



animex workshops 2010

SKELETONS for ANIMATORS and RIGGERS

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-Stuart Sumida



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SKELETONS for ANIMATORS and RIGGERS

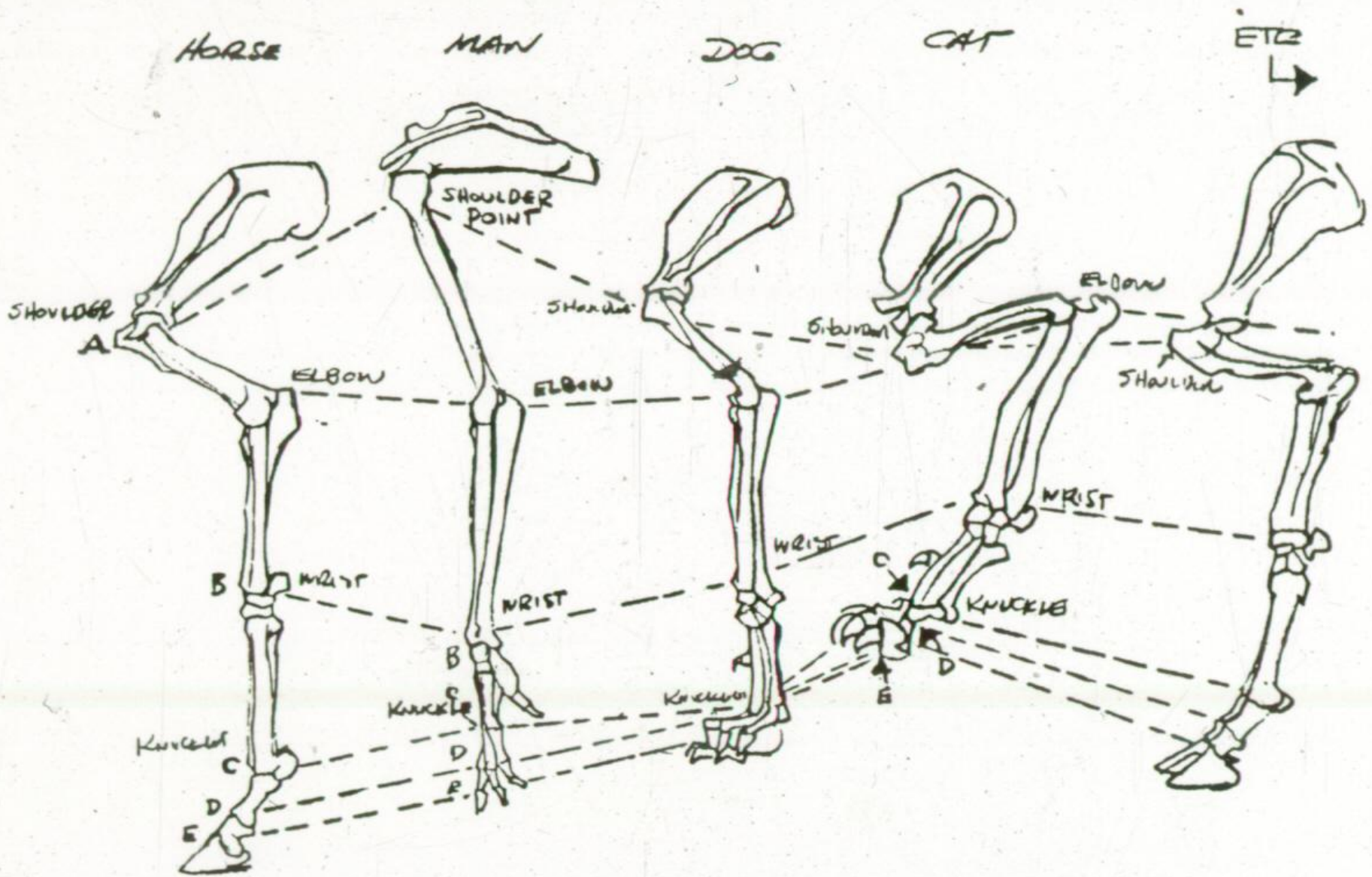
- i overview**
- ii case study (Schell Games and Disney Feature Animation)**
- iii particularly troublesome joints**



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SKELETONS for ANIMATORS and RIGGERS

- i overview**
- ii case study (Schell Games and Disney Feature Animation)**
- iii particularly troublesome joints**



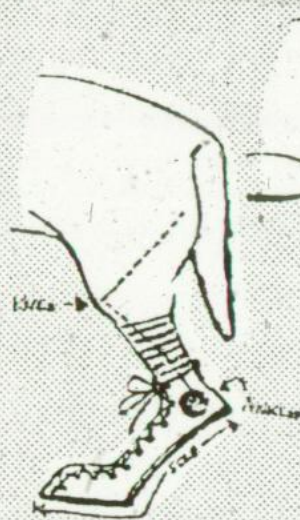
Any resource where good animators are referencing the skeleton....



