Fragmental Notes on Avian Morpho-anatomy:
3. Myological notes on *Neophron percnopterus* (Egyptian Vulture)
and *Spilornis cheela* (Crested Serpent Eagle)

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Abstract. *Neophron* had *musculus pectoralis major profundus*, reflecting its soaring flight, while *Spilornis* lacked this layer of the *pectoralis*, showing general (non-soaring) flight type. The *pars anterior* of *m. latissimus dorsi* in *Spilornis* was so anteriorly shifted as to connect the shoulder and the base of the neck. The complicated feature of the linkage of tendon of *m. ambiens* to tibial muscles, in *Spilornis*, was shown. General pattern of branchial musculature of *Neophron* was illustrated.

Key words: Avian myology, *Neophron percnopterus*, *Spilornis cheela*.

キーワード: 鳥類筋肉学, エジプトハゲワシ, カンムリワシ.

An Egyptian Vulture, *Neophron percnopterus* (not dated) and a Crested Serpent Eagle, *Spilornis cheela* (died 1991), presented to Yamashina Institute from Ueno Zoo, were myologically examined and sketched. Here, the branchial musculature and *pectoralis*

Table 1. Some muscular weights and body measurements of *Spilornis cheela*.

(1) Muscular weights (g)			
Brachial muscles		80.3	Pectoral muscles 122.3
Humeral muscles	46.6	Ulnar muscles 33.7	<i>Pectoralis major</i> 115.0
			<i>Supracoracoideus</i> 7.3
<i>Biceps brachii</i>	13.6	<i>Flexor carpoulnalis</i>	4.7
<i>Triceps brachii</i>	20.0	<i>Extensor metacarpalis radialis</i>	7.0
<i>Deltoides major</i>	9.2	Other muscles	22.0
<i>Propatagialis longus</i>	3.8		
Leg muscles			150.7
Tibial muscles		82.7	Theigh muscles 68.0
<i>Tibialis anterior</i>		16.3	
<i>Flexor perforans et perforatus digiti II</i> (?)		20.7	
<i>Gastrocnemius</i>		15.2	
Other muscles		30.5	
(2) Some body measurements (mm) (see Fig. 1)			
Pectoral width	80		
Trochanteral width	61		
Theigh width	88		
Pelvic length	91		

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Fig. 1.

Fig. 1. Brachial musculature and pectoral muscles of *Nephron percnopterus*

I. Ventral view of brachial muscles

A. Superficial visible muscles (表面筋肉)

a. *m. abductor pollicis* (拇指外転筋) b. digit I (第1指骨) c. *m. abductor indicis* (第2指外転筋) d. *m. adductor pollicis* (拇指内転筋) e. pollex (digit II: 第2指骨) f. metacarpus III (第3掌骨) g. *tendo extensor digitorum communis* (総指伸腱) (cf. Kuroda 1971) h. *m. flexor digitorum profundus* (深部屈指筋) i. *m. extensor indicis longus* (第2指伸筋) j. *m. flexor digitorum superficialis* (表面屈指筋) k. digit III, 2 (第3指第2指骨) l. *m. interosseus palmaris* (腹側骨間筋) m. digit III, 1 (第3指第1指骨) n. ligament (靱帯) o. digit IV (第4指骨) p. ligament (靱帯) q. *m. flexor digiti III* (第3指屈筋) r. *m. interosseus palmaris* (=l.) s. metacarpus IV (第4掌骨) t. vein (血管) u. *tendo metacarpalis ventralis* (背側掌骨腱) (cf. Kuroda 1971: p. 325) v. *m. ulnometacarpalis dorsalis* (背側尺掌骨筋) w. *m. flexor carpiulnaris* (尺腕骨屈筋) x. humero carpal band (上膊腕骨帯) y. *m. flexor digitorum profundus* (深部屈指筋) z. vein (血管) a'. *m. extensor indicis longus* (第2指伸筋) (背面の筋) b'. *m. ulnometacarpalis ventralis* (腹側尺掌骨筋) c'. undeterminable (不明筋) d'. radius (橈骨) e'. *m. pronator profundus* (深部前屈筋) f'. *m. pronator superficialis* (表面前屈筋) g'. *m. extensor metacarpi radialis* (橈掌骨伸筋) h'. *m. brachialis* (内腕筋) i'. nerve (神経) j'. *m. biceps brachii* (二頭膊筋) k'. *m. pectoralis major* (大胸筋) l'. *m. triceps brachii* (三頭膊筋) m'. humerus (上膊骨)

B. Muscles near wrist joint of the lower arm (手首部)

a. radius (橈骨) b. *m. extensor indicis longus* (第2指伸筋) (dorsal muscle seen from ventral) c. *m. ulnometacarpalis ventralis* (腹側尺掌骨筋) d. (=c' of A) (undeterminable 不明筋) e. ulna (尺骨)

