

ZOO 4377L - VERTEBRATE MORPHOLOGY LAB

LABS 8 & 9: CAT MUSCULATURE

Name: _____ SSN: _____

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Preparation: Walker & Homberger - pp. 165-211 of Chapter 7

Background

Refer to last week's Lab (Lab 6). The background material provided also applies to Labs 7 & 8.

Part I: Review the external morphology of the cat using pp. 47-51 of Walker & Homberger.Part II: Work in pairs. Below are the muscles you are responsible for dissecting and identifying in your cat. Use the table on the following pages to classify them according to embryonic origin, and note general actions of muscles or muscle groups as indicated.

Suggestions: 1) Highlight the required muscles in your manual and work through the corresponding section in order to identify them (pages shown in parentheses in the list below). 2) Take time to clean fat and connective tissue off the cat as you dissect; it makes identification easier. 3) Plan to find most, or at least the majority, of these muscles during this lab, but remember you can finish the dissection next week. You will have time, honest! 4) Do the muscle homology worksheet (attached). 5) Remember to quiz yourself with a your labmates' cats.

VIP: When you are finished, spray down your specimen with wetting solution and put it back into its plastic bags, using binder clips to seal the bags. Put your initials on the outer bag.

For the quiz, you will be responsible for identifying all structures shown in **bold**; *hindlimb muscles will be covered only if time permits*.

? For each muscle, supply its (1) attachments (i.e., (a) origin and (b) insertion), (2) its innervation (Table 7-1 may help) and (3) its action (function *sensu* Kardong).

e.g., external [abdominal] oblique: origin) caudal ribs and thoracolumbar fascia; insertion) midventral raphe; innervation) ventral rami; action) compress viscera

N.B. Use the following terms to describe movement of the scapula: protraction (= cranial translation); retraction (=caudal translation); abduction (= translation toward middorsal ine); adduction (= translation toward mid-ventral line).

N.B. Use the folloiwng terms to describe movement of the humerus: flexion or protraction (= humerus moves cranially); extension or retraction (humerus rotates caudally); abduction (= humerus rotates dorsally); adduction (=humerus rotates ventrally); medial rotation (about longitudinal axis); lateral roation (about longitudinal axis)

N.B. Make sure and complete the "Shark and Cat Muscle Homologies" work sheet on page 5.

Identify:

hypaxial musculature (pp. 167-169; Fig. 7-19)

external oblique

internal oblique

transversus abdominis - note that the fibers of transverse abdominis extend all the way to the ventral midline

? What structure lies deep to transversus abdominis?

rectus abdominis

? What structures form the sheath around rectus abdominis

epaxial musculature (caudal; pp. 169-170; Figs. 7-41 & 7-42)

multifidi

erector spinae

pectoralis group (pp. 170-171; Fig. 7-20; also W&C Fig. 24-15)

pectoralis complex - cranial edge lies deep to cleidobrachialis

trapezius and sternocleidomastoid group (pp. 172-173; Figs. 7-21, 7-20)

thoracic trapezium - supf to latisimus dorsi

cervical trapezium

cleidocervicalis

sternomastoid - deep to ext jugular v

? What vessel lies superficial to sternomastoid?

superficial shoulder muscles (pp. 174-175; Figs. 7-21, 7-23; W&C Fig. 24-19)

cleidobrachialis - part of deltoideus complex

? The cleidobrachialis and cleidocervicalis are collectively termed the *brachiocephalicus*. Given there is no clear demarcation between the two portions, what is the basis for distinguishing the two muscles? **Hint: It's neither their attachments nor their action.**

? What skeletal element is found within brachiocephalicus? To what other skeletal element does this bone directly articulate in the cat? In humans, to which skeletal elements does the clavicle articulate?

omotransversarius (= levator scapulae)

acromiodeltoid

scapulodeltoid

latissimus dorsi

deep shoulder muscles (pp. 175-179; Fig. 7-23, 7-24)

supraspinatus

infraspinatus

teres major

rhomboideus complex - to expose these muscles, reflect the thoracic and cervical trapezium from the dorsal midline.

serratus ventralis - note the two heads (costal and vertebral)

epaxial muscle (continued; pp. 202-205; Fig. 7-40, 7-42)

spinalis

erector spinae

optional: splenius

hypobranchial muscles (pp. 205; Figs. 7-43, 7-44)

sternohyoid

sternothyroid

thyrohyoid

branchiomic muscles (mandibular arch; pp. 208-210; Fig. 7-40; 7-43; Note dissection of mylohyoid and digastric found on pp. 205-206)

digastric

? In the cat the digastric is actually two muscles fused together, the rostral (anterior) and caudal (posterior) digastric. Given there is no clear demarcation between the two portions, what is the basis for distinguishing the two muscles? **Hints:** 1) It's neither their attachments nor their action; 2) see Table 7-1.

mylohyoid

masseter

temporalis

If time permits, dissect the following hindlimb muscles:

lateral thigh muscles (pp. 186-188; Fig. 7-31, 7-32, 7-35)

sartorius

tensor fascia lata

biceps femoris

gluteal complex (pp. 189-191; Fig. 7-31, 7-32)

gluteus superficialis

gluteus medius

caudomedial thigh muscles (pp. 192-194; Fig. 7-35)

gracilis

Shark and Cat Muscle Homologies

Remember, homologous structures are identified on the basis (criteria) of:

- a) similarity of anatomical construction (e.g., segmentation)
- b) similar topological relationship to the animal body (e.g., origin, insertion, position relative to other muscles, etc.)
- c) similar course of embryonic development (e.g., common innervation is a reflection of common developmental origin).

Most importantly, recall that function is **not** a criterion of homology.