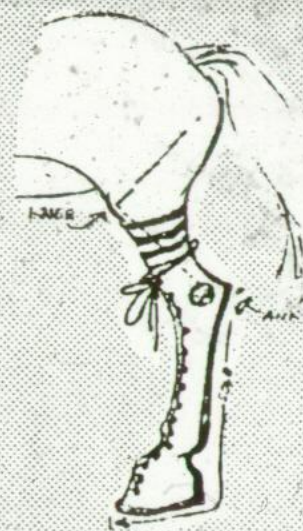
HUMAN BEING



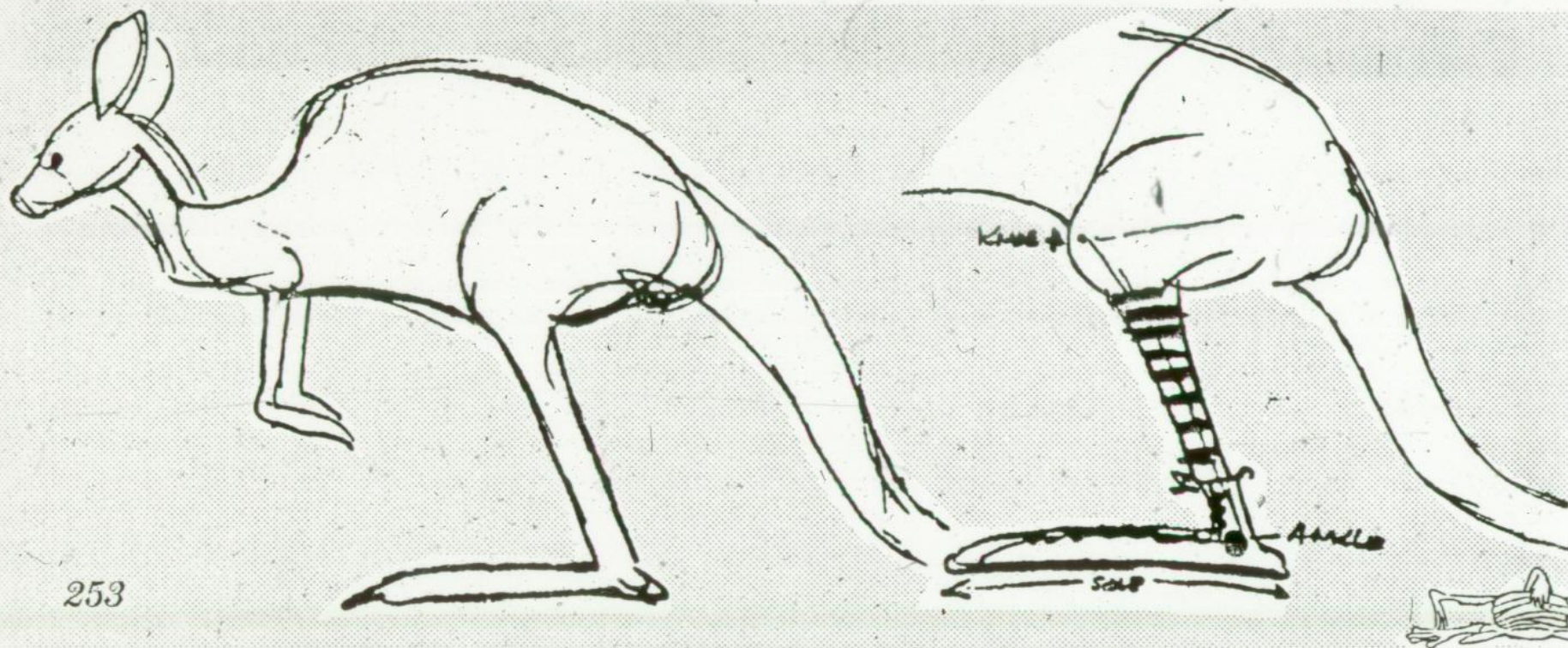
DOG

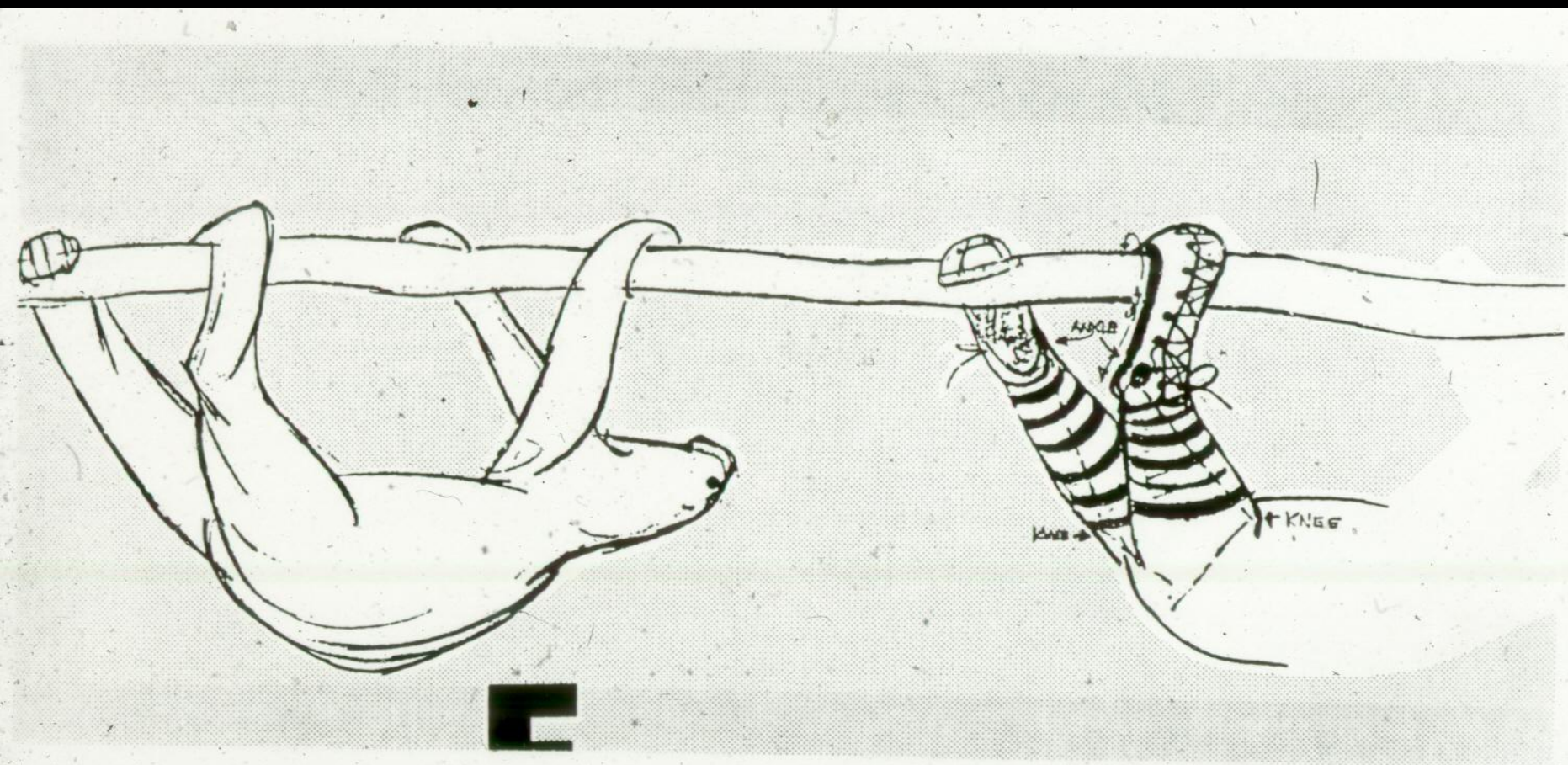


HORSE

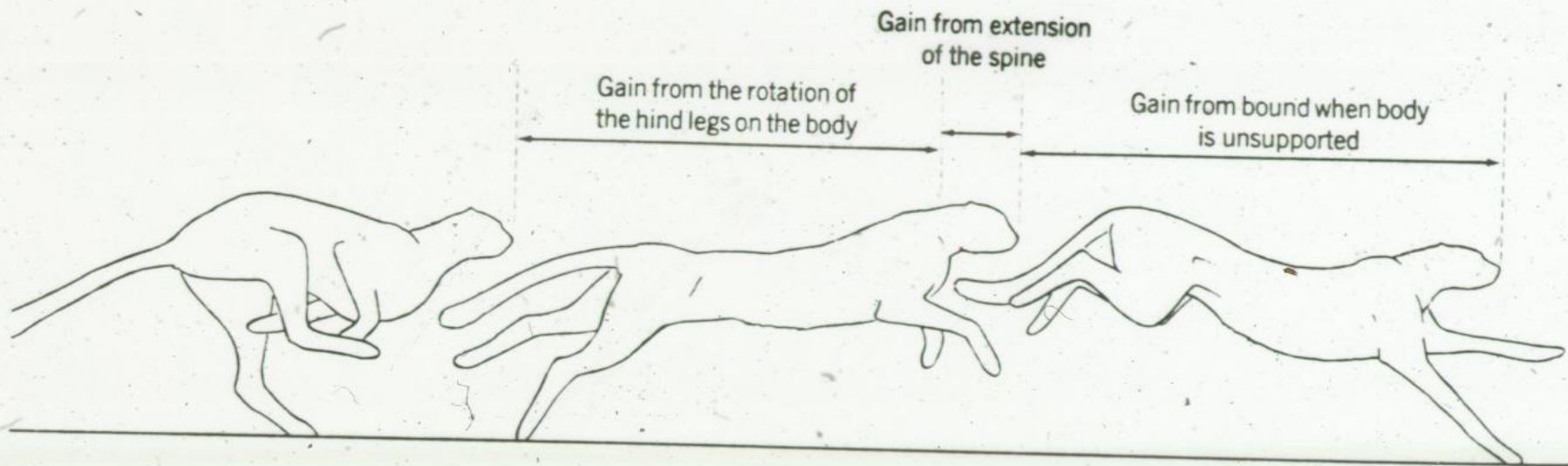


253



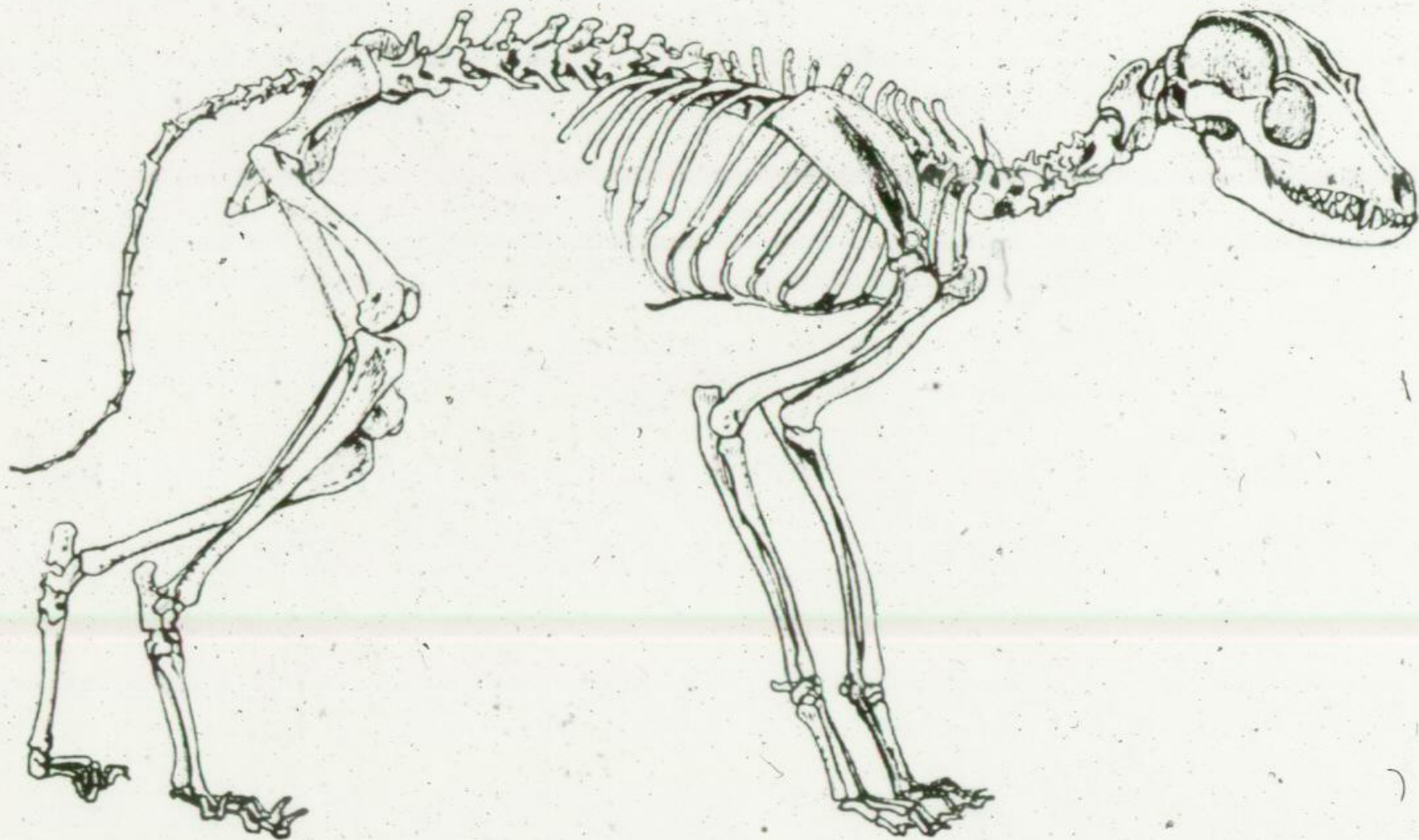




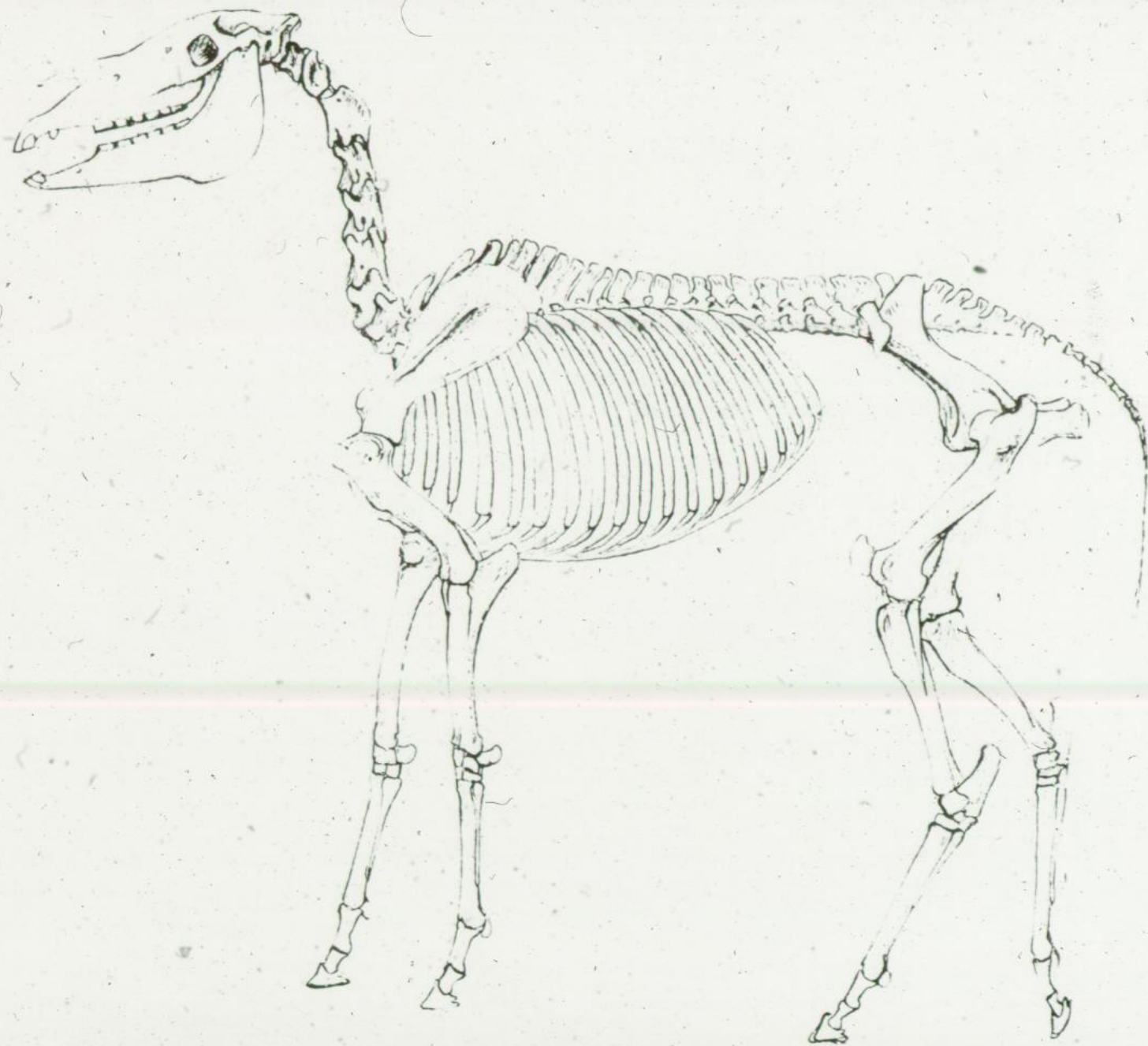


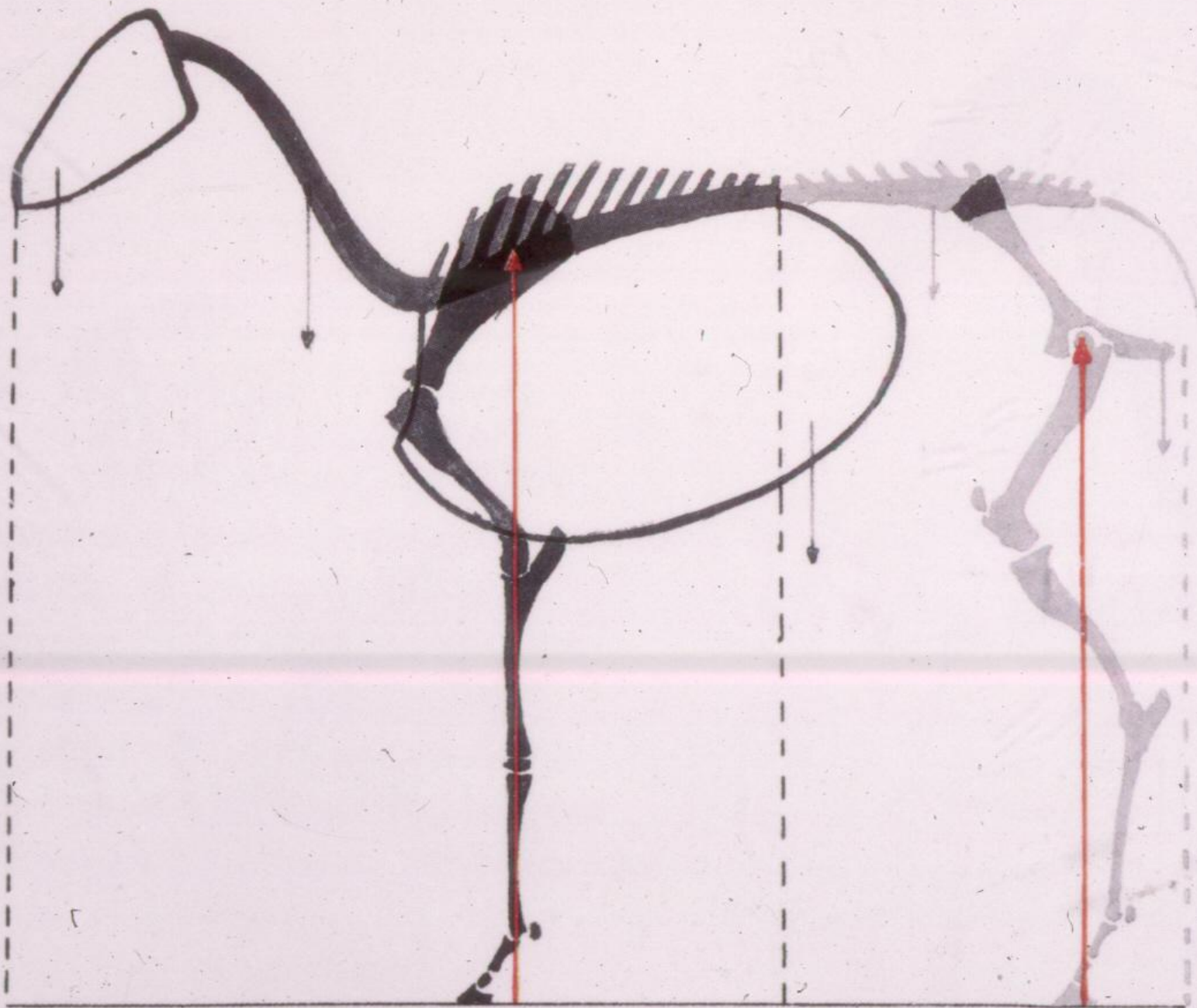


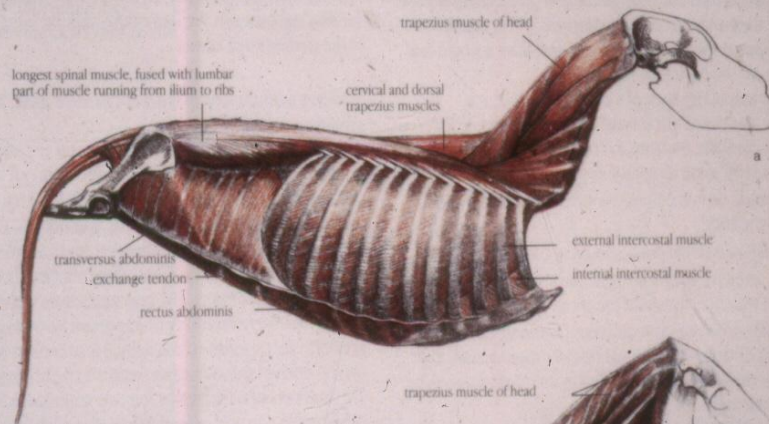
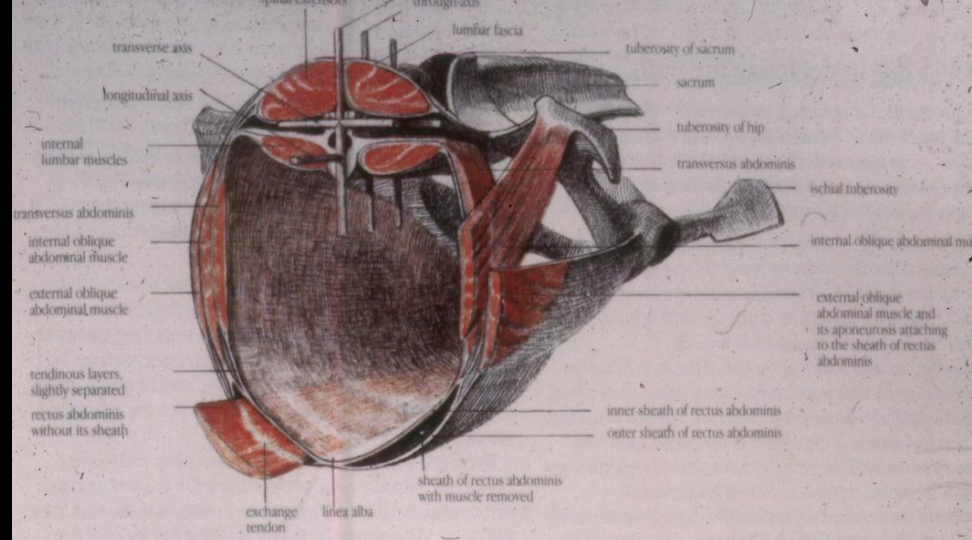




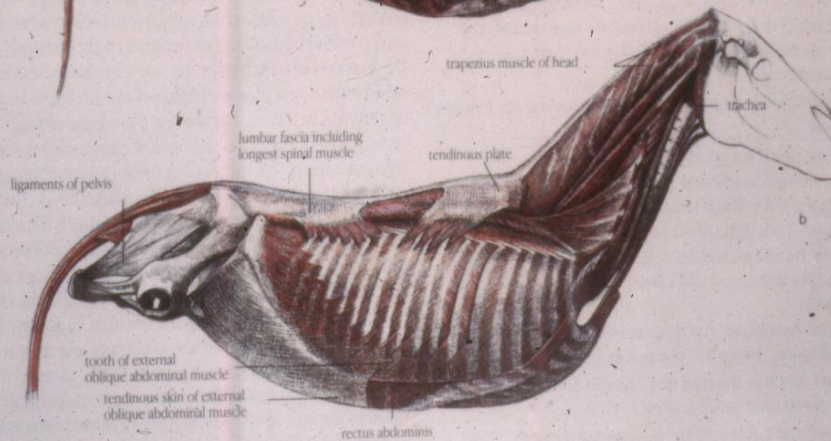




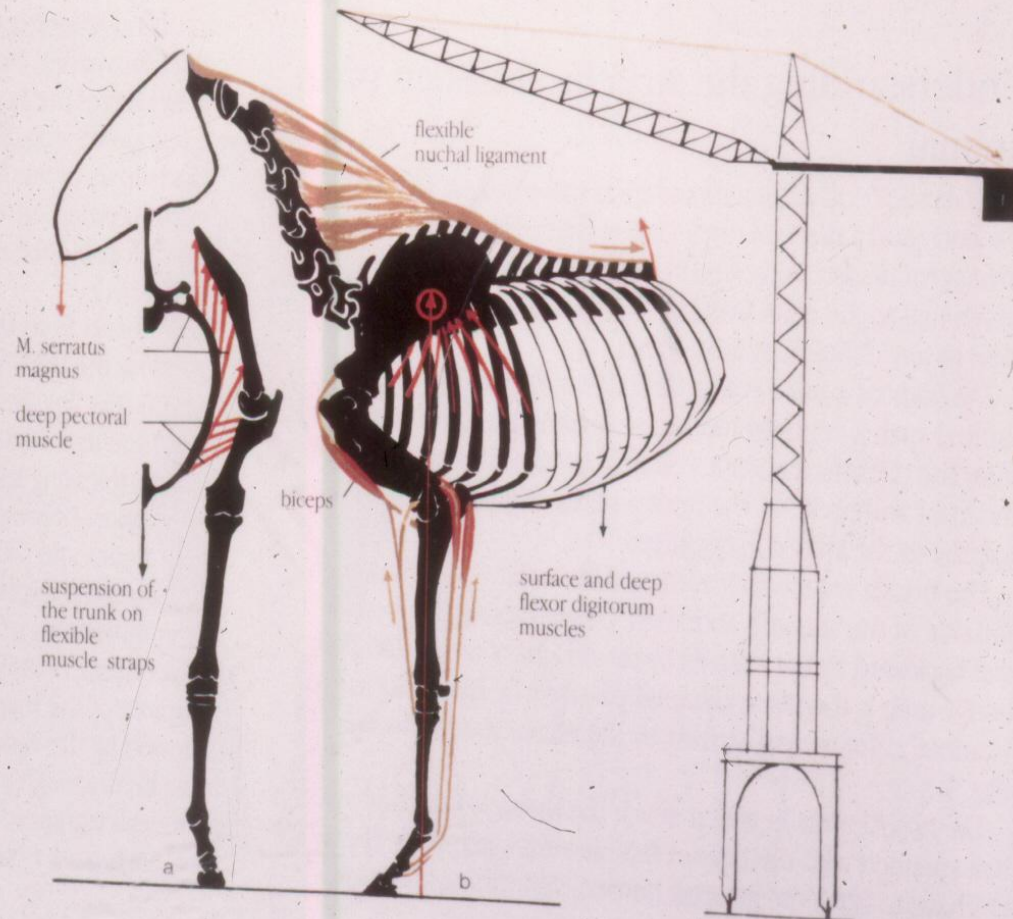
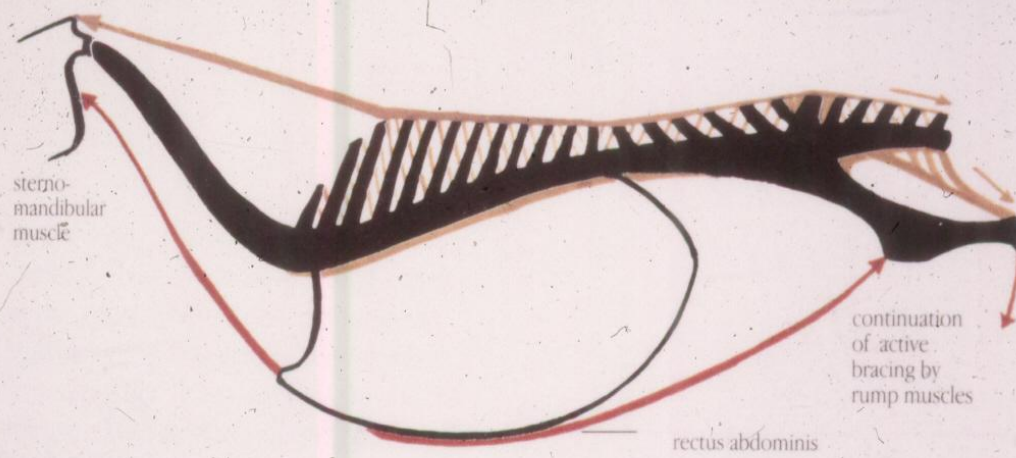


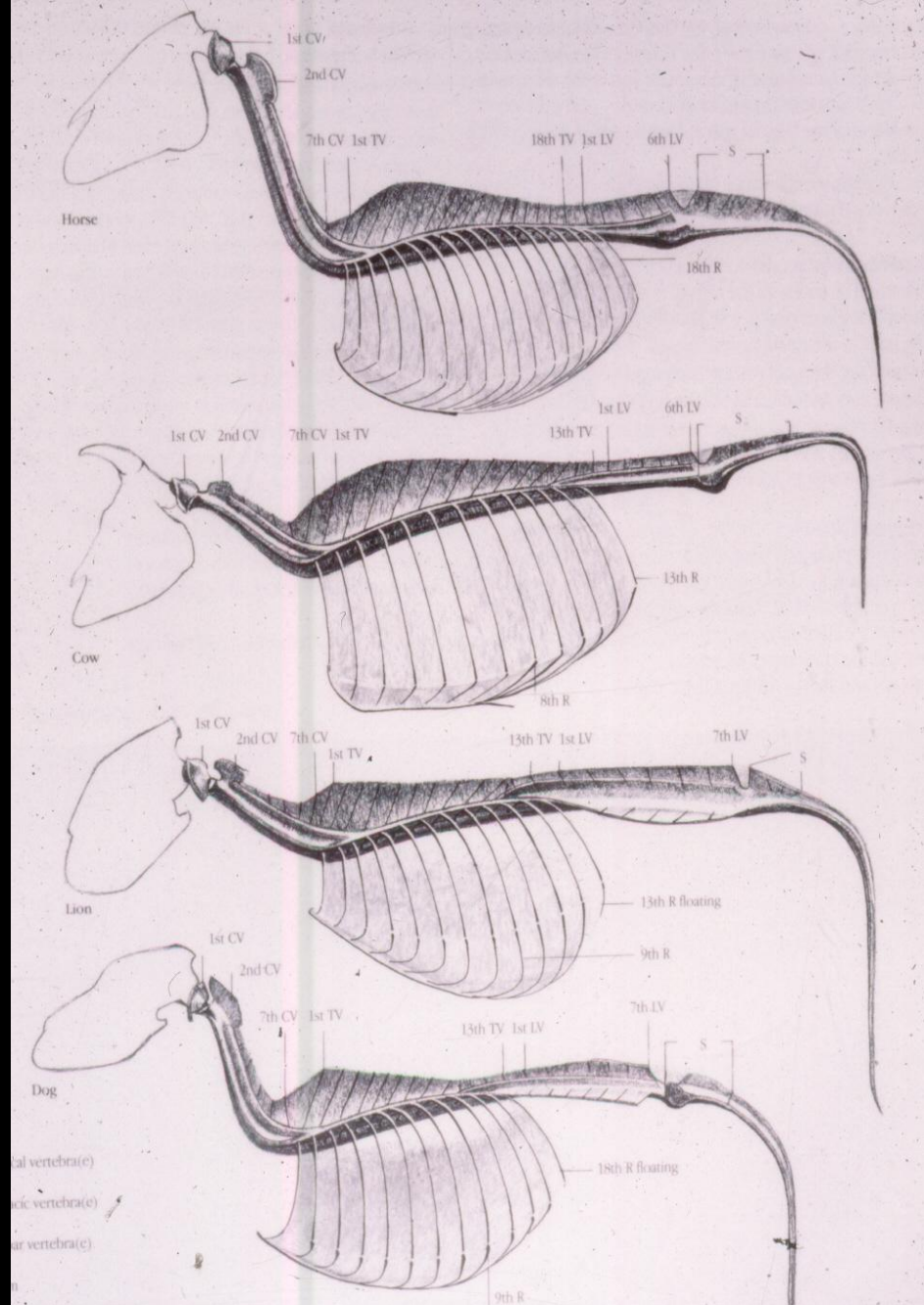


Dog



Horse

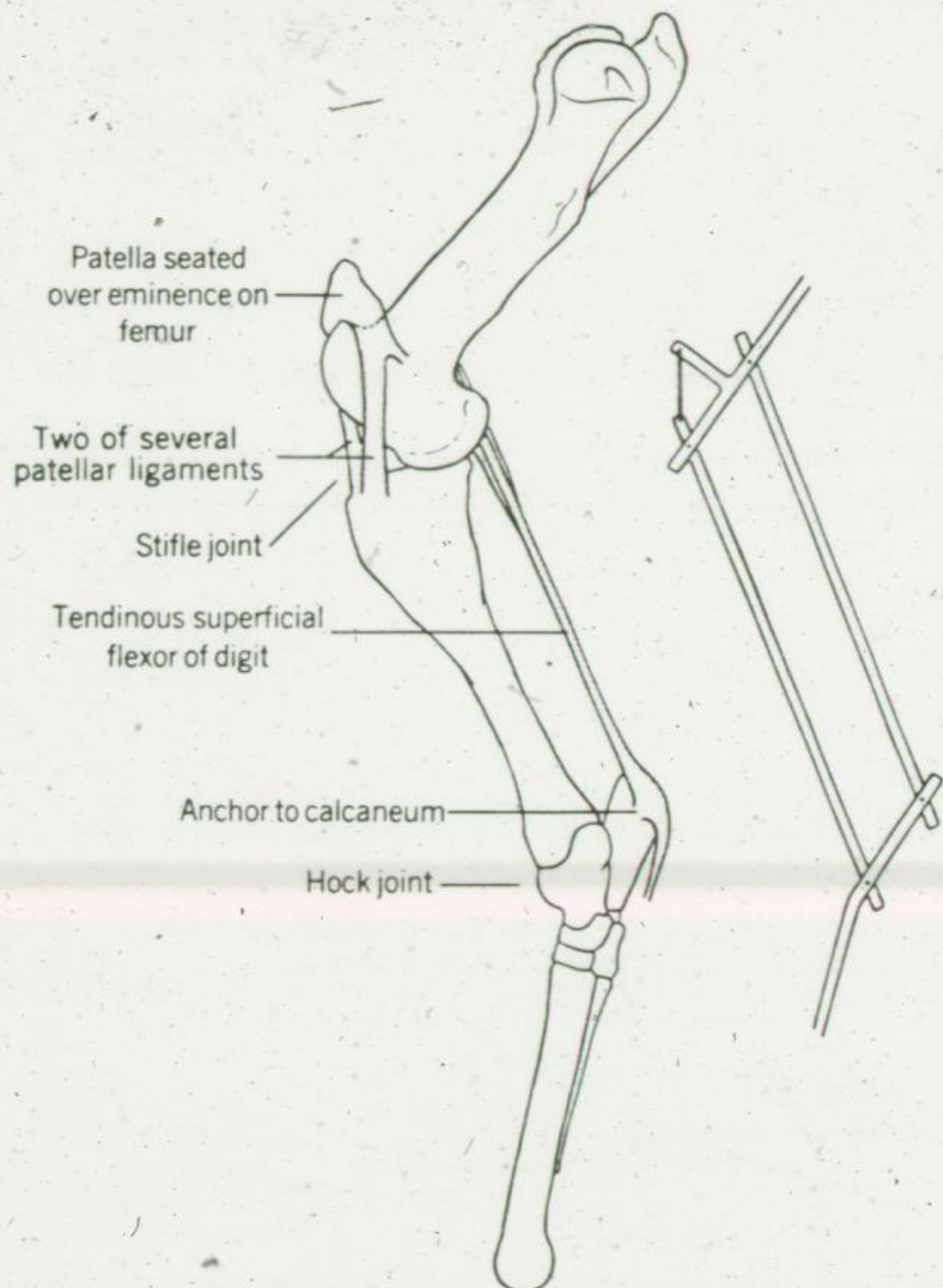


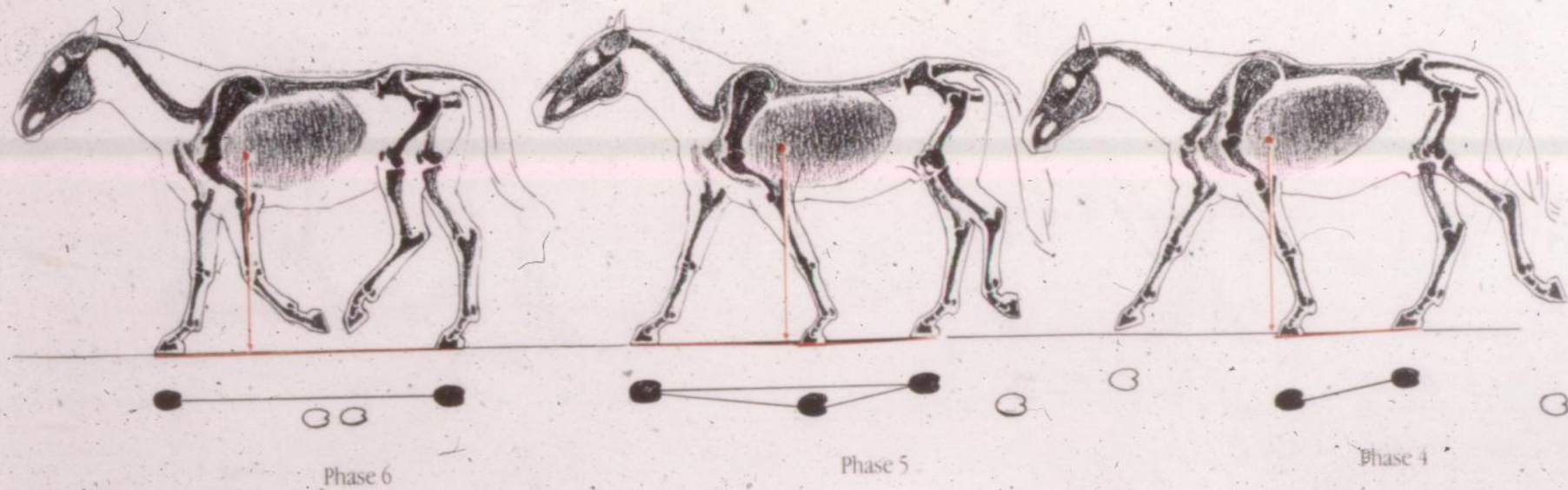
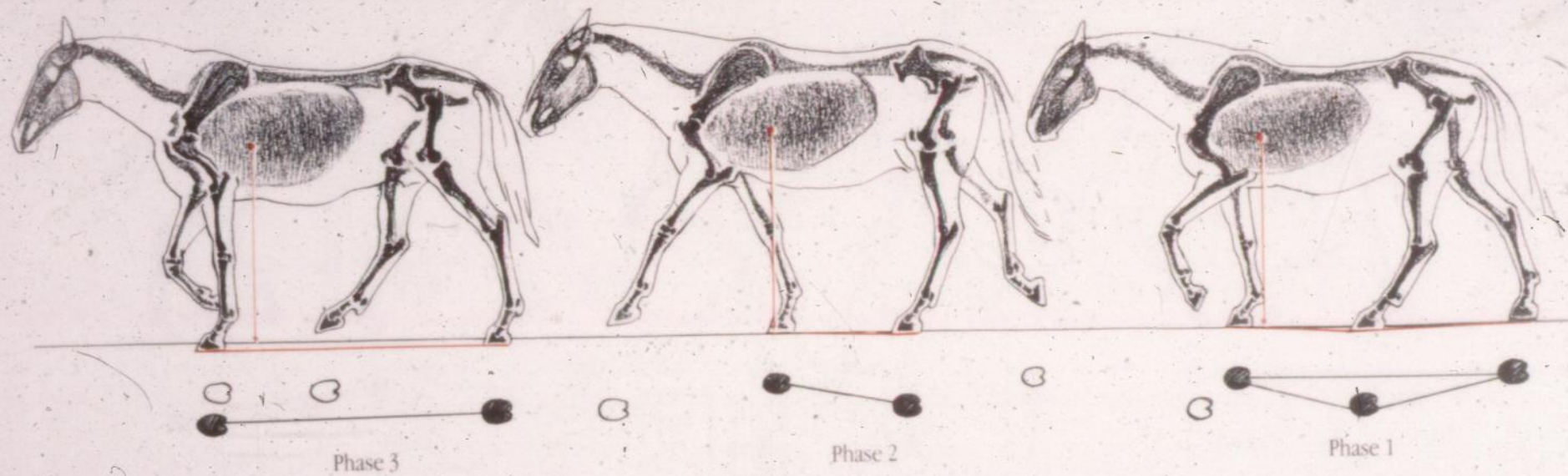