C. Digit-metacarpal joint seen from above (upper view) (掌指骨関節, 上面)

a. metacarpus (upper view) (掌骨上面) b. branch (枝) of *tendo extensor digitorum communis* (総指伸腱) (h) c. (extension of h.) d. digit III, 1 (第3指第1指骨) e. *tendo m. flexor digitorum profundus* (深部屈指筋の腱) f. *m. interosseus palmaris* (腹側骨間筋) g. *m. abductor indicis* (第2指外転筋) h. *m. extensor digitorum communis* (総指伸筋)

D. Ulnal muscles (尺骨部の筋肉)

a. *m. flexor digitorum profundus* (深部屈指筋) b. ulna (尺骨) c. slender muscle attached to d. (with blood vessels) d. humerocarpal band (上膊腕骨帯)

E. Details at carpal joint (尺腕骨部の拡大)

a. carpus ulnaris (尺腕骨) b. slender tendon (細腱) c. skin (皮膚) d. *m. flexor carpo-ulnaris* (尺腕骨屈筋) e. blood vessels (血管) f. humerocarpal band (上膊腕骨帯)

II. Dorsal view of brachial muscles

A. Superficial visible muscles (表面筋肉)

a. *m. extensor indicis longus* (第2指伸筋) b. *m. extensor digitorum communis* (総指伸筋) c. *m. adductor pollicis* (拇指内転筋) d. pollex (digit II: 第2指骨) e. *m. extensor pollicis brevis* (短拇指伸筋) f. *m. tensor metacarpi radialis* (橈掌骨伸筋) g. *m. extensor pollicis longus* (長拇指伸筋) h. = a. i. = b. j. radius (橈骨) k. *m. supinator* (後屈筋) l. *m. biceps brachii* (二頭膊筋) m. *m. tensor patagii brevis* (短前翼張筋) n. *m. triceps brachii* (三頭膊筋) o. humerus (上膊骨) p. ulna (尺骨) q. *m. anconeus* (肘筋) r. *m. extensor metacarpi ulnaris* (尺掌骨伸筋) s. *m. ulnometacarpalis dorsalis* (背側尺掌骨筋) t. *tendo metacarpalis dorsalis* (背側尺掌骨腱) u. *m. interosseus dorsalis* (背側尺掌骨腱) v. *m. interosseus ventralis* (腹側骨間筋)

B. Metacarpus muscles (掌骨筋)

a. phalange III, 2 (第3指骨, 第2指骨) b. phalange III, 1 (第3指骨, 第1指骨) c. *m. extensor indicis longus* (第2指伸筋) d. *m. extensor digitorum communis* (総指伸筋) e. *m. extensor indicis longus accessorius* (第2指伸筋副筋) (cf. Kuroda 1971) f. phalange I (第1指骨) g. *m. extensor metacarpi ulnaris* (尺掌骨伸筋) h. *m. ulnometacarpalis dorsalis* (背側尺掌骨筋) i. *m. interosseus dorsalis* (背側骨間筋) j. *m. interosseus ventralis (palmaris)* (腹側骨間筋) k. metacarpus III (第3掌骨) l. metacarpus IV (第4掌骨)

C. Showing *m. extensor indicis longus* (第2指伸筋)

a. *m. extensor indicis longus* b. radius (橈骨)

D. Showing *m. extensor pollicis longus* (長拇指伸筋)

a. radius (橈骨) b. ulna (尺骨) c. *m. extensor pollicis longus*

III. Pectoral muscles (胸筋群)

a. keel (胸骨の竜骨) b. clavicles (鎖骨) c. *m. pectoralis major profundus* (大胸筋深部) d. *m. supracoracoideus* (小胸筋) e. exposed part of *m. pectoralis major lateralis* (大胸筋側方部の露出面) f. *m. pectoralis major proprius* (大胸筋主部)

of *Neophron* and dorsal musculature and tibial muscles of *Spilornis* are illustrated, and some muscular weights and body measurements are given. For identification of muscles Baumel *et al.* (1993), George & Berger (1966) and Kuroda (1971) were referred.

Egyptian Vulture, *Neophorn percnopterus*

Superficially visible musculature of the right wing is illustrated ventrally (Fig. 1, I) and dorsally (Fig. 1, II). The myological system showed a general pattern of a long winged bird, with elongation of tendons and shortened muscular bellies. There was, as expected, a median layer of the *pectoralis major* (*pars profundus*) (Fig. 1, III), which works to stabilize the wings in soaring and gliding flights.

Fig. 2. Muscular illustrations of *Spilornis cheela*

I. Dorsal view of superficial musculature (背面筋肉)

A. Total view (全般)

a. *M. latissimus dorsi posterior* (潤背筋後部) b. *m. serratus metapatagialis* (後翼鋸狀筋) c. *m. rhomboideus superficialis* (表面菱形筋) d. *m. latissimus dorsi anterior* (潤背筋前部) e. *m. dorsalis scapulae* (上肩胛骨筋) f. *m. tensor patagii longus* (長前翼張筋) g. *m. deltoideus major anterior* (大三角筋前部) h. = f. (elastic tendon 軟腱) i. *tendo m. tensor patagii brevis* (短前翼張筋腱) j. *m. scapulotriceps* (肩胛三頭膊筋) k. *m. humerotriceps* (上膊三頭膊筋) l. *m. semimembraneus* (半膜筋) m. *levator coccygis* (尾部挙筋) n. *m. piriformis pars caudofemoralis* (梨狀筋尾骨部) o. = l. p. *m. gastrocnemius pars externa* (腓腸骨筋外部) q. *m. peroneus brevis* (短腓骨筋) r. *m. peroneus longus* (長腓骨筋) s. *m. flexor perforans et perforatus digitii III* (第3趾穿孔鞘狀屈筋) t. *m. iliobtibialis* (腸脛骨筋) u. *m. iliiochantericus posterior* (後腸骨軀子筋) v. *m. sartorius* (縫匠筋) w. *m. pectoralis major* (大胸筋)