In the columns below, (1) use arrows to match the shark muscles to their homologues in the cat.
 (2) For each match, explain why they are homologous using as many of the three criteria given above as you think applies.

<u>shark muscle</u>	<u>cat muscle</u>	<u>reason</u>
adductor mandibulae	mylohyoid	
coracohyoideus	latissimus dorsi	
cucullaris	multifidus	
epaxial myomere	pectoralis	
hypaxial myomere	rectus abdominus	
intermandibularis	sternohyoid	
pectoral abductor	temporalis	
pectoral adductor	trapezius	

REVIEW OF CAT SKELETAL MUSCULATURE

I. Axial musculature - *innervated by segmental spinal nerves*

A. hypaxial musculature

- covers ventrolateral body wall of neck, thorax and abdomen
- innervated by *ventral rami of segmental spinal nerves*
- consists of 4 layers:
 - 1 midline - rectus layer
 - neck - rectus cervicis complex
 - a) infrahyoid muscles:
 - omohyoid
 - sternohyoid** - superficial; bilateral about midline
 - sternothyroid** - deep and lateral to st-hy
 - thyrohyoid** - deep and lateral to st-hy
 - b) suprahyoid muscles: geniohyoid
 - thorax - replaced by sternum
 - abdomen - **rectus abdominus**
 - 3 lateral layers - superimposed
 - neck - scalenes (ant., middle and post.)
 - thorax - ext., int, and innermost innercostals
 - abdomen: **ext. oblique, int. oblique** and **transversus abdominis**

B. epaxial musculature

- *intrinsic* back musculature (originates and inserts to axial skeleton)
- innervated by *dorsal rami of segmental spinal nerves*
- consists of 3 major groups (from superficial to deep):
 - 1) **splenius** - broad sheet of muscle cover dorsal and lateral surface of neck
 - 2) **erector spinae** - intermediate; forms 3, bilateral longitudinal columns
best seen in thoracic region; from medial to lateral:
 - a) **spinalis** (spinospinalis) - extends through thoracic and cervical regions
 - b) longissimus (transversotransversus)
 - c) iliocostalis (costocostalis)
 - 3) transversospinalis - fibers run from transverse to spinal processes
 - a) **multifidis** - best developed in lumbar region

II. Appendicular musculature - Appendicular muscles arise from cells originating from hypaxial portion of myotome and are therefore innervated by *ventral rami of spinal nerves*. Reorganization of the appendicular muscles along a proximo-distal axis (rather than cranio-caudal) requires a redirecting of the ventral rami branches which occurs in the peripheral nerve plexi. The forelimb is innervated by branches of the branchial plexus (formed by the *ventral rami* of spinal nerves C6-T1) and hindlimb innervated by branches of the lumbosacral plexus (formed by *ventral rami* of spinal nerves L4-S3)

Forelimb muscles

- #### A. Extrinsic - originate from axial skeleton and insert to pectoral girdle or brachium (humerus); suspend forelimb in muscular sling since no direct bony attachment between axial skeleton and pectoral girdle (note clavicle does not articulate with scapula)
1. dorsal
 - a. **omotransversalis** (levator scapulae ventralis) - inserts to spine of scapula
 - b. **rhomboideus complex** - inserts to caudal border of scapula
 - c. **latissimus dorsi** - inserts to humerus; fibers merge with pectoralis complex
 2. ventral

- serratus ventralis** - inserts to caudal border of scapula
pectoralis complex - inserts to brachium and ante-brachium
- B. Intrinsic - originate and insert to skeletal elements of the forelimb
1. pectoral girdle origin
 - a. deltoid group - 3 muscles arranged from cranio to caudal
 - i. **cleidobrachialis** - continuation of cleidocervical portion of trapezius; clavicle marks border
 - ii. **acromiodeltoid**
 - iii. **scapulodeltoid**
 - b. **supraspinatus**
 - c. **infraspinatus**
 - d. **teres major**

Hindlimb muscles

Due to direct attachment of pelvic girdle to axial skeleton (sacro-iliac joints) all of the hindlimb muscles originating from the axial skeleton insert to the femur or crus. Thus, there is no extrinsic hindlimb musculature which functions to support the pectoral girdle

- A. Thigh muscles - muscles originating from axial skeleton or pelvic girdle and which insert to femur or crus. Muscles inserting to femur work the hip joint while those inserting to the crus act on both the hip and knee joints (biarticular)
1. Dorsal derivatives - form anterior and lateral muscles of the thigh; homologue of fin abductors
 - a. **sartorius**
 - b. **tensor fascia lata**
 - c. **gluteus superficialis** - superficial and caudal to medius
 - d. **gluteus medius** - posterior to TFL
 2. Ventral derivatives - from medial and posterior muscles of the thigh; homologue of fin adductors
 - a. **gracilis**
 - b. **biceps femoris**
- III. Branchiomeric muscles - muscles associated with skeletal derivatives of the visceral arches and *innervated by cranial nerves*
- a. mandibular arch (visceral arch 1) - *innervated by CN V (trigeminal)*
 - 2 muscle groups
 - 1) intermandibularis
 - a) **mylohooid**
 - b) **rostral (anterior) digastric**
 - 2) jaw adductors
 - a) **masseter**
 - b) **temporalis**
 - c) medial pterygoid
 - d) lateral pterygoid
 - e) tensor veli palatini & tensor tympani (embryonic adductors)
 - b. muscles innervated by CN XI (*accessory*) and associated with the pectoral girdle (reflecting phylogenetic relationship between skull and pectoral girdle)
 - 1) **sternomastoid**
 - 2) trapezius - most superficial muscle of dorsum
 - a. **cleidocervicalis** - continuous with cleidobrachialis; clavicle at junction
 - b. **cervical trapezius**
 - c. **thoracic trapezius**