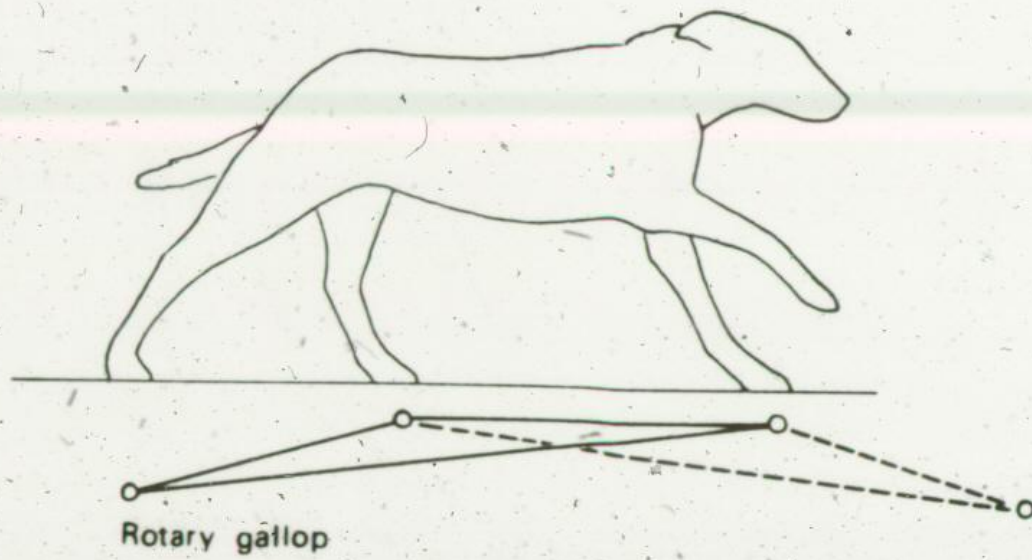
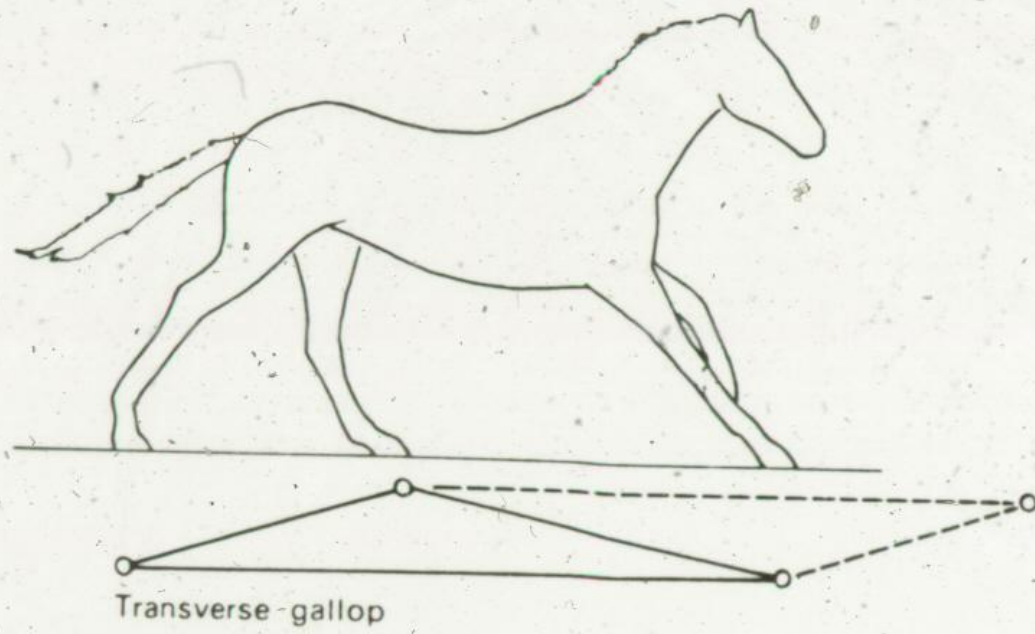
COURSE AND SHAPE OF THE
BACK AND THE THORAX IN
VARIOUS ANIMAL FORMS
tively the tips of the spinous

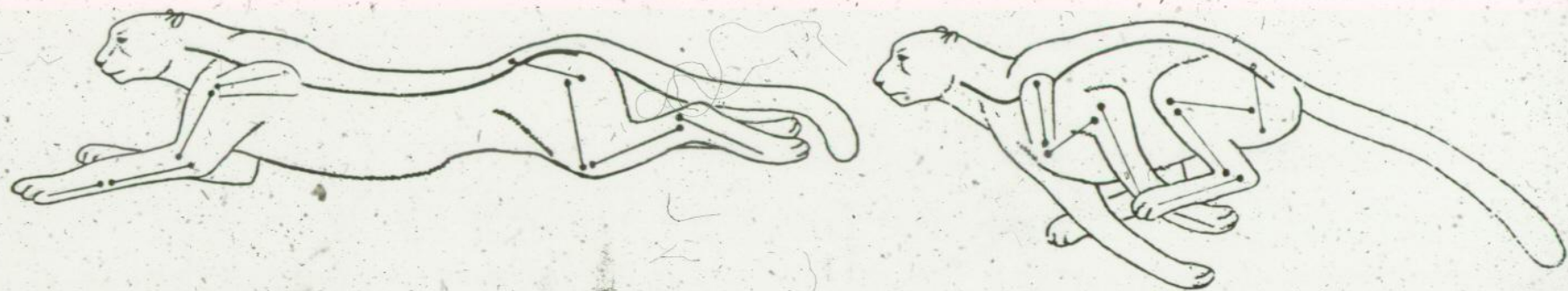
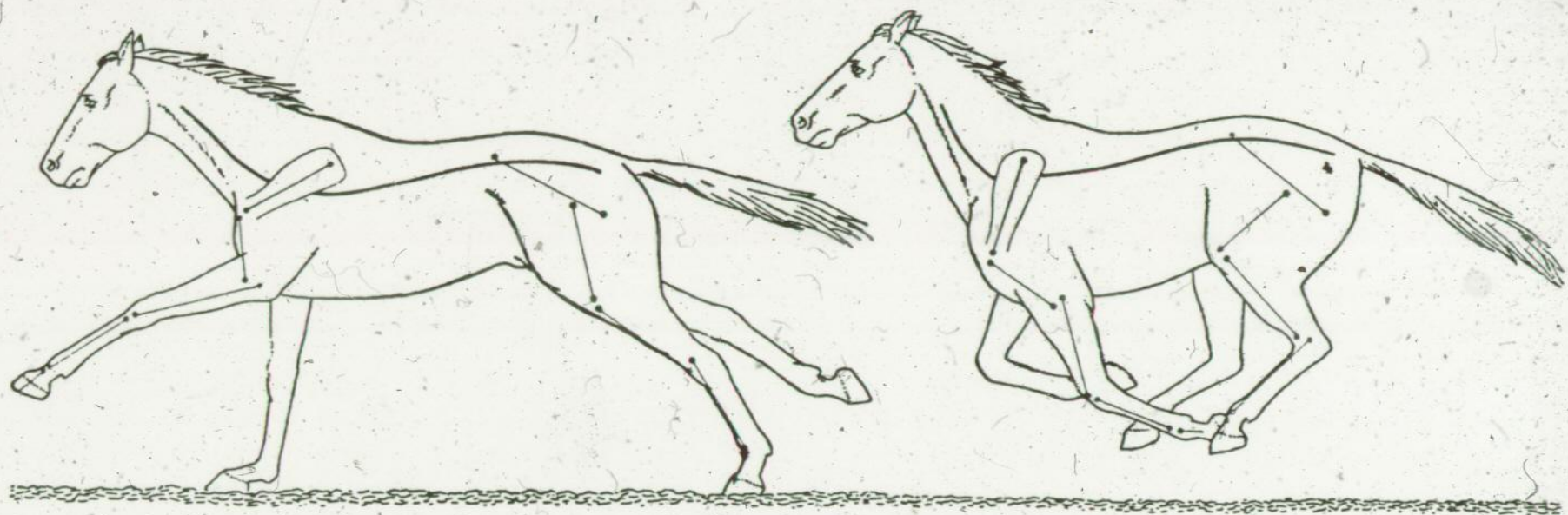
shaped bridging arch found in all animal
forms made by the bodies of the vertebrae.
The articular, transverse and spinous
processes combine with processes of

arrangement, the outline shape of
thorax formed by the ribs, the an











SECOND HIND
FIRST HIND
FIRST FRONT
SECOND FRONT



SECOND HIND
FIRST HIND
FIRST FRONT

TIME (SECONDS)

.1

.2



ONE STRIDE

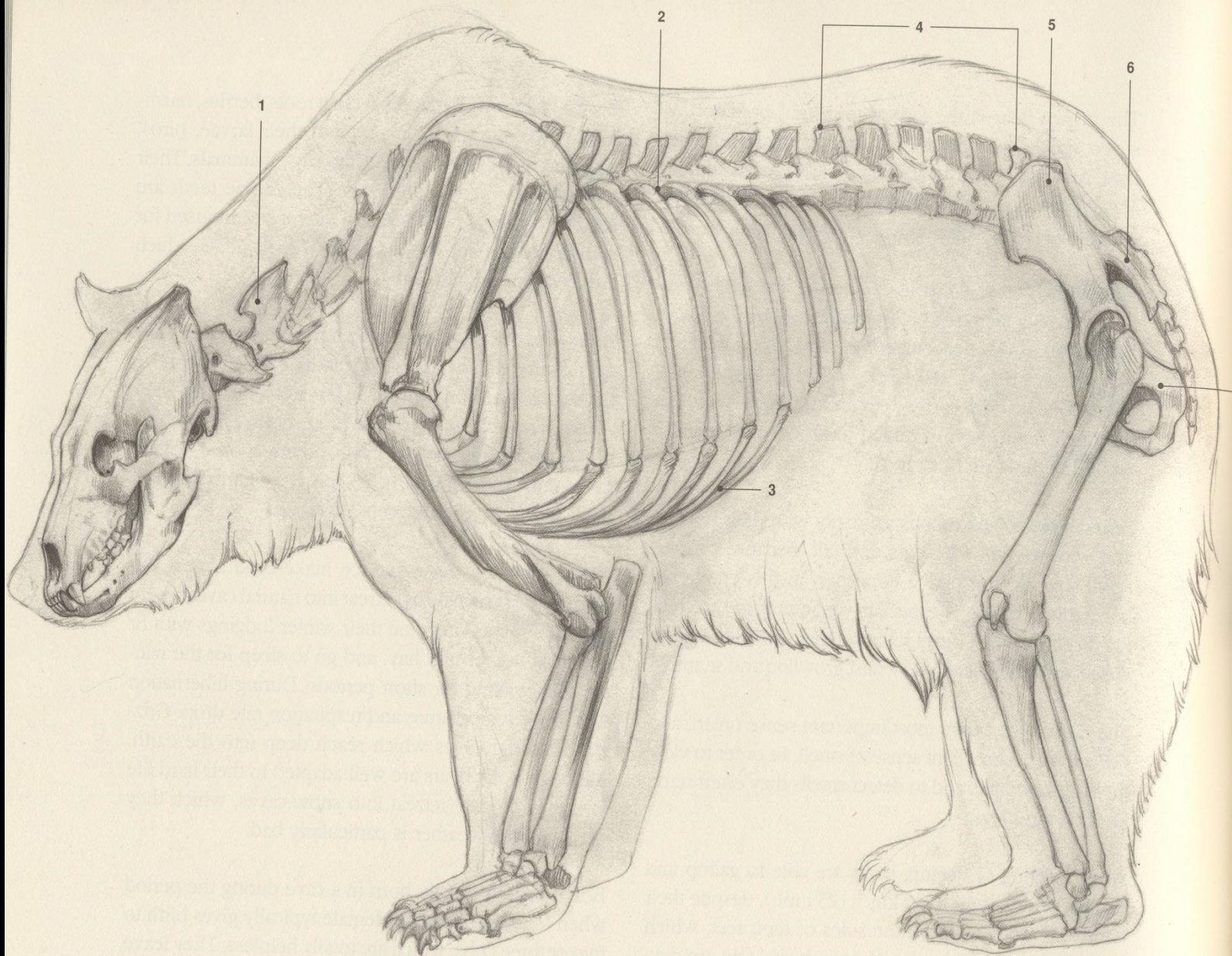


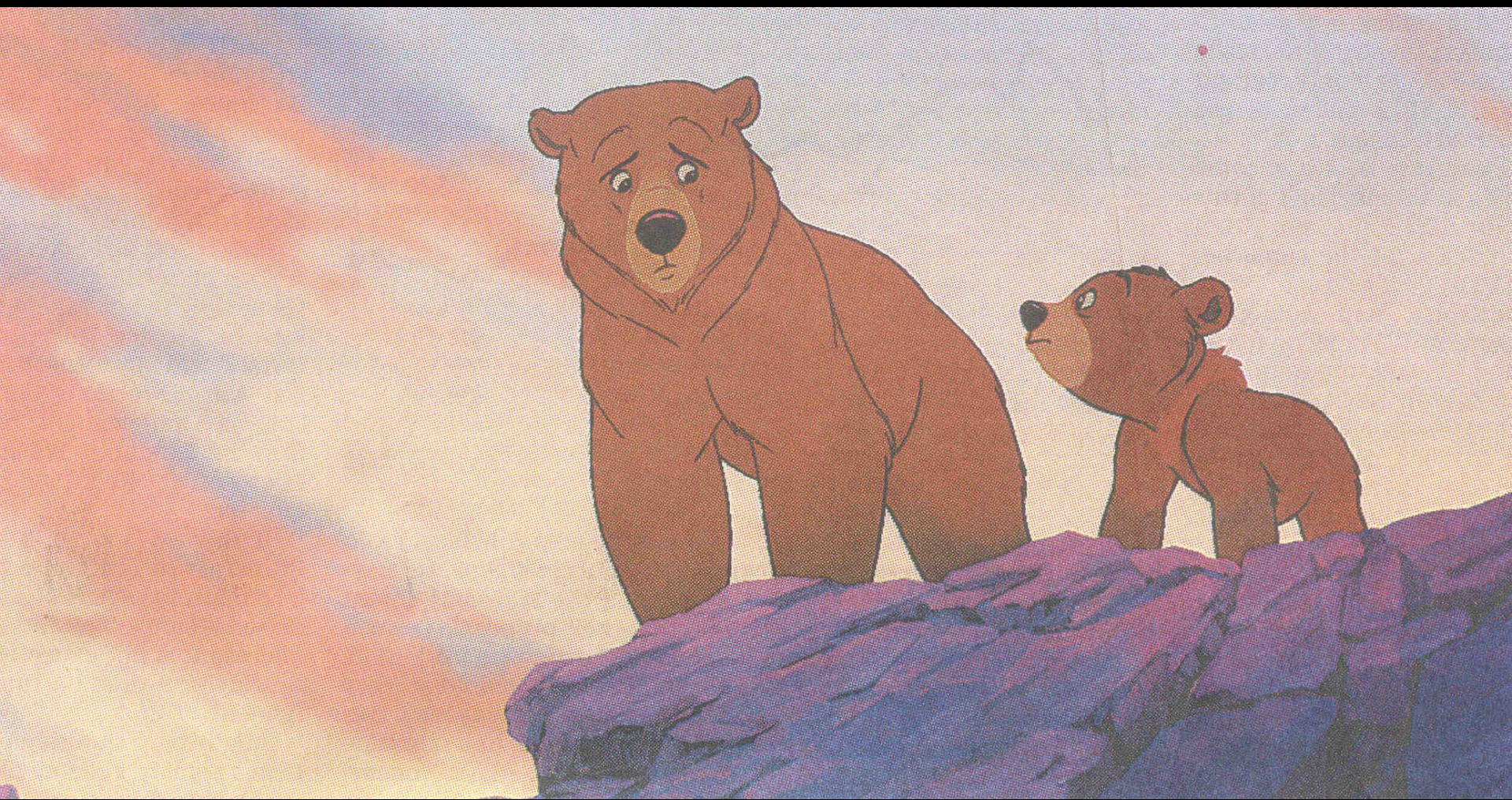
SECOND FRONT

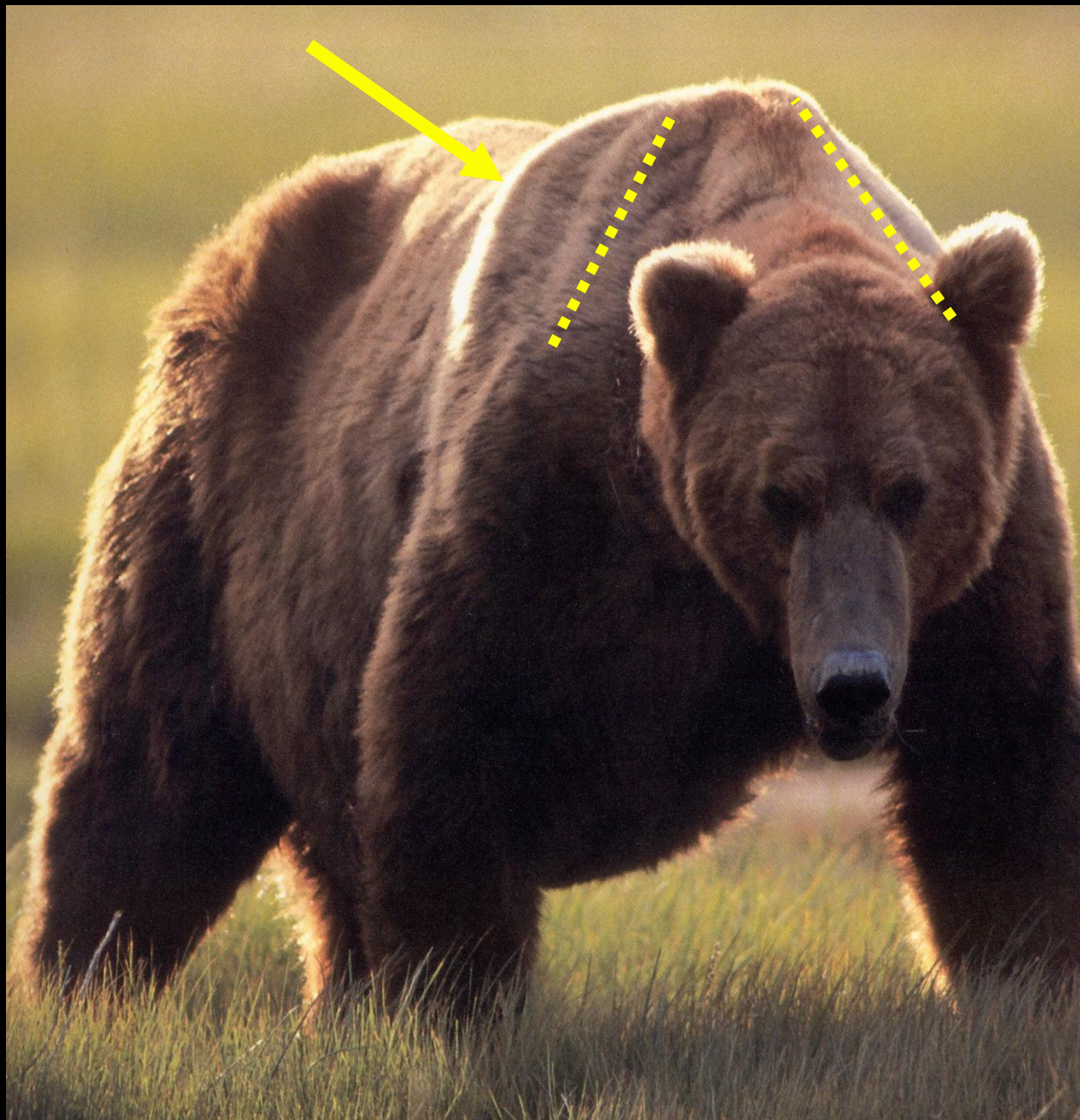
ONE STRIDE

3

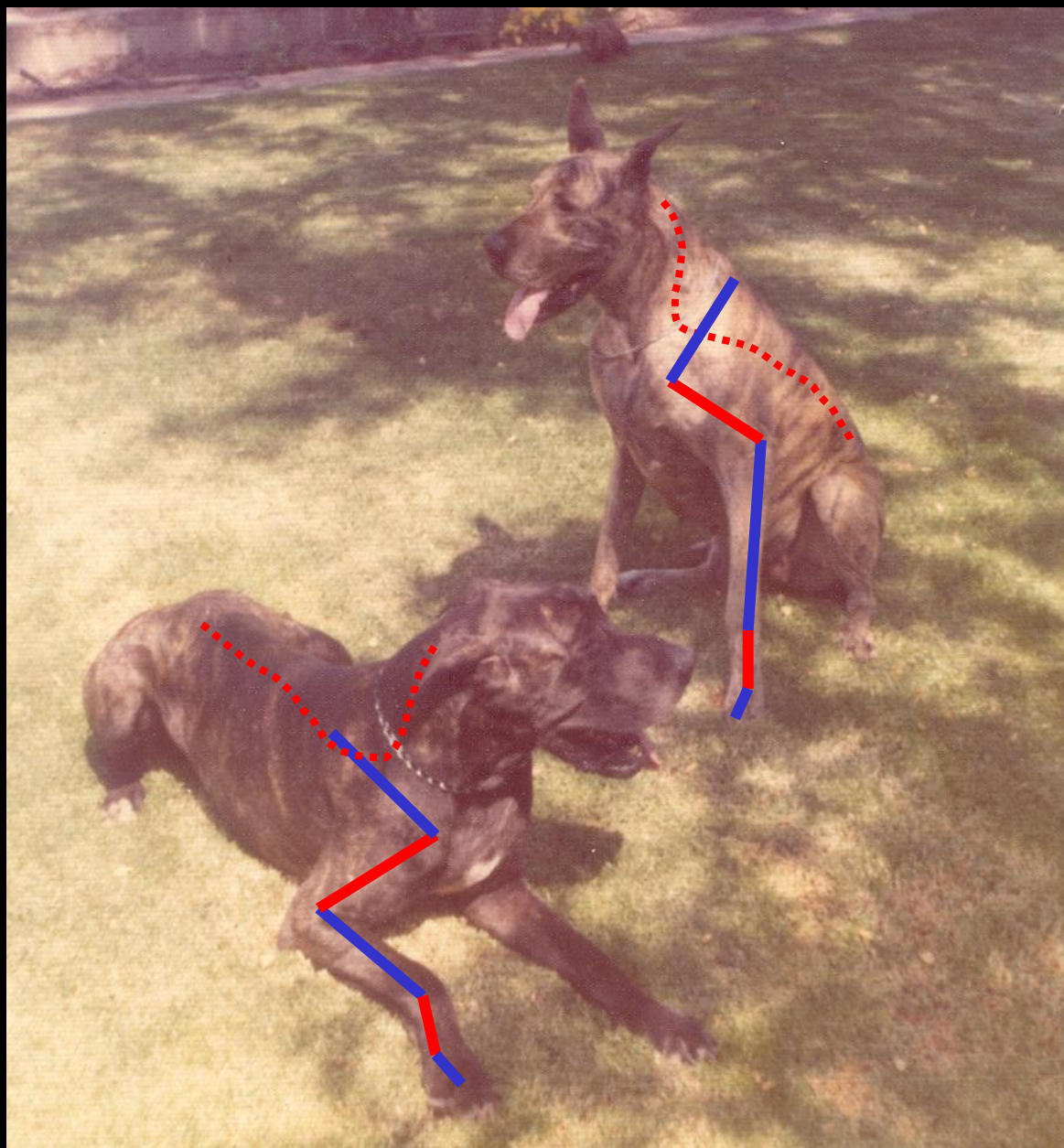
4



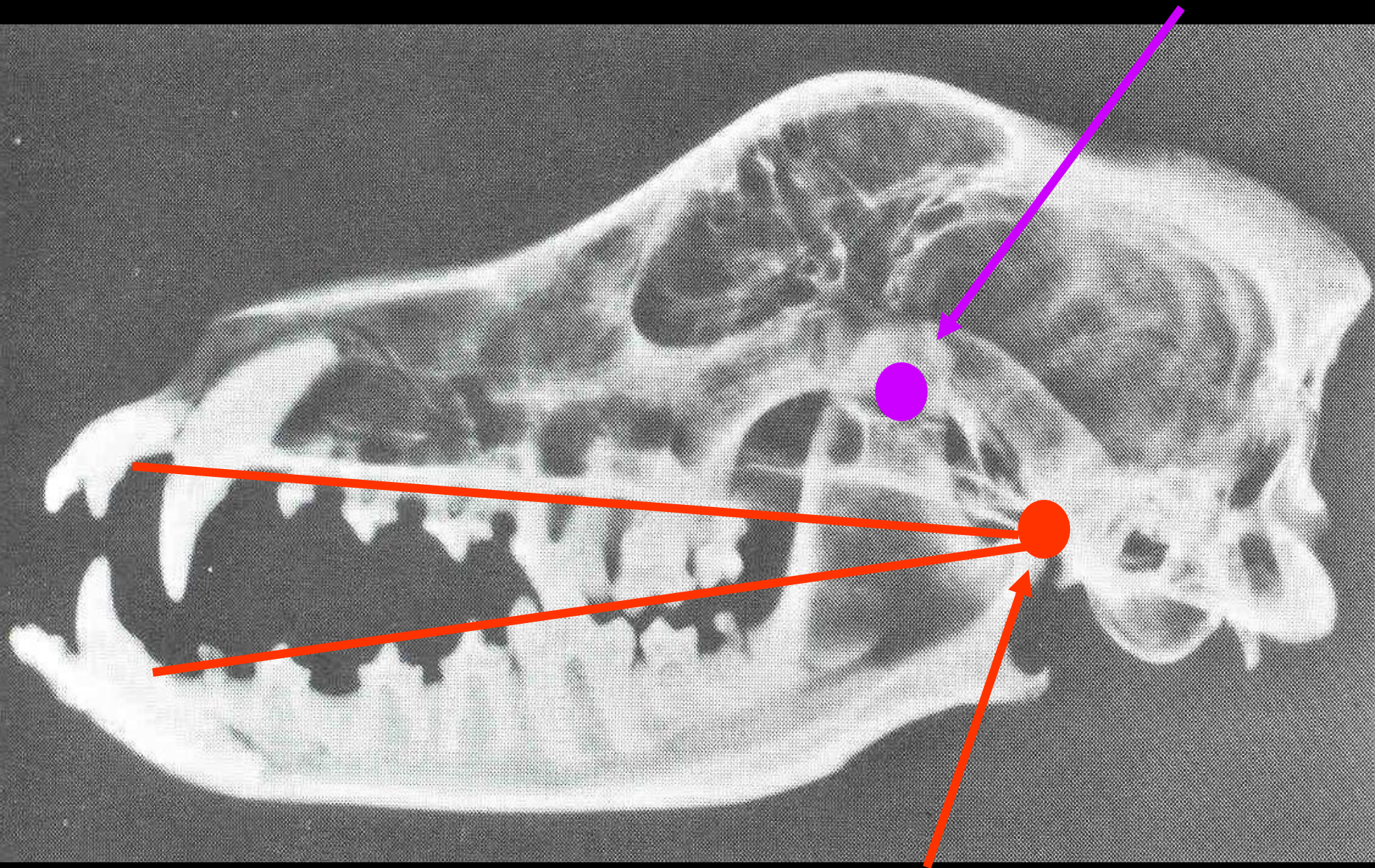








Approximate position for cheek elevation and pivot



Approximate position of jaw joint

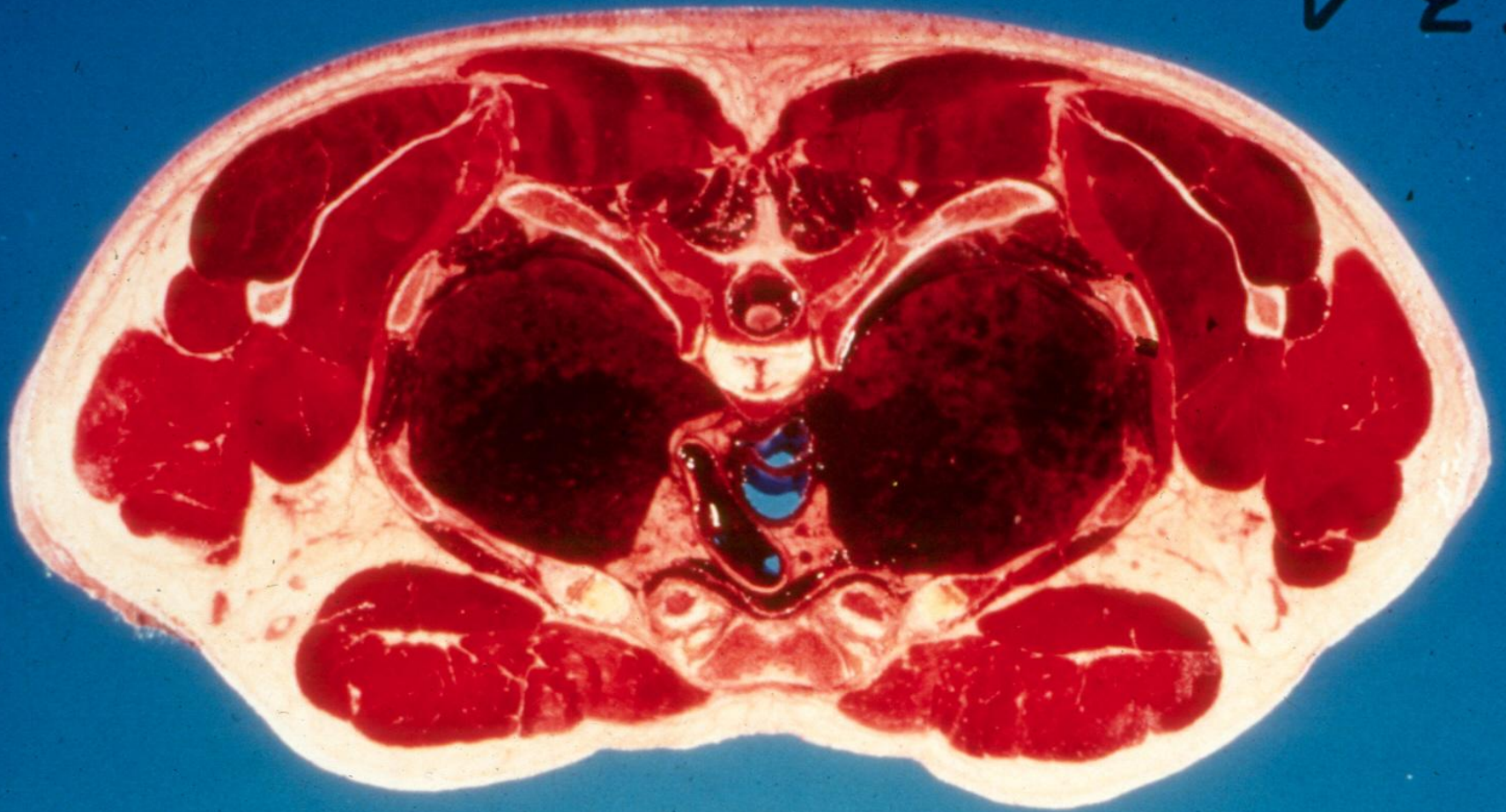


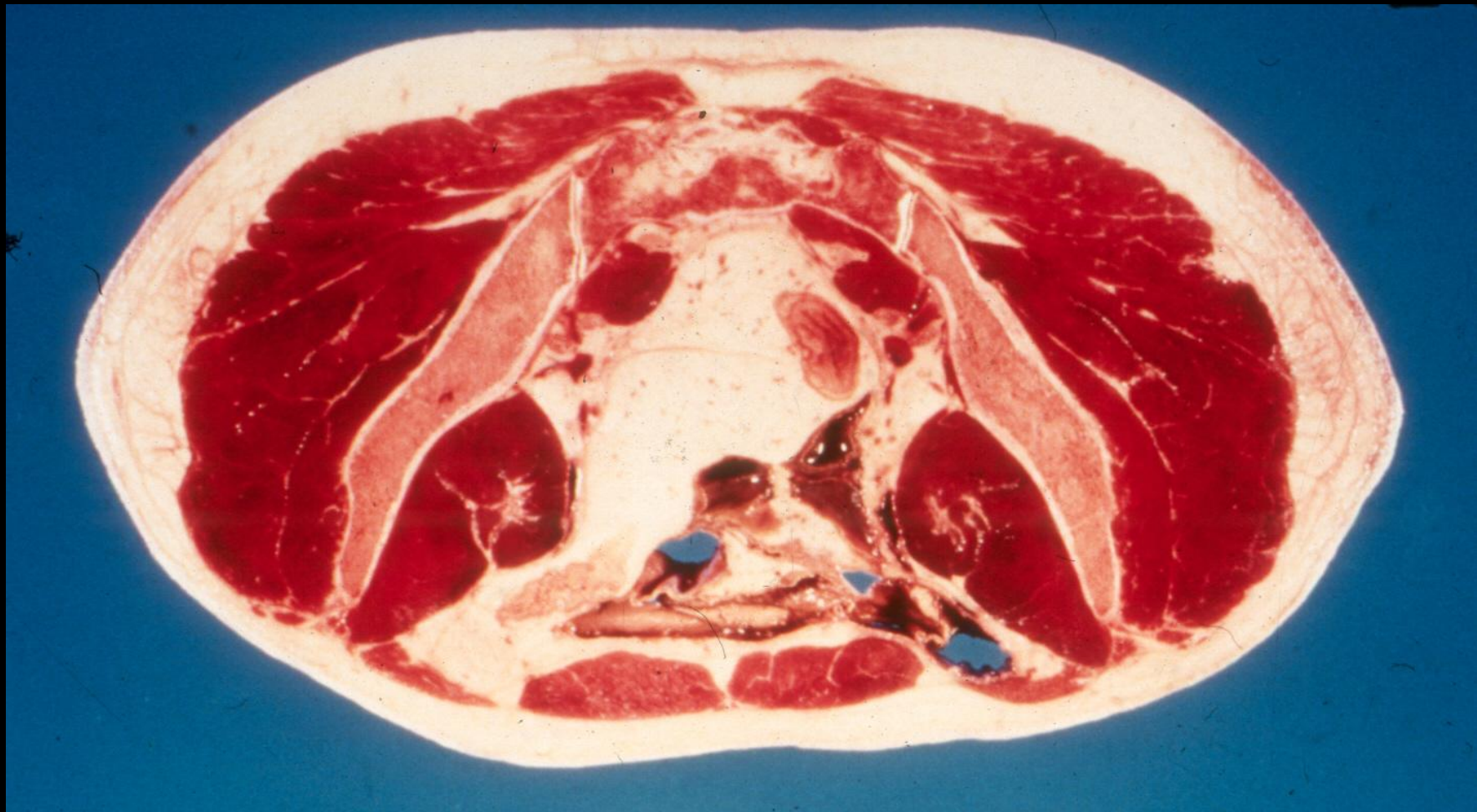


Placement of the Limbs Relative to Body Wall

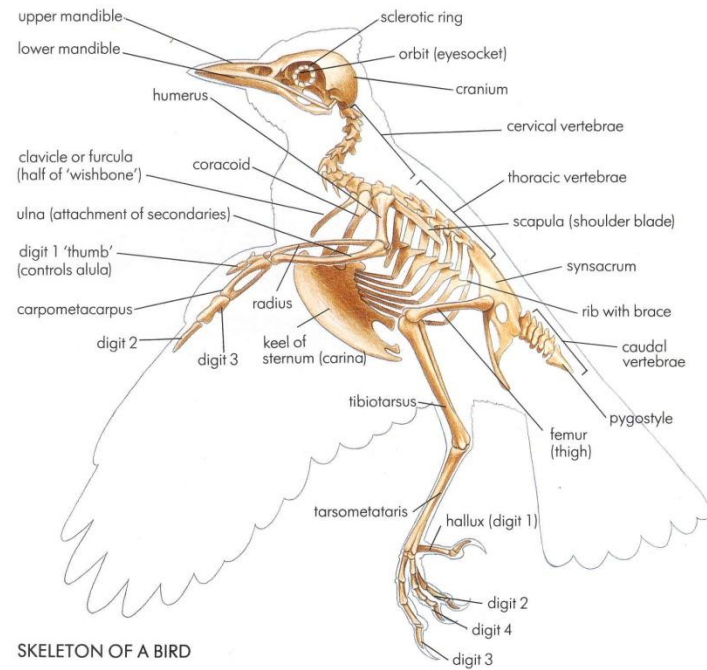
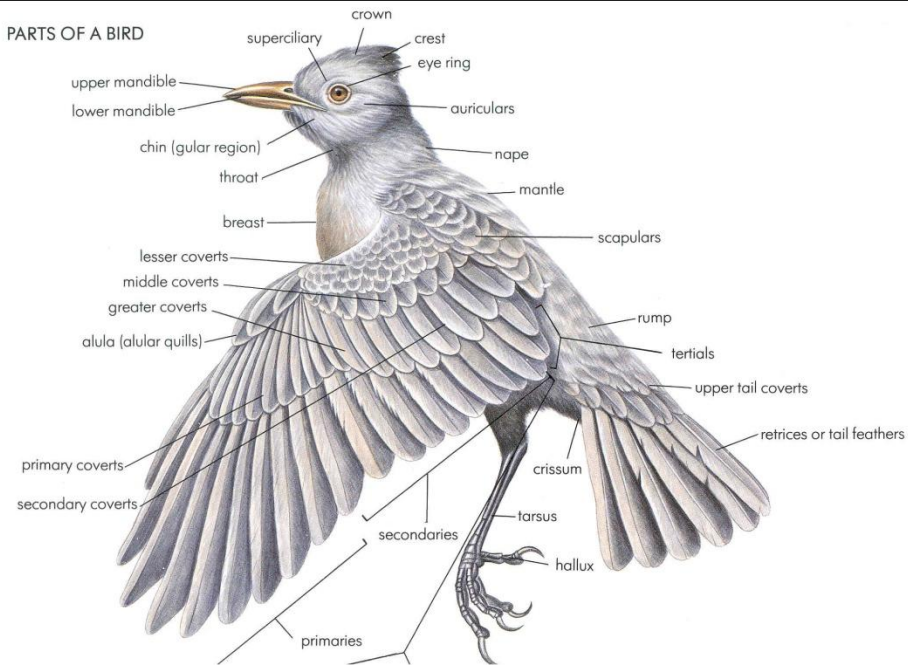
- Pectoral girdle is SUPERFICIAL to the body wall.
- Pectoral limb attaches to dorsal aspect of body wall.
- Pelvic Girdle temporarily INTERRUPTS the body wall.
- Pelvic limb attaches to lateral aspect of body wall

T 3, 4

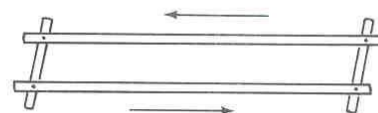
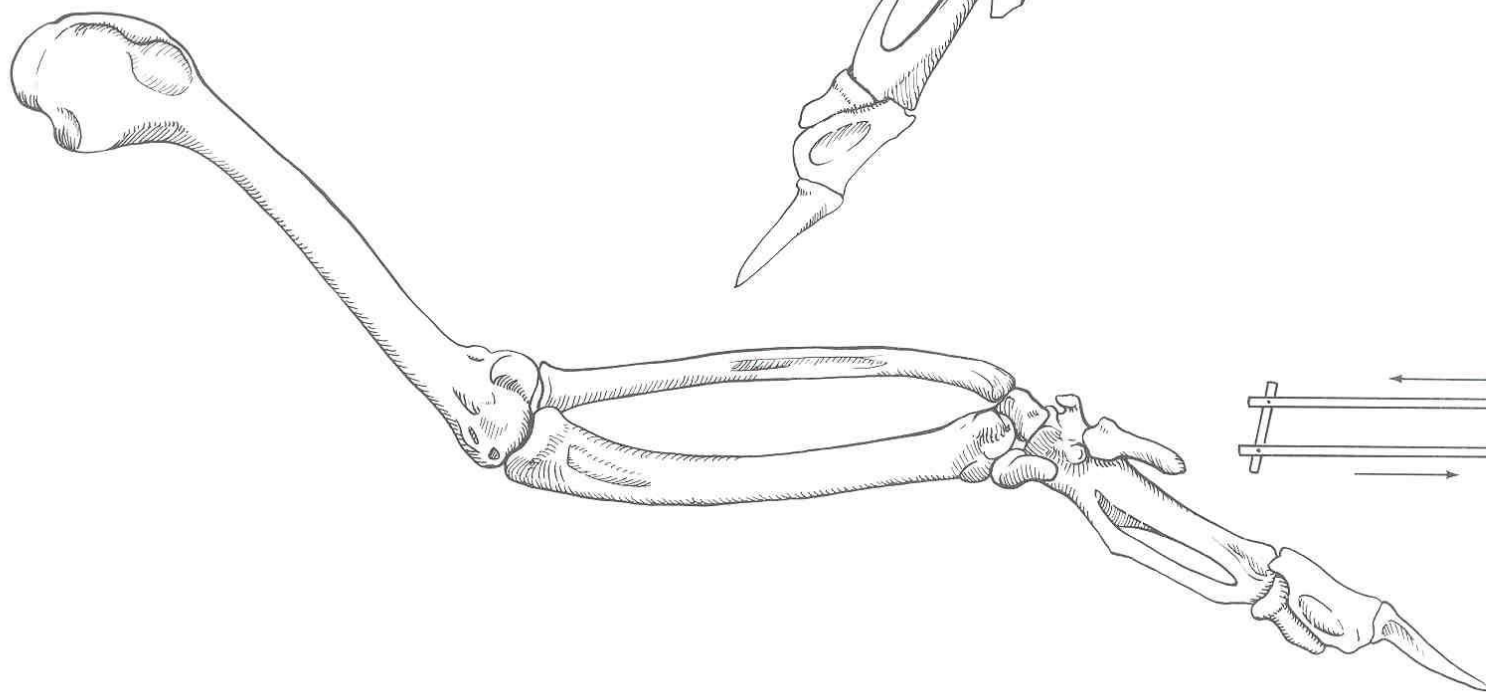
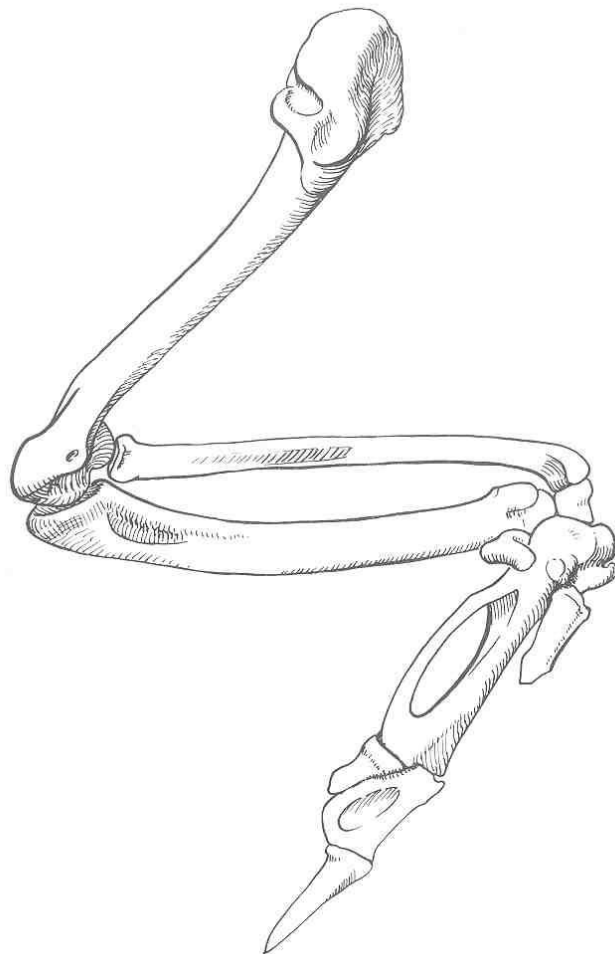


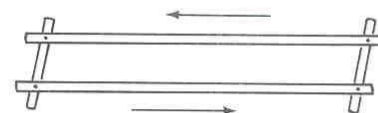
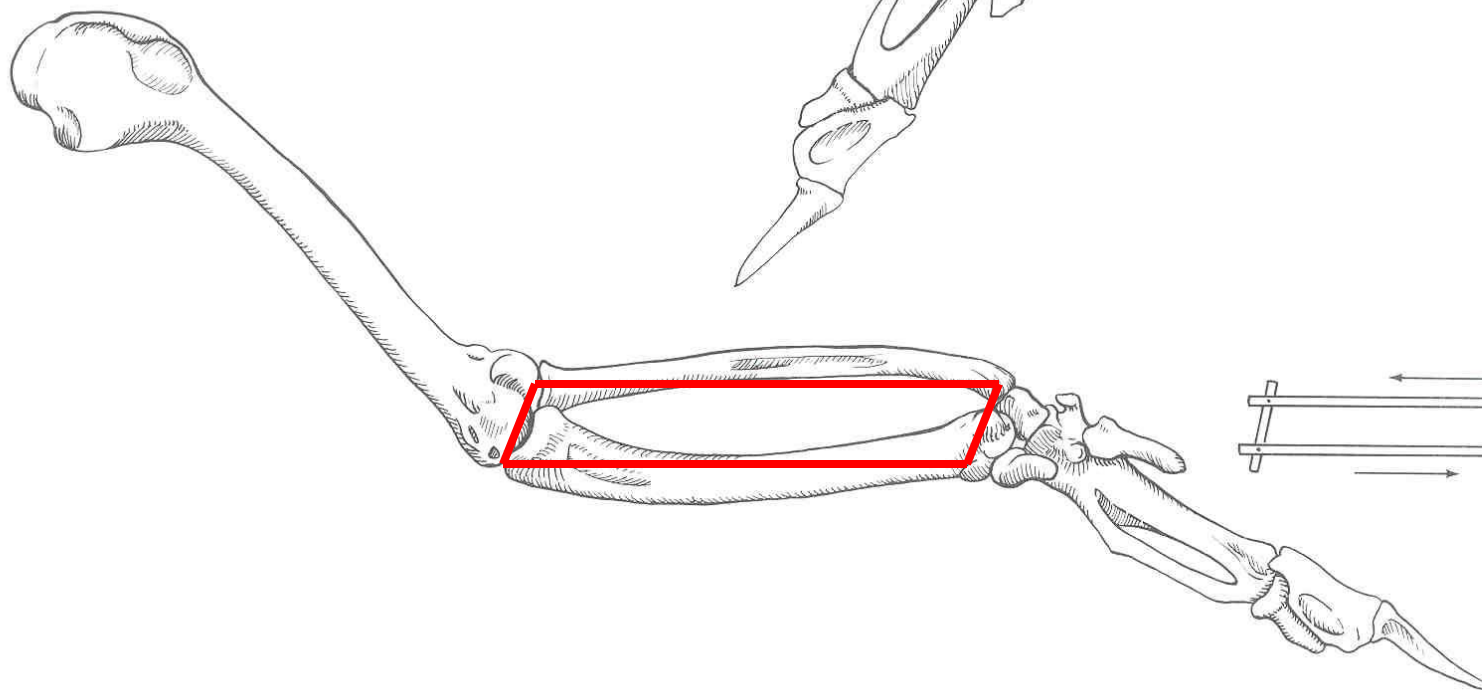
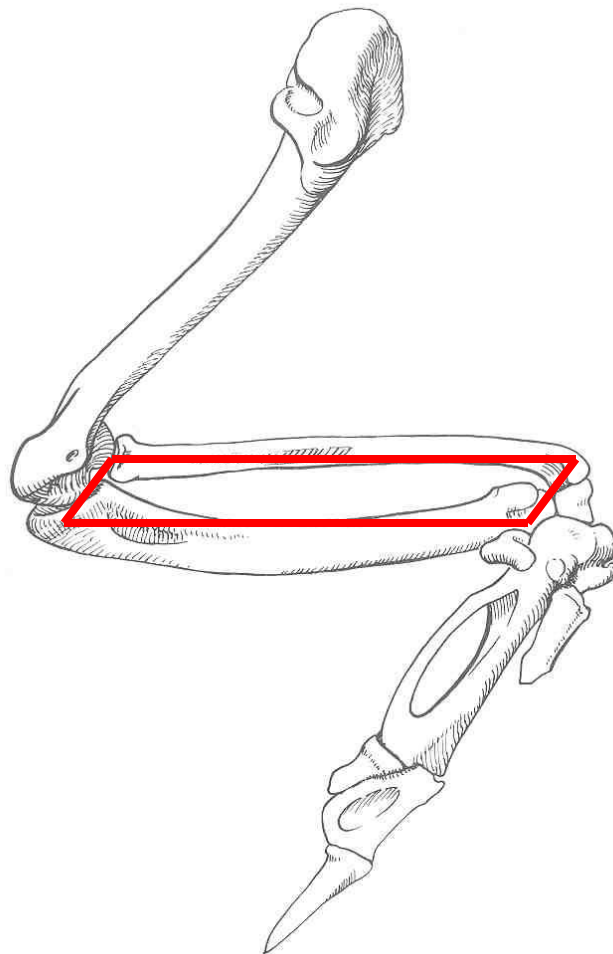


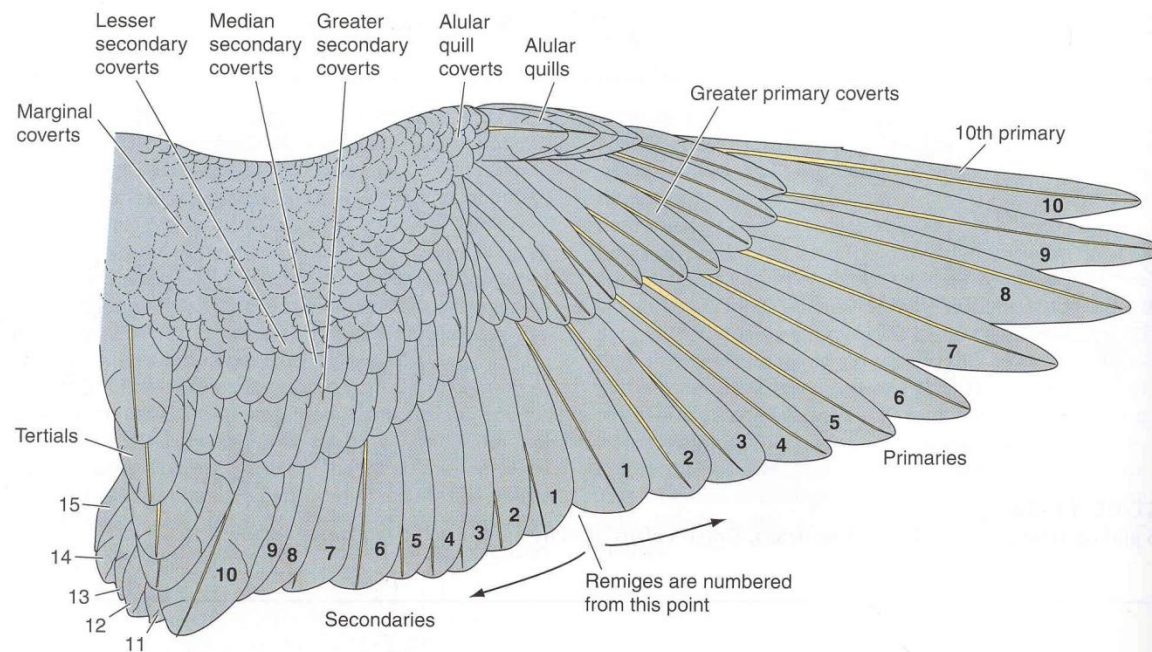
PARTS OF A BIRD



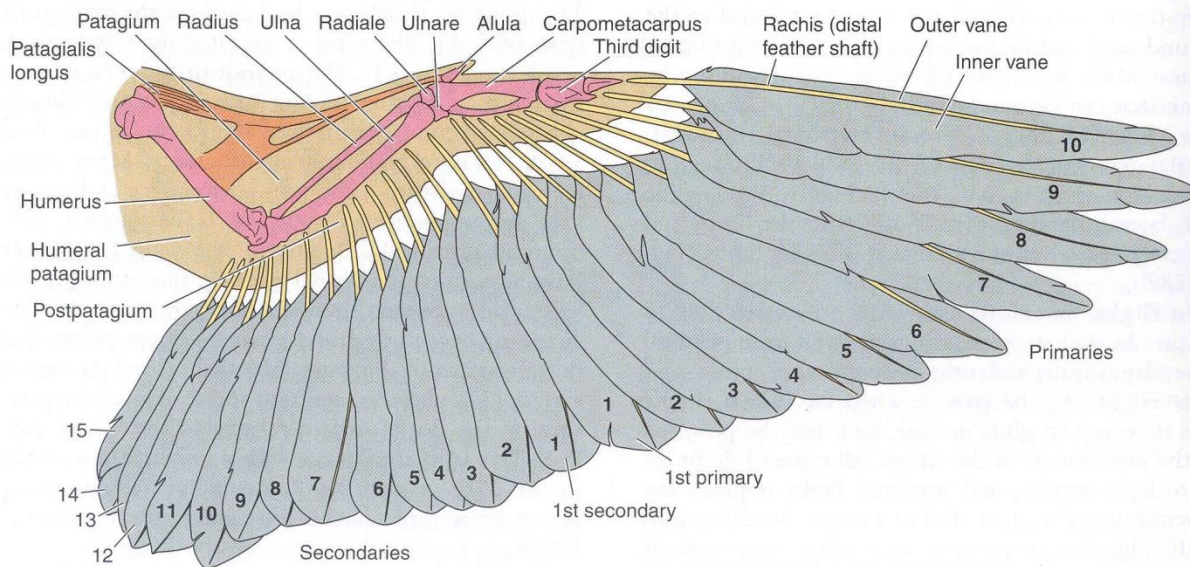
SKELETON OF A BIRD



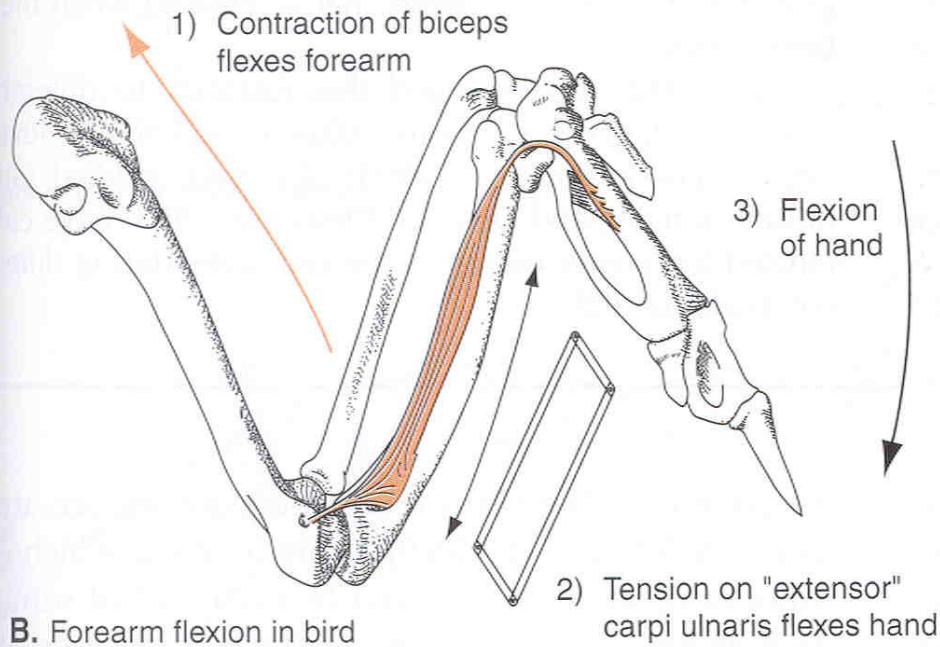
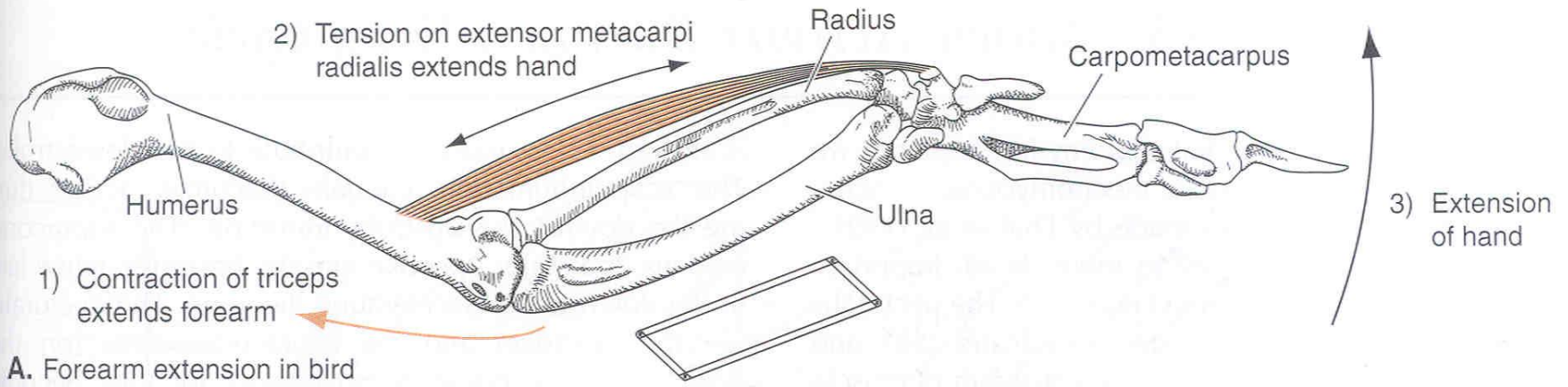