B. Right leg muscles (dorsal side) (右脚筋)

a. *m. piriformis pars caudofemoralis* (梨狀筋尾骨部) b. *m. semimembraneus* (半膜筋) c. *m. gastrocnemius pars externa* (腓腸筋外部) d. *m. peroneus brevis* (短腓骨筋) e. *m. peroneus longus* (長腓骨筋) f. *m. flexor perforans et perforatus digitii III* (第3趾穿孔鞘狀屈筋) g. *m. tibialis anterior* (前脛筋) h. *m. iliobtibialis* (腸脛骨筋) i. *m. sartorius* (縫匠筋)

II. Tibial muscles (ventral view of right leg) (脛部筋肉右背面)

A. Main muscles (right ventral) (右脛部筋内面)

a. *m. gastrocnemius pars interna* (腓腸筋内部) b. *m. gastrocnemius pars media* (腓腸筋中部) (a, b and c spread outside) (a, b, c は横に開いた状態) c. *m. gastrocnemius pars externa* (腓腸筋外部) d. *m. flexor perforans et perforatus digiti II* (第2趾穿孔鞘狀屈筋) e. *m. flexor perforans et perforatus digiti III* (第3趾穿孔鞘狀屈筋) f. nerve and vein (神経, 血管) g. *m. flexor hallucis longus* (母趾長屈筋) h. *m. peroneus longus* (長腓骨筋) i. *m. flexor digitorum longus* (長趾屈筋) j. *m. flexor perforatus digiti IV* (第4趾鞘狀屈筋) k. *m. flexor digiti III brevis* (第3趾短屈筋) l. menbraneous (膜狀部)

B. Outer tibial muscles (right dorsal) (右外部脛筋背面)

a. *m. peroneus longus* (長腓骨筋) b. *m. flexor perforans et perforatus digiti III* (第3趾穿孔鞘狀屈筋) c. Outer tibial crest (脛骨突起外縁) d. *m. flexor perforans et perforatus digiti II* (第2趾穿孔鞘狀屈筋) e. *m. gastrocnemius pars externa* (腓腸筋外部)

C., D. *M. ambiens* and related muscles (left leg dorsal) (宇回筋と他筋の連結, 左脛背面) am. *m. ambiens* (宇回筋腱末部) e●, d○, h○, i▲, g▽, k●, j△ : cf. names given in A. x, y and z show the same parts in C and D.

Crested Serpent Eagle, *Spilornis cheela*

Dorsal view of the body musculature (Fig. 2, I) and the right leg (Fig. 2, II) are illustrated. It was noted that the *pars anterior* of the *m. latissimus dorsi*, band-like in type, was so anteriorly shifted as to connect the shoulder tip to the base of the neck. The *pars posterior*, also band-like, rises from the anterior edge of the pelvis to be attached to the *scapula*.

It was marked that the end of the tendon of *m. ambiens* showed complicated branching to tibial muscles which extend to toes (Each muscle could not be confirmed to reach to which toe, the tendon having been cut for staffing.) The chief muscles connected to the *ambiens* are considered to be *m. perforans et perforatus digiti* III and IV, etc. In *Spilornis*, the lack of *pars profundus* of the *m. pectoralis major* was confirmed (although not illustrated). This reflects its forest-dwelling and reptile-eating habits, in which soaring flight is not required, although it may be observed leasurly soaring over the forest. See Table 1 for some data of muscular weights and body measurements.

References

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鳥類の形態・解剖学的所見：3. エジプトハゲワシとカンムリワシの筋肉系所見

この第3報では、エジプトハゲワシとカンムリワシ（共に上野動物園提供）の各1体の二、三の筋肉所見を報告した。エジプトハゲワシは右前肢（翼）の筋肉図（背、腹面）を図示した。それは長翼型の鳥類の基本的筋肉系であった。大胸筋には帆翔性を示す大胸筋深部があった。

カンムリワシでは、背面から見た筋肉系と右脚の脛筋分解図を示した。とくに宇回筋の腱と脛筋群との複雑な連繋が明らかとなった（但し各筋の腱は標本解剖上切断され各趾への連絡は確認できなかった）。また、本種は森林性、爬虫類食であり、森林上を帆翔はするが、長距離帆翔はしないことが、大胸筋の深部欠除（一般飛翔型）に示された。尚翼筋、脚筋の重量、体型測定も示した。

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