, ilio-fibularis; *il, fm (il, f)*, ilio-femoralis; *il, s, cd*, ilio-sacro-caudalis; *is, cd*, ischio-caudalis; *is, f*, ischio-femoralis; *ob, ext*, obliquus externus; *pb, cd*, pubi-caudalis; *pb, is, tb*, pubi-ischio-tibialis; *pb, tb*, pubi-tibialis; *peron, ant*, peroneus anterior; *peron, post*, peroneus posterior; *p, is, f, ext*, pubi-ischio-femoralis externus; *p, is, f, int*, pubi-ischio-femoralis internus; *p, is, f, post*, pubi-ischio-femoralis posterior; *quadr, lb*, quadratus lumborum; *rect*, rectus abdominis; *tib, ant*, tibialis anticus; *tib, post*, tibialis posticus; *trans*, transversus abdominis; *tr, per*, transversus perinei; *m, post, il*, posterior border of ilium; *ob*, foramen in pubis for the obturator nerve; *o, il*, ilium; *o, is*, ischium; *o, pb*, pubis; *o, cl*, cloacal bone; *pr, l, pb*, lateral process of pubis; *pr, tr*, transverse process; *sp, ant, il*, anterior spine of ilium; *Sy, p*, symphysis pubis; *Sy, is*, symphysis of ischium; *tb, is*, tubercle of ischium.