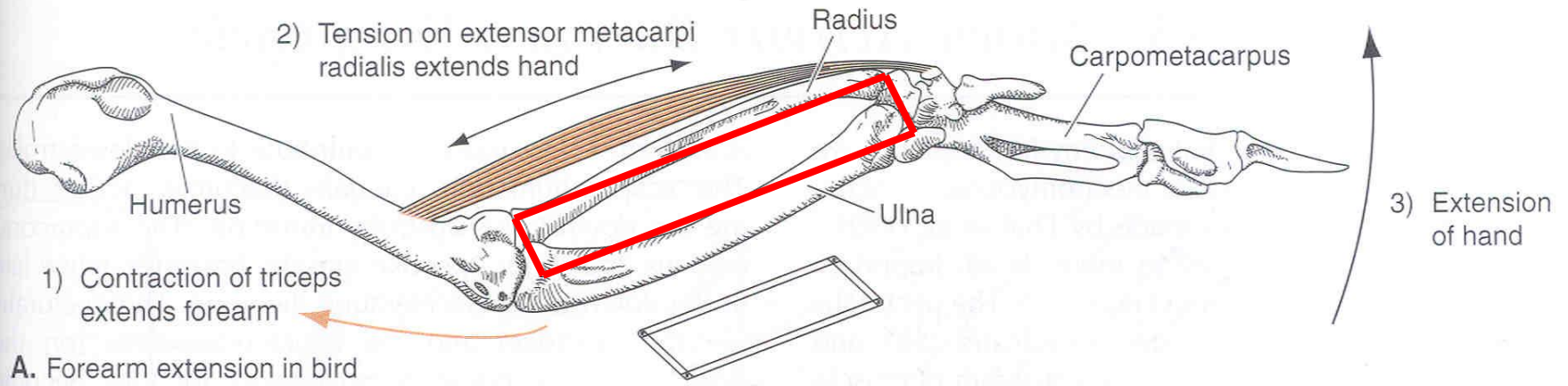


A. Dorsal view of wing surface showing coverts, alular quills and flight feathers (= remiges)

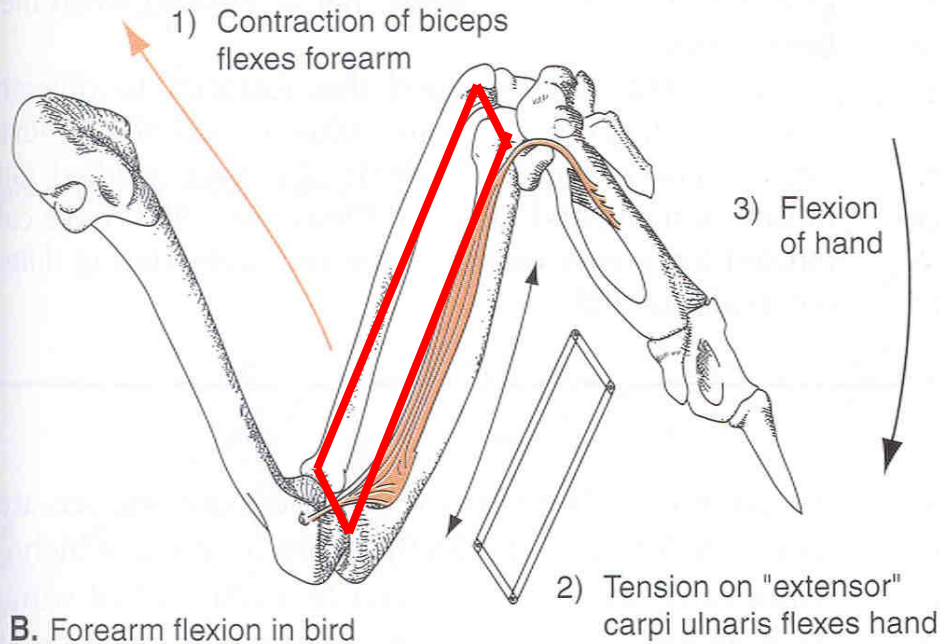


B. Ventral view of wing after removal of covert feathers

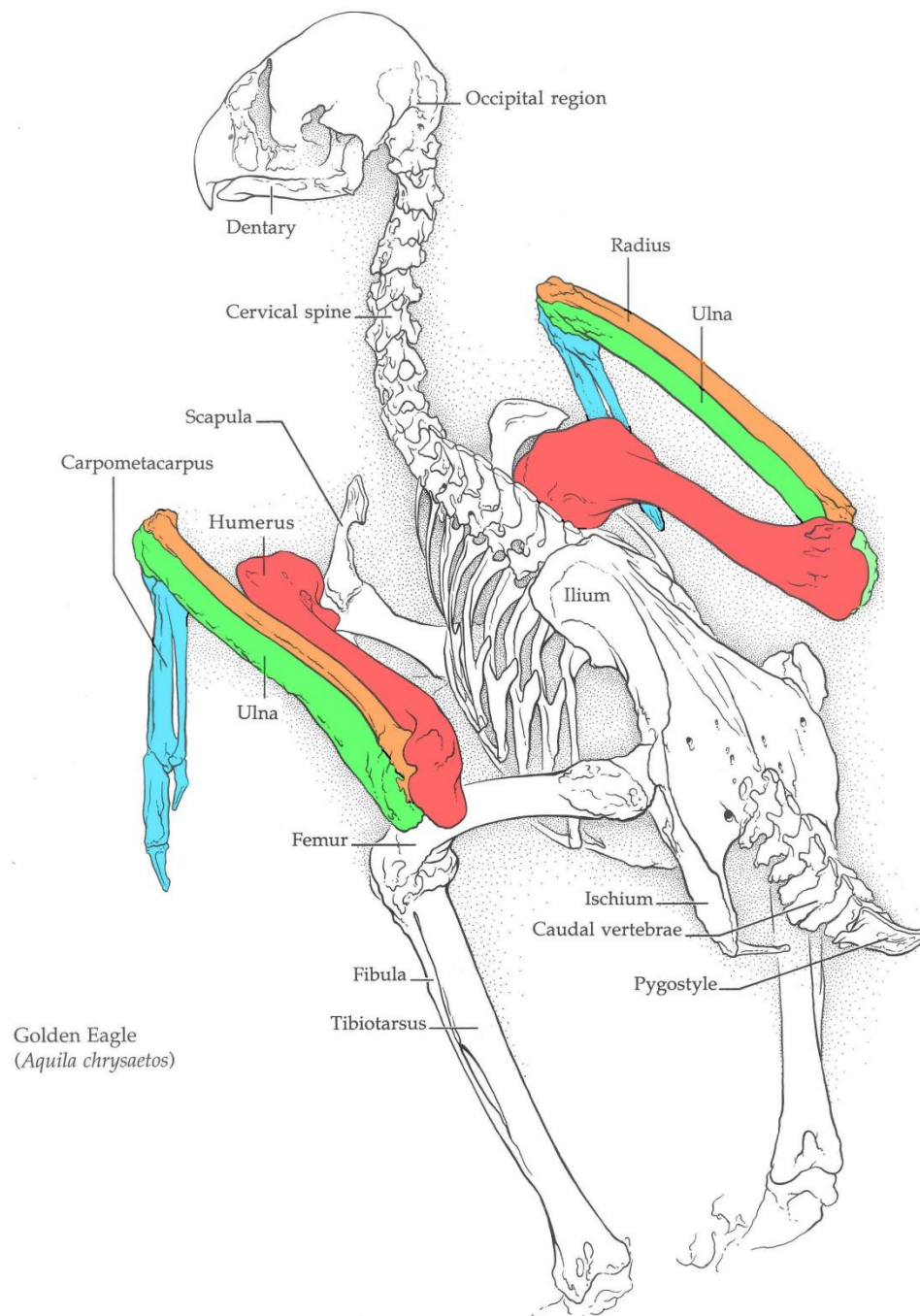




A. Forearm extension in bird



B. Forearm flexion in bird





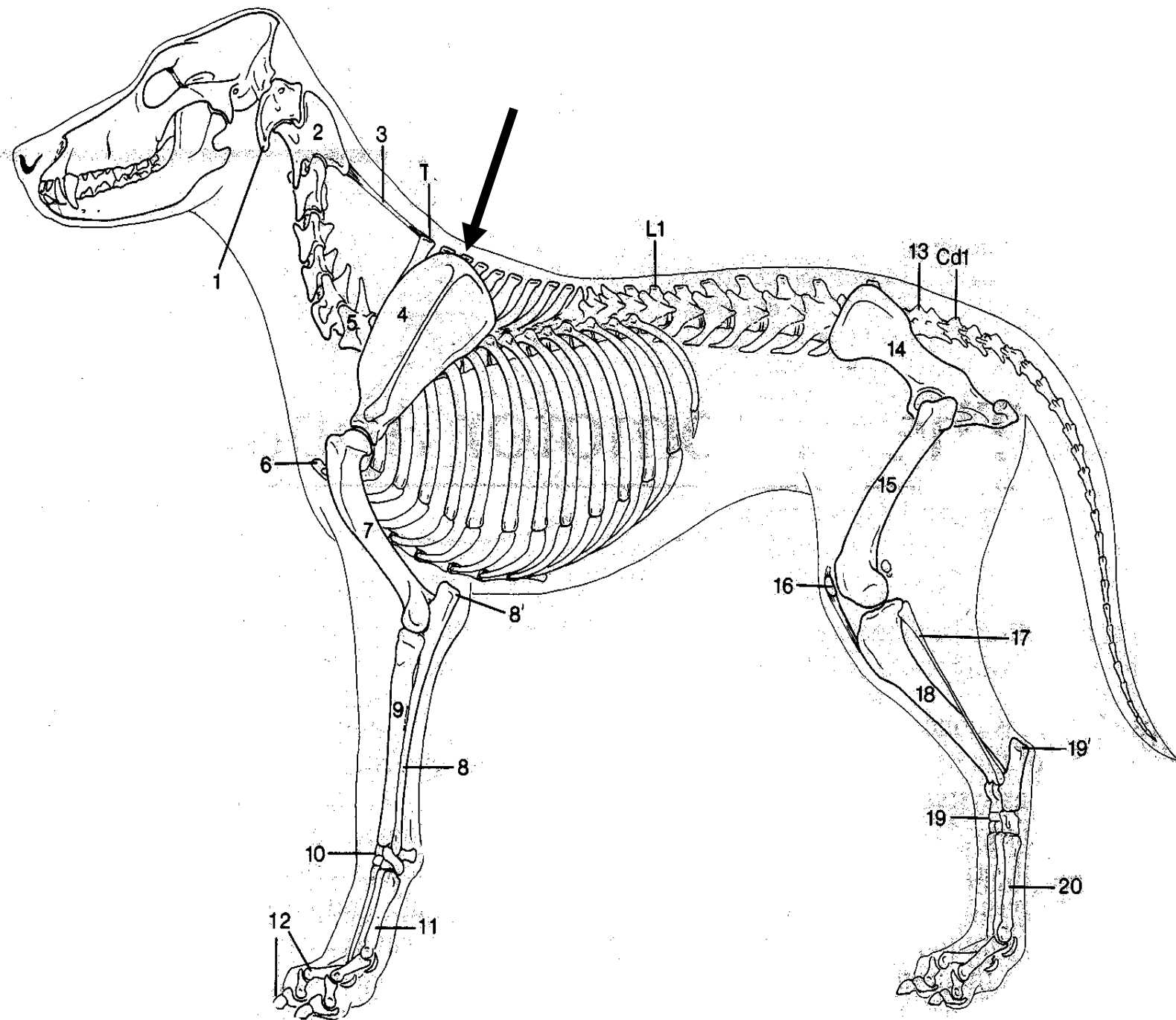
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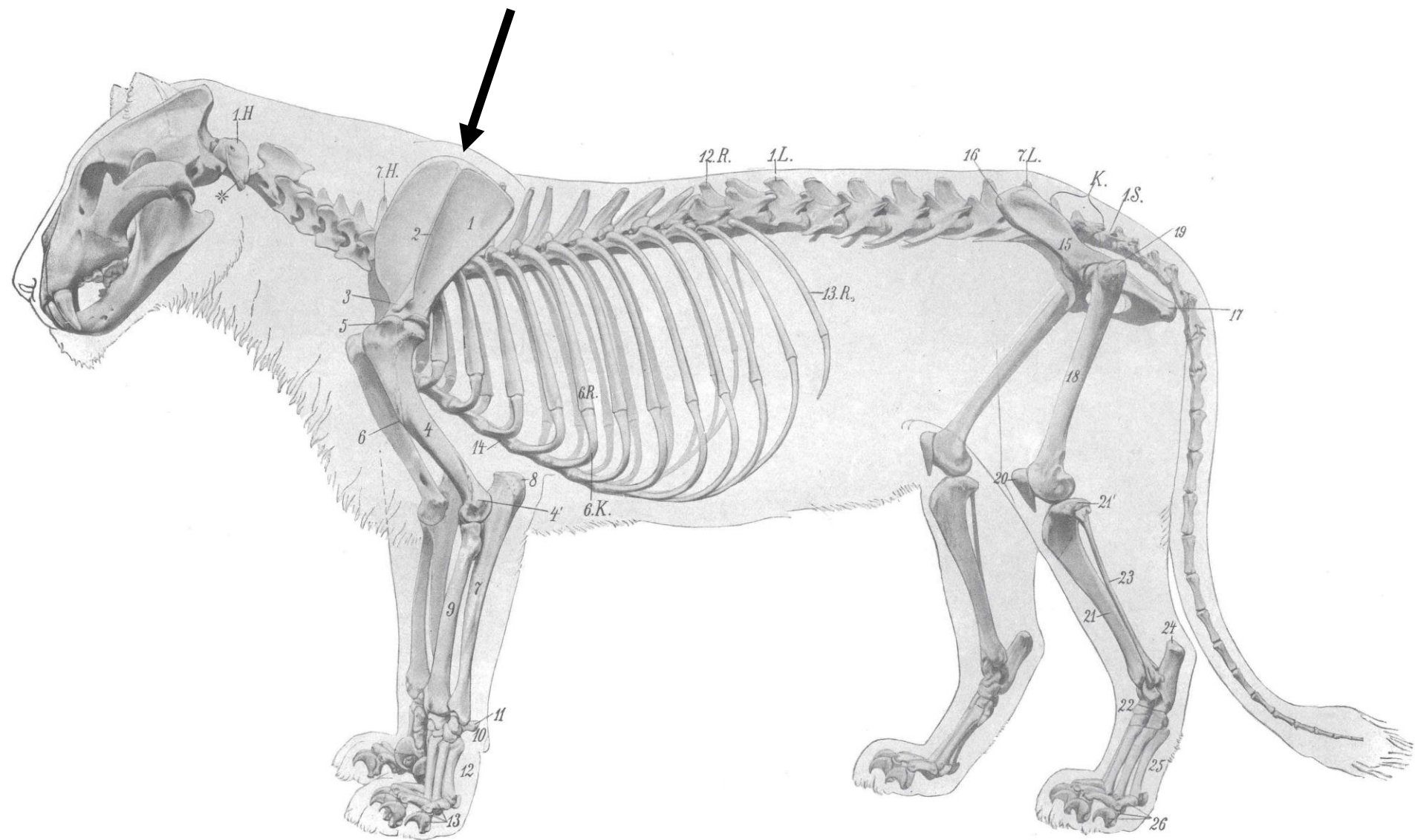
SKELETONS for ANIMATORS and RIGGERS

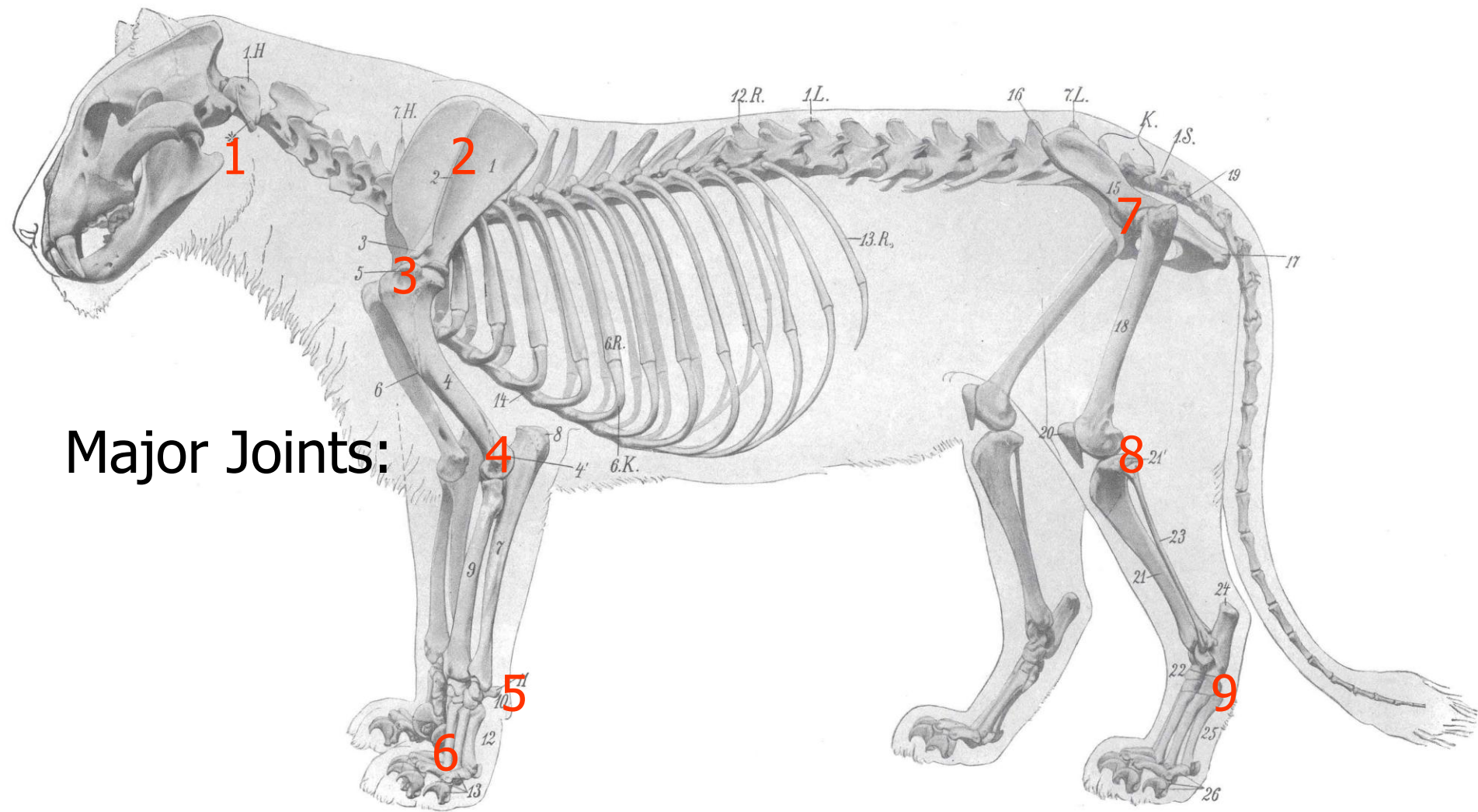
- i overview**
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Major Concerns:

- Carnivores
- Small to Medium Herbivores
- Large Herbivores (Giraffes, Elephants, and others)
- Shoulders are (always) a Pain

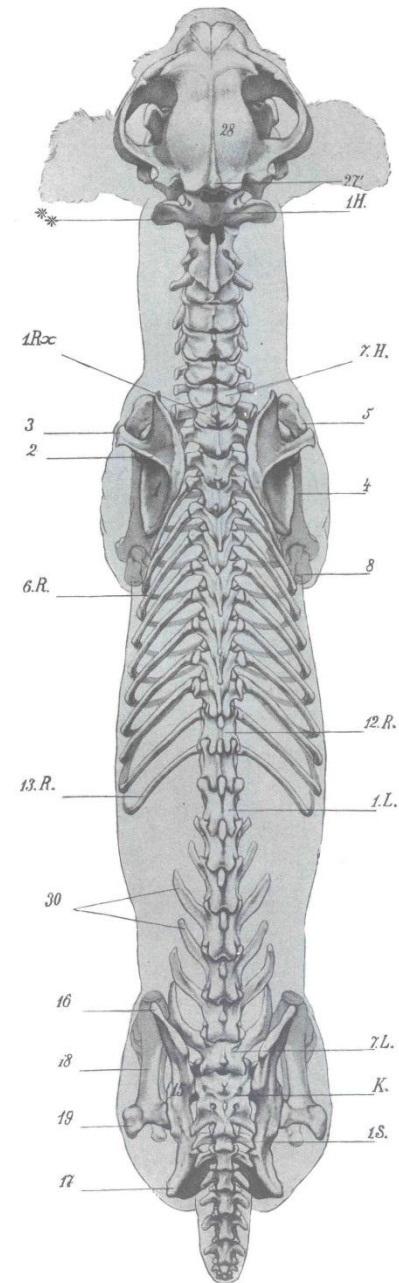
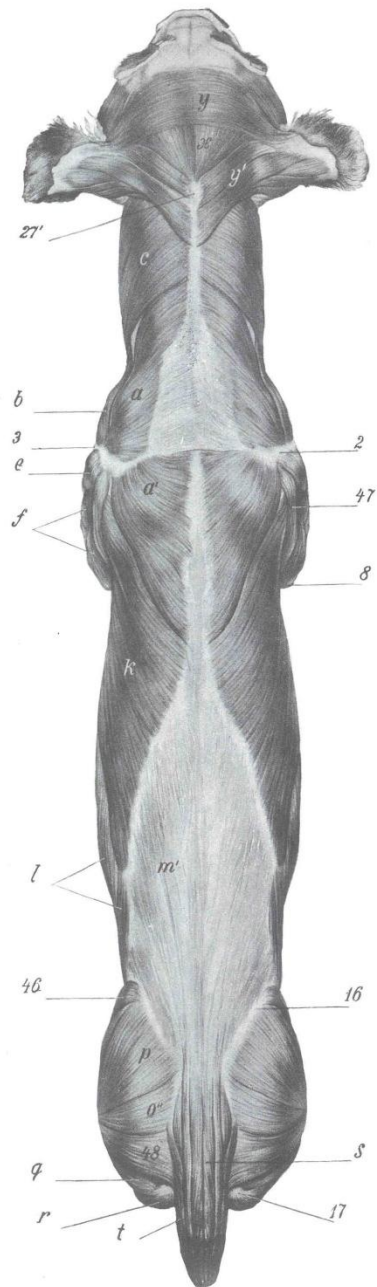


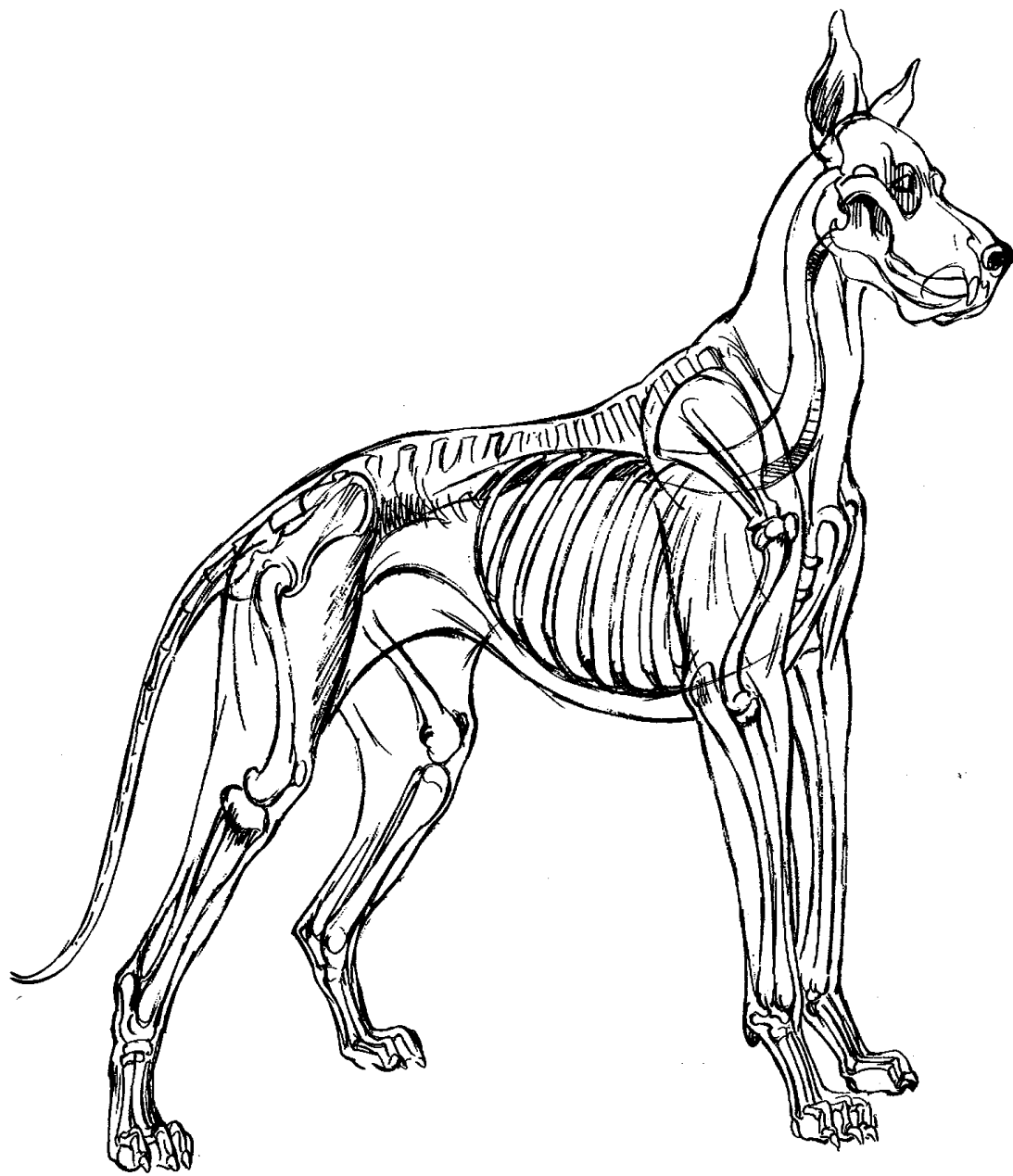


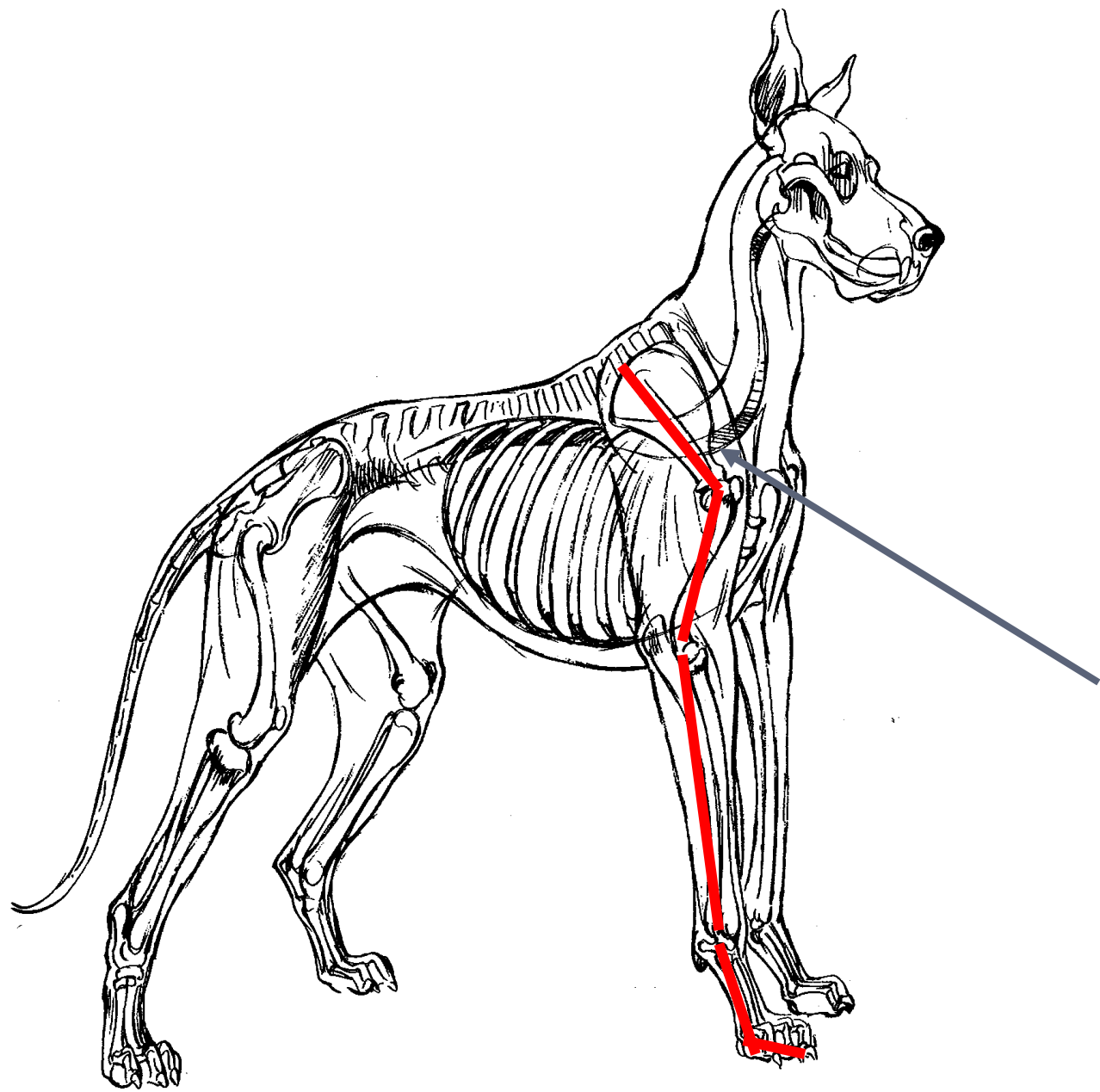


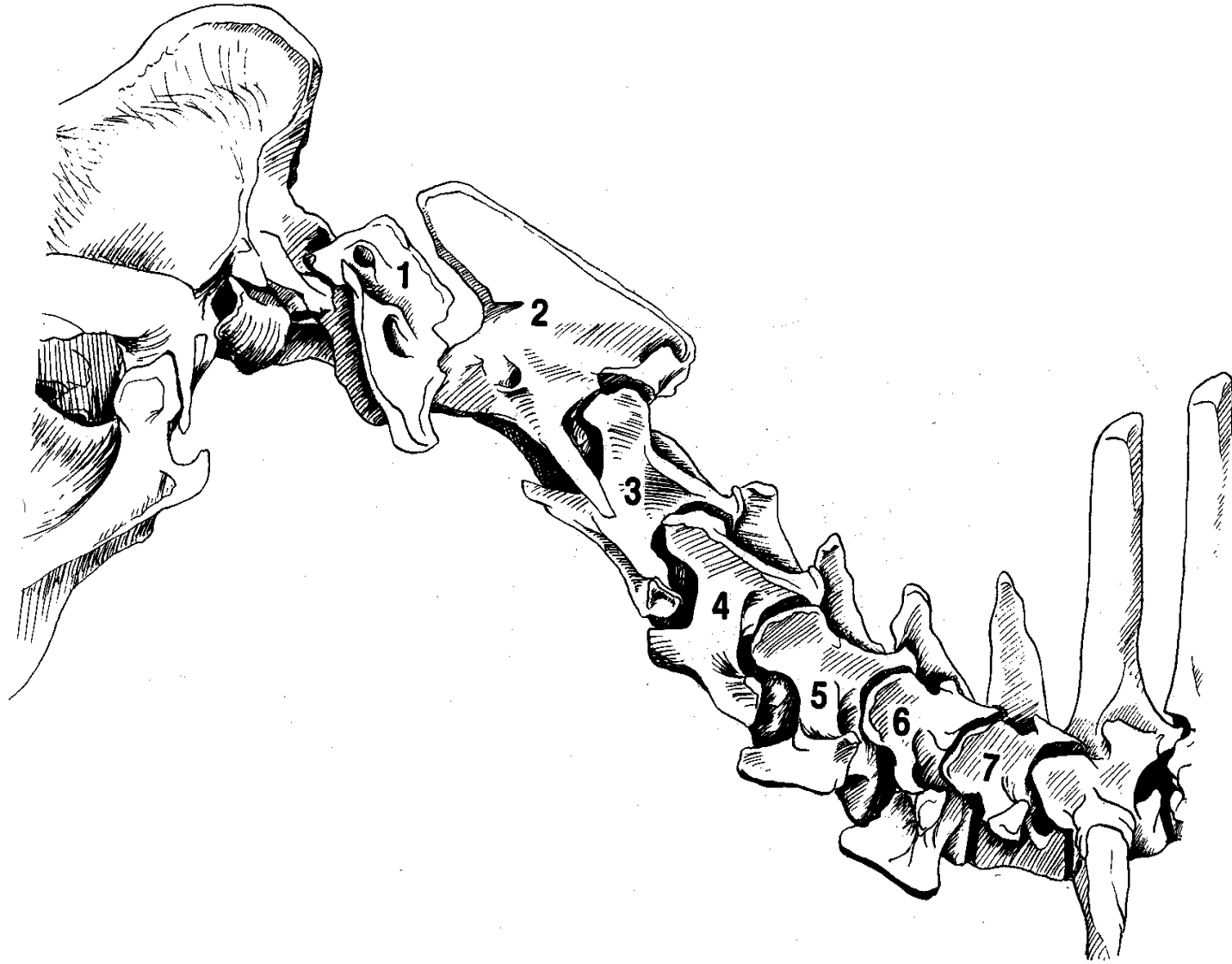
Major Joints:

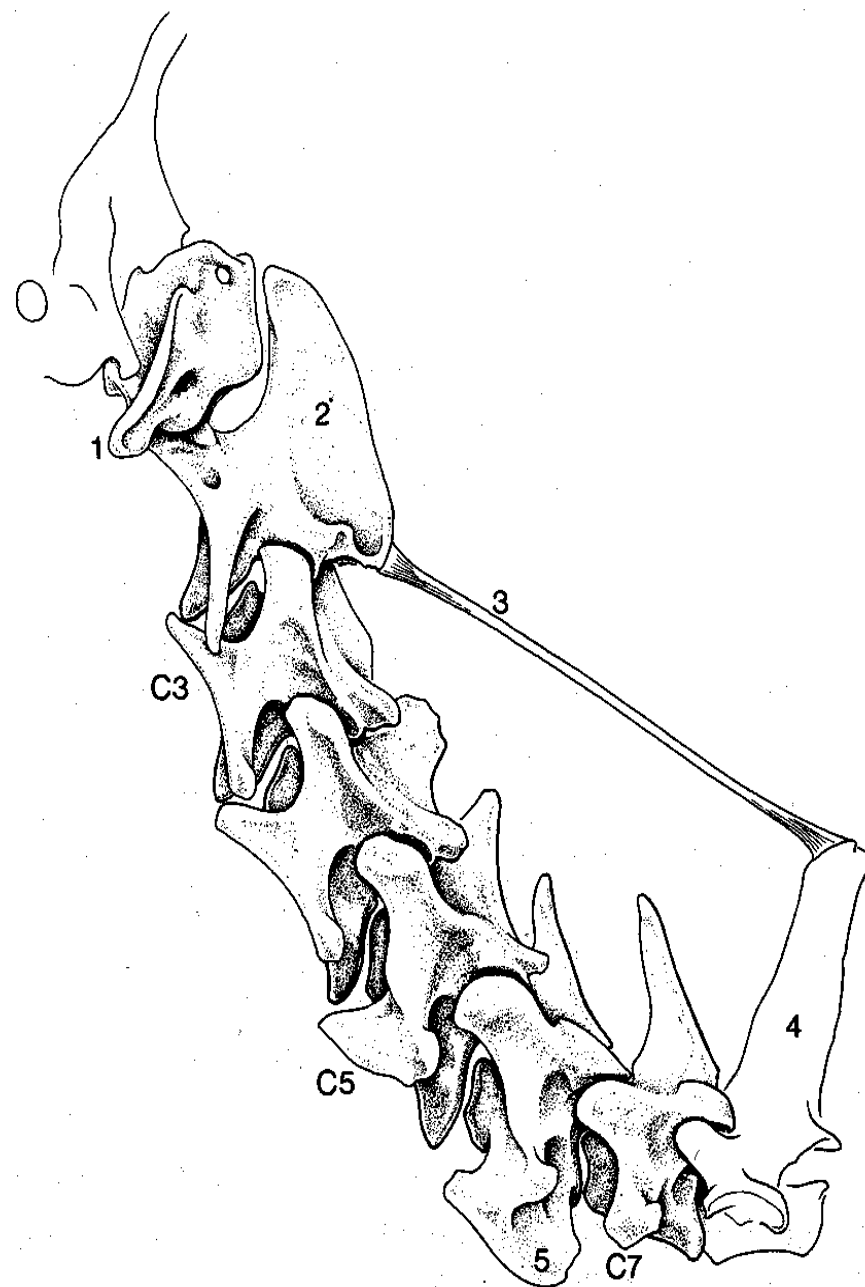
1. Atlas-axis – flex&extend/rotation respectively.
- 2 Scapula – pendular.
- 3 Shoulder (glenoid) – ball and socket.
4. Elbow – flex/extend; forearm rotation.
5. Wrist – flex/extend saddle joint.
6. Phalangeal – flex/extend.
7. Acetabulum – ball and socket.
8. Knee – ball and plate joint.
9. Ankle – flex /extend.

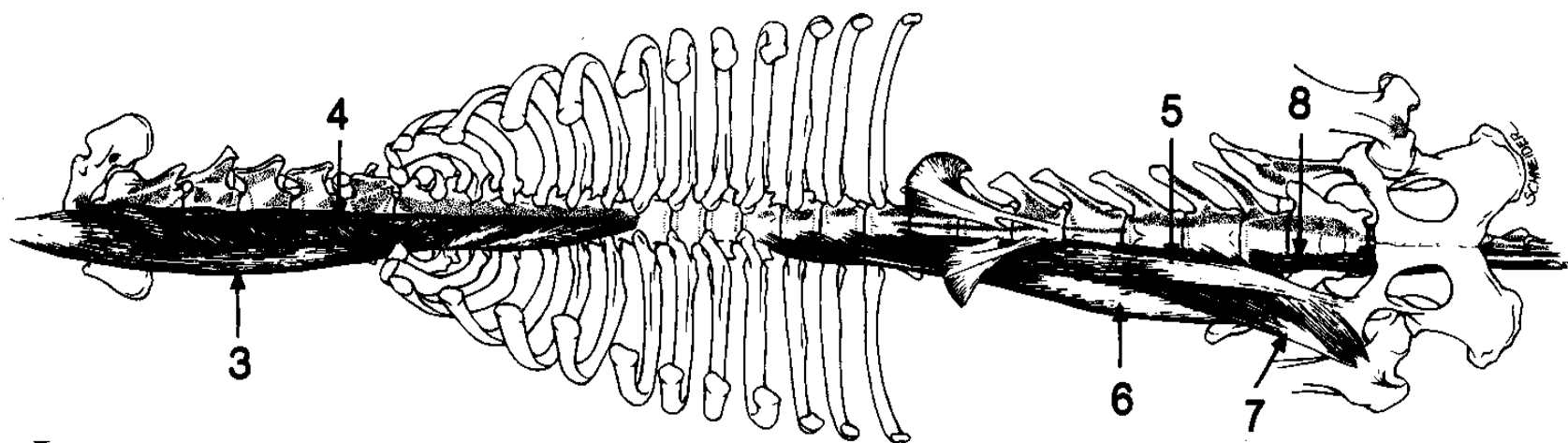


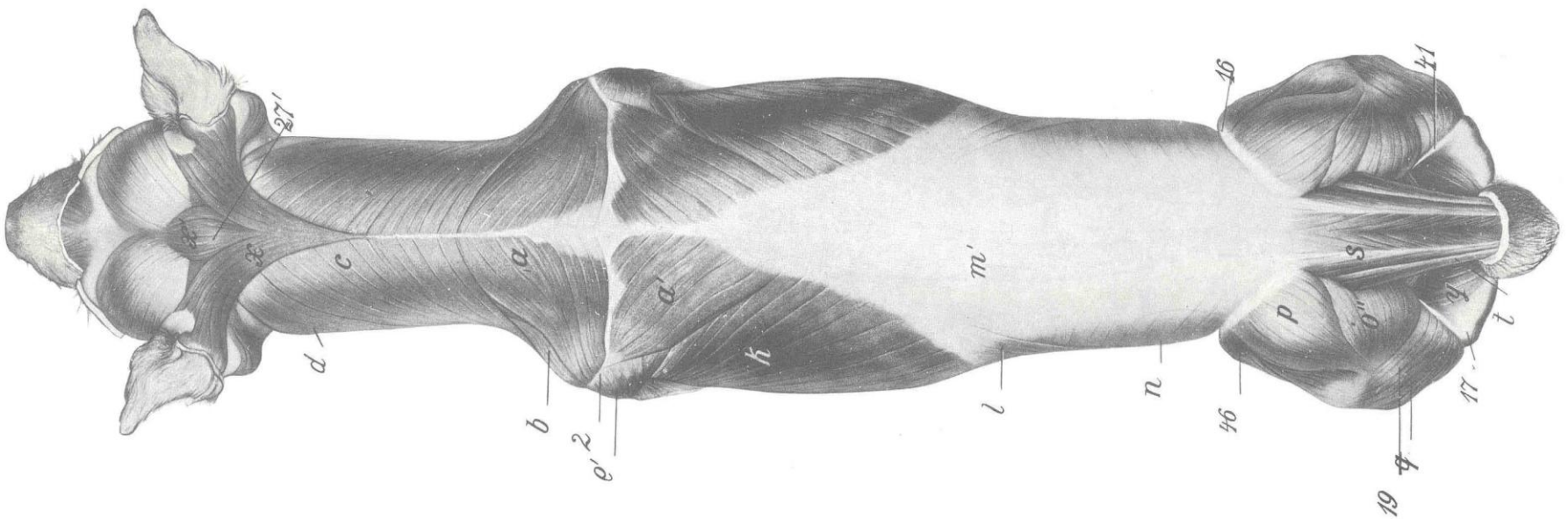
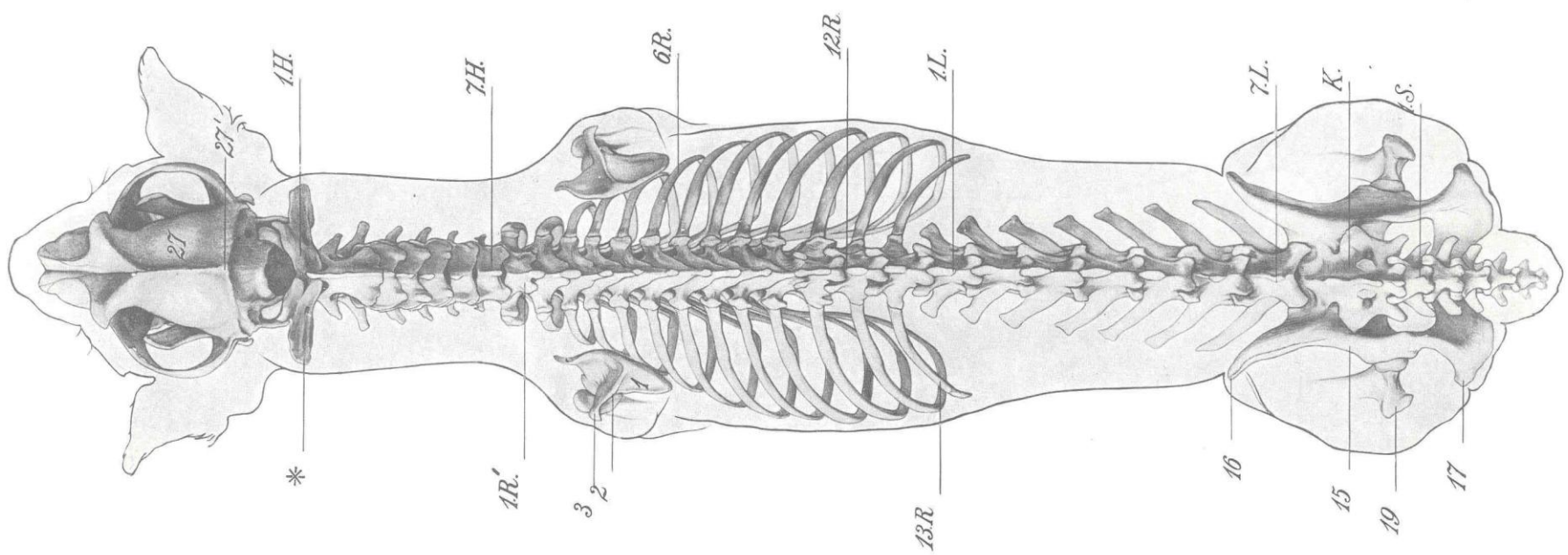


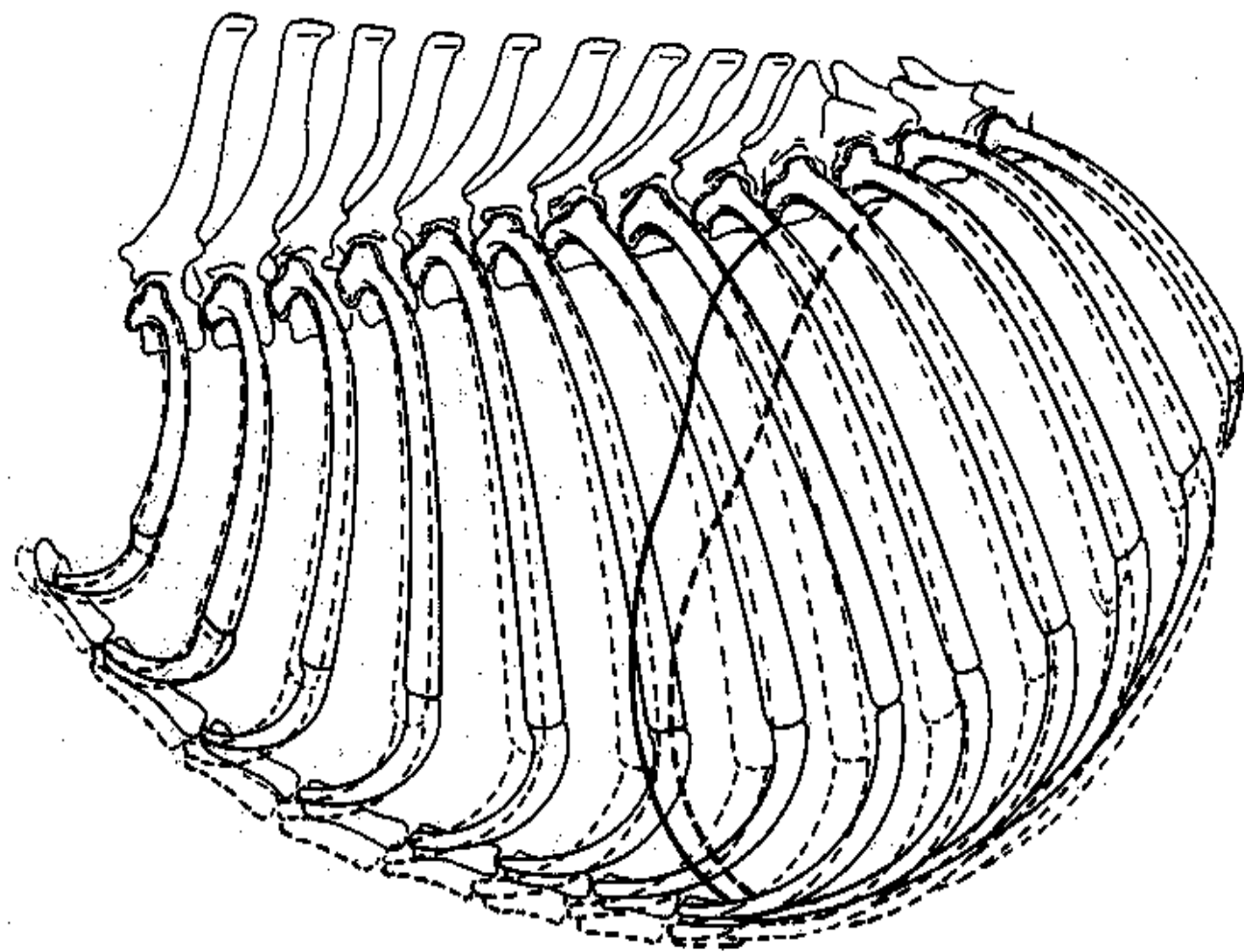


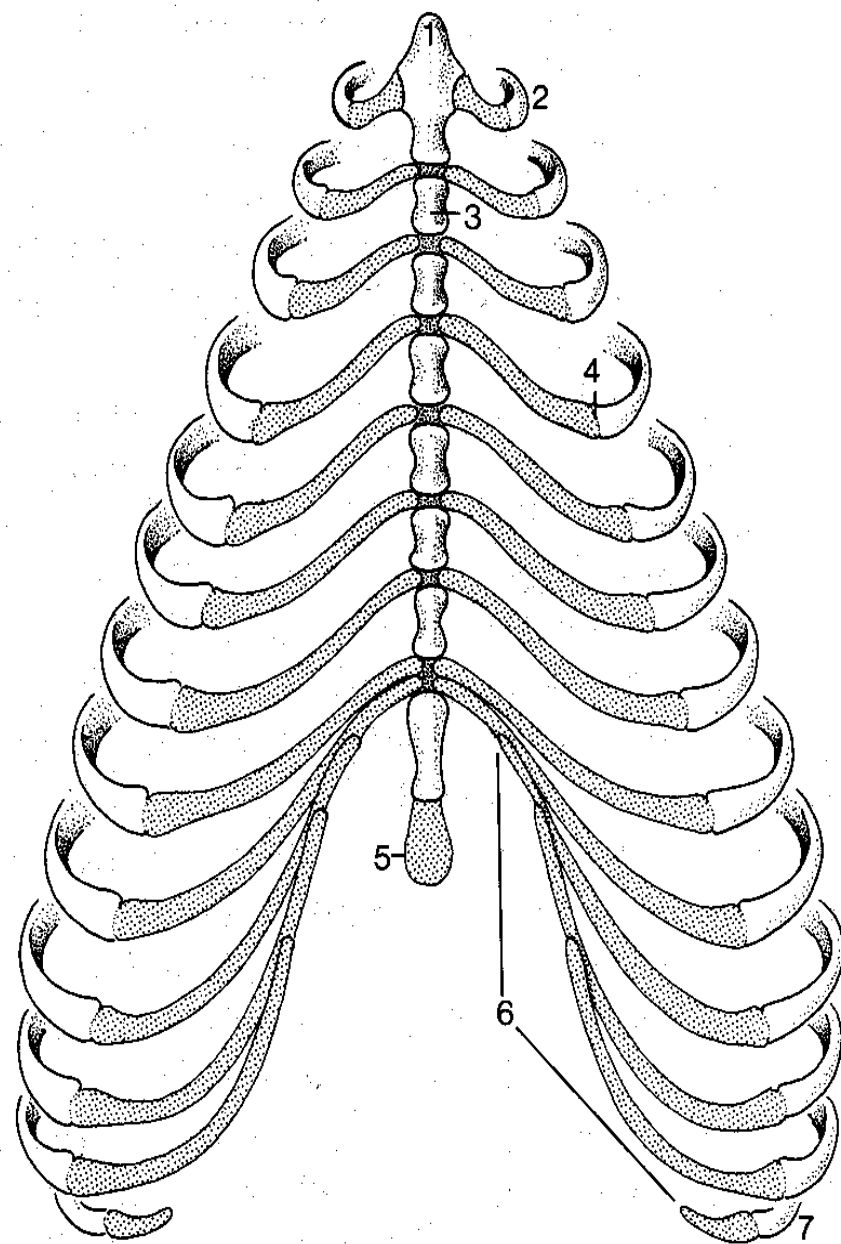


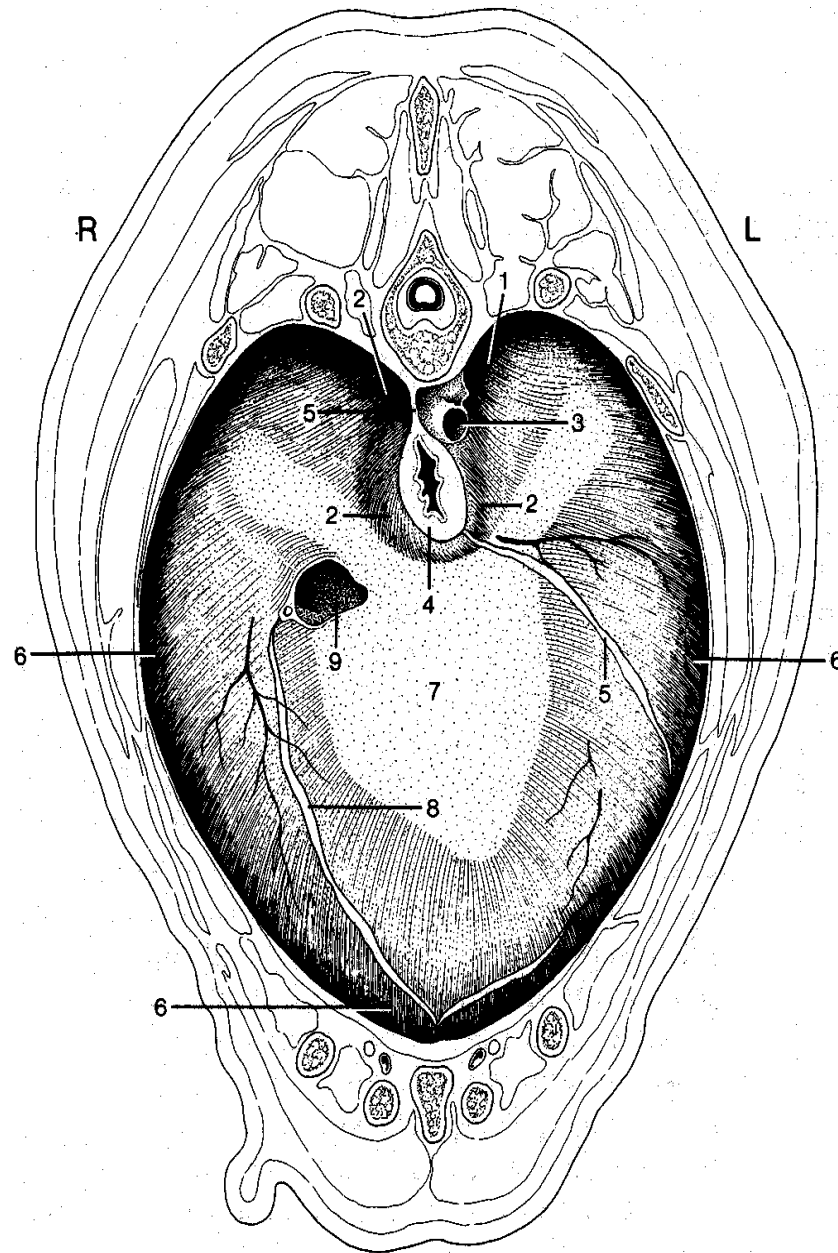


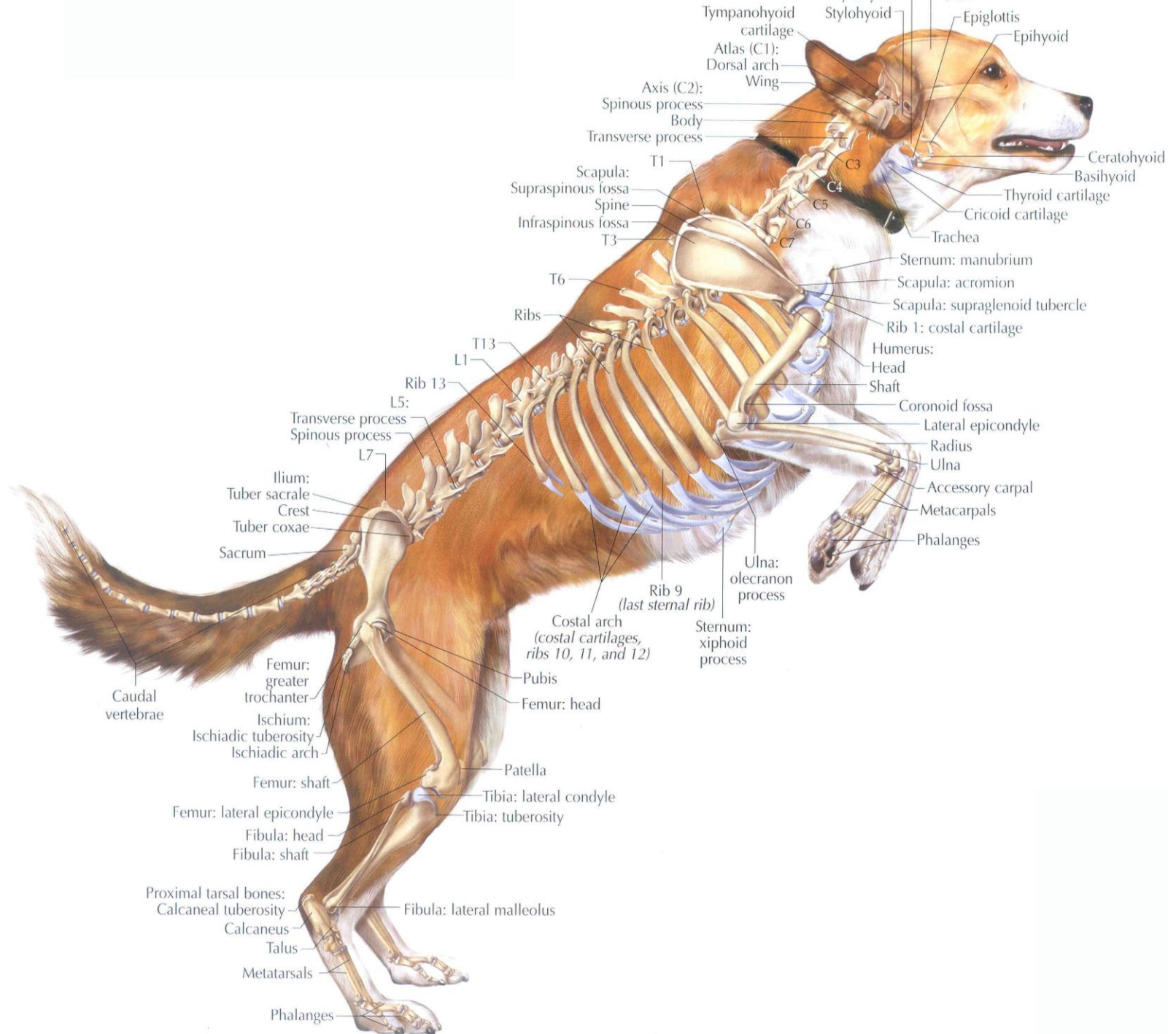


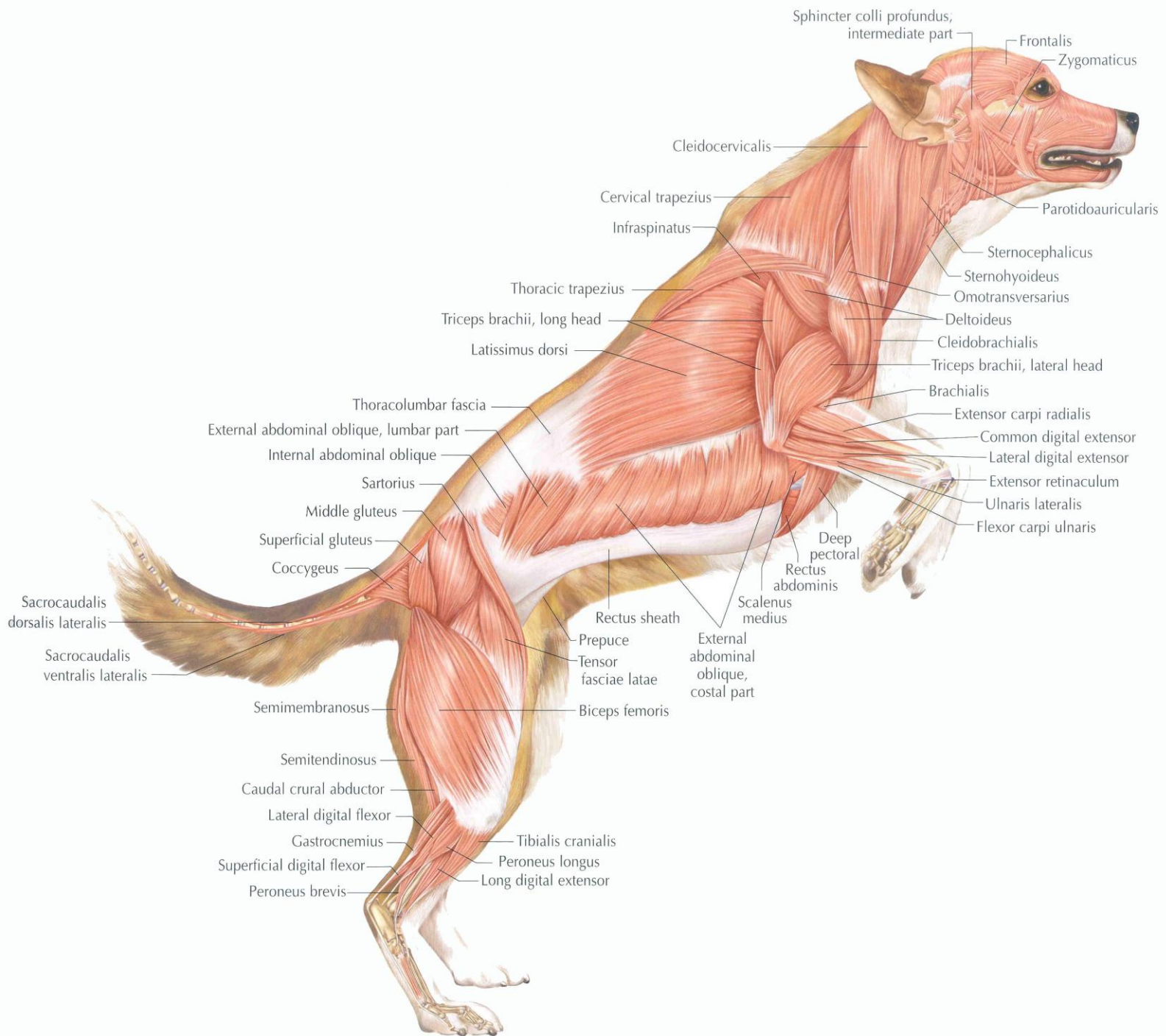


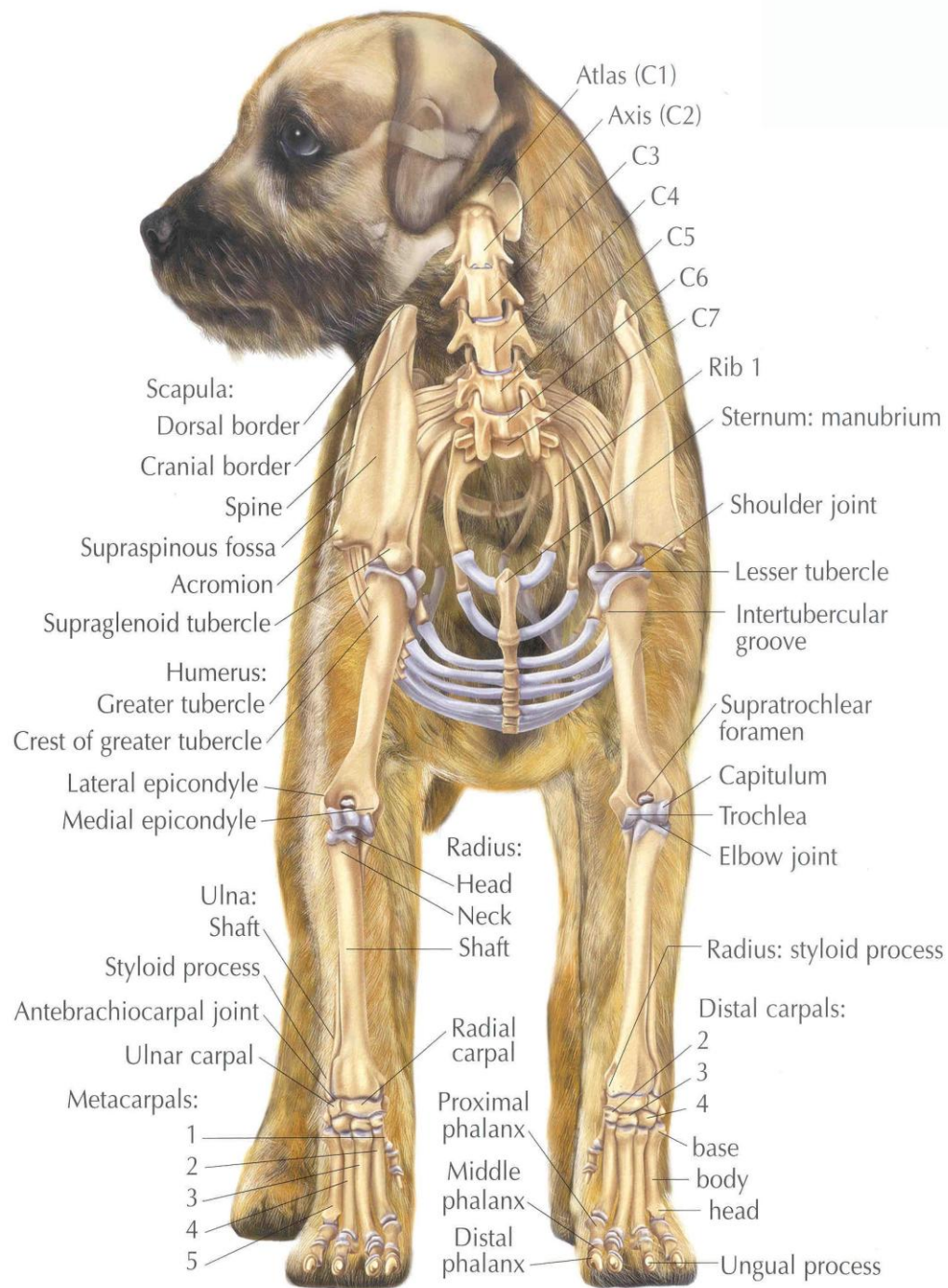


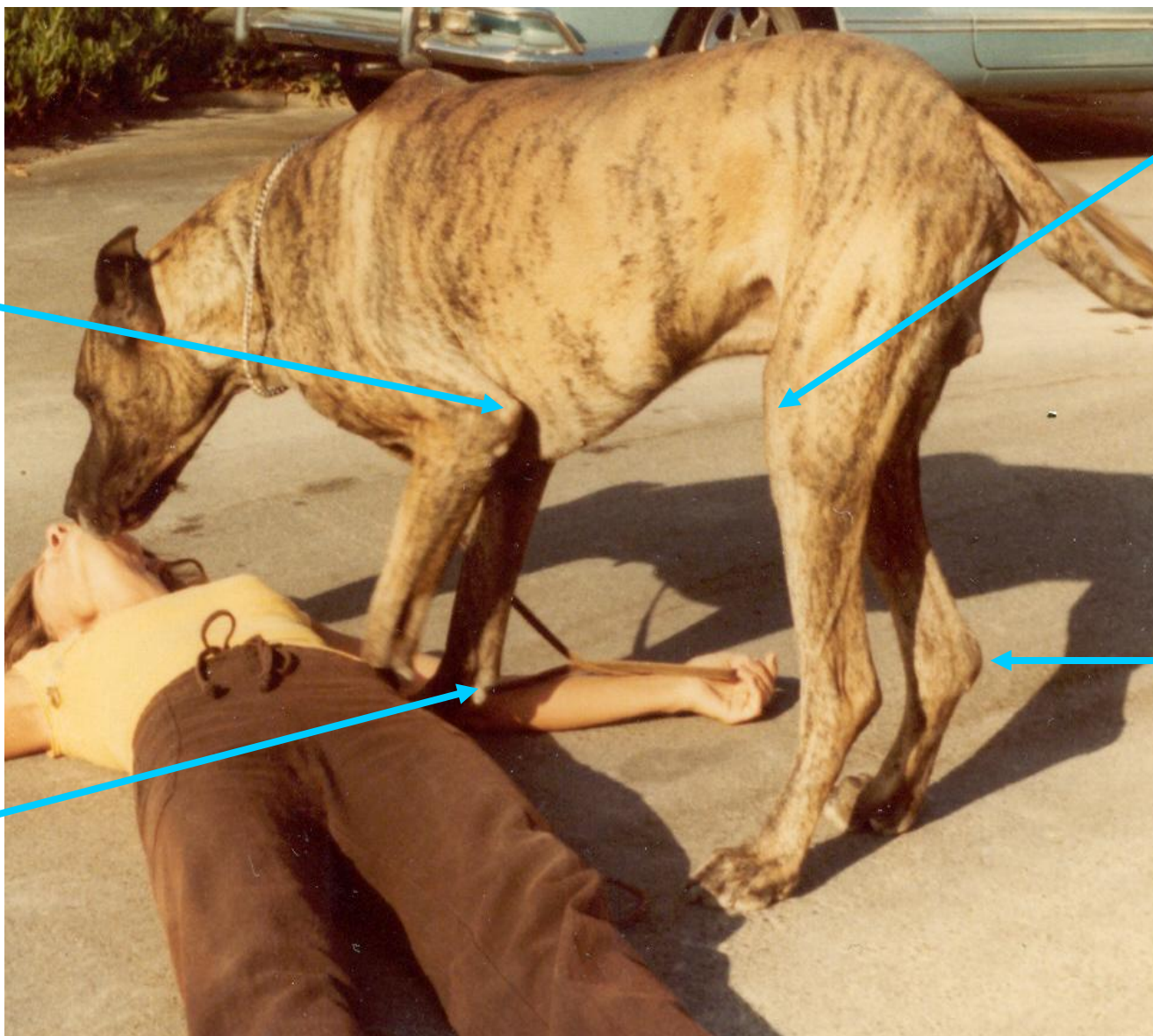












Elbow

Knee

Heel

Wrist



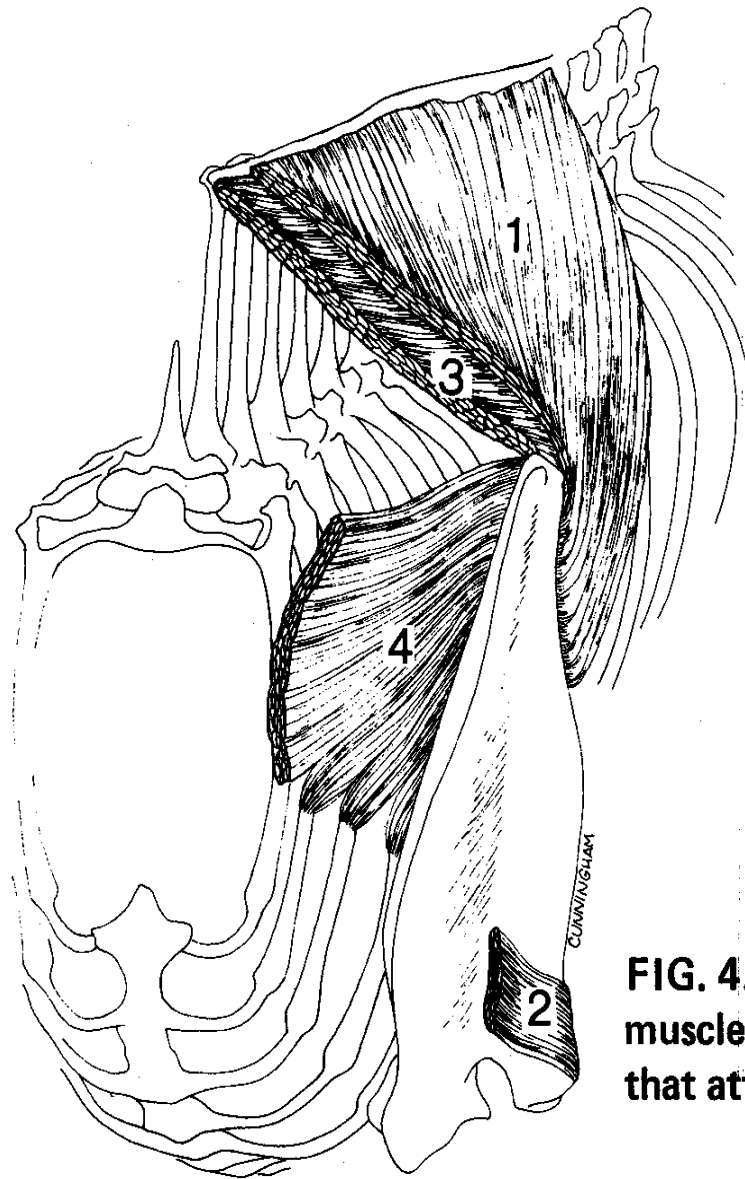
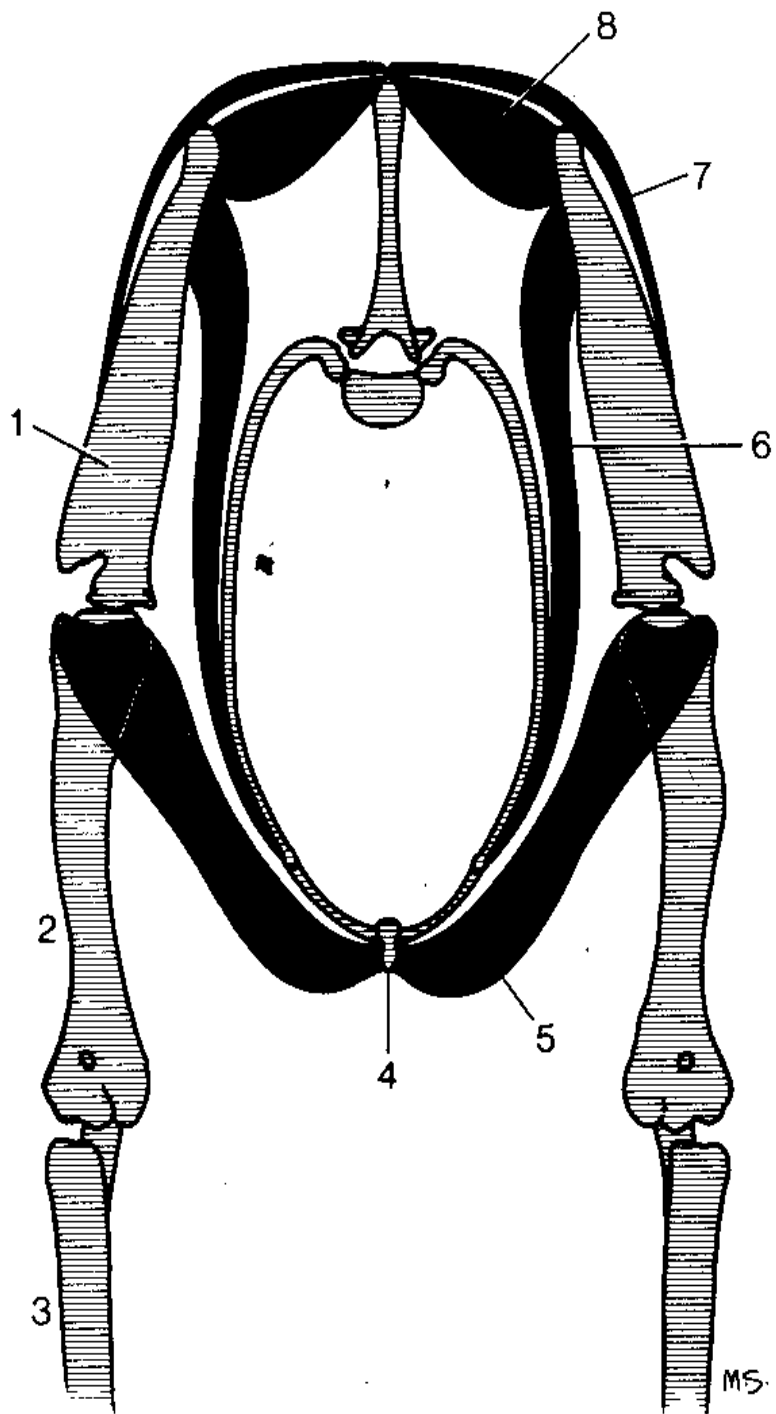
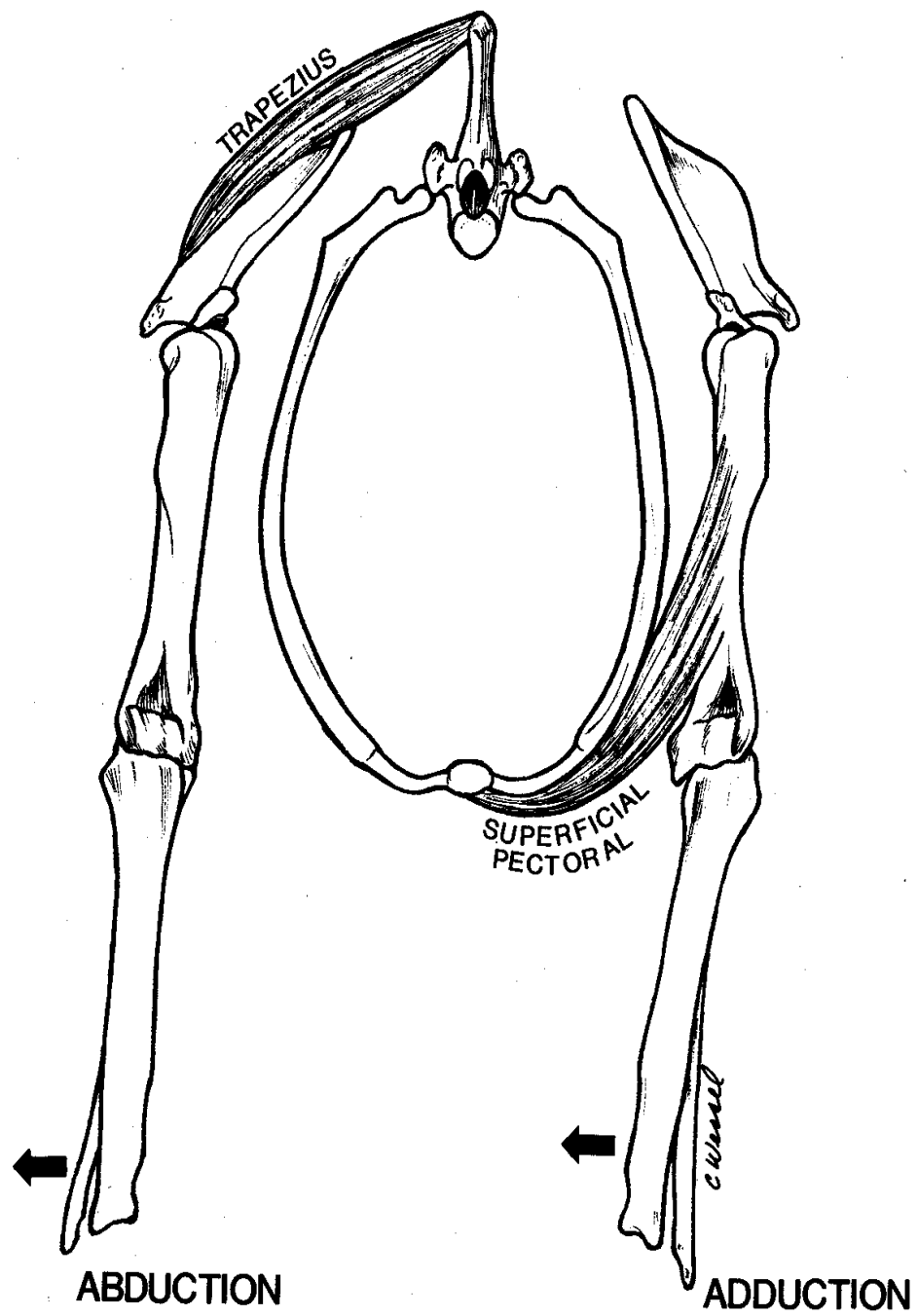


FIG. 4.35.
 muscles: cr
 that attach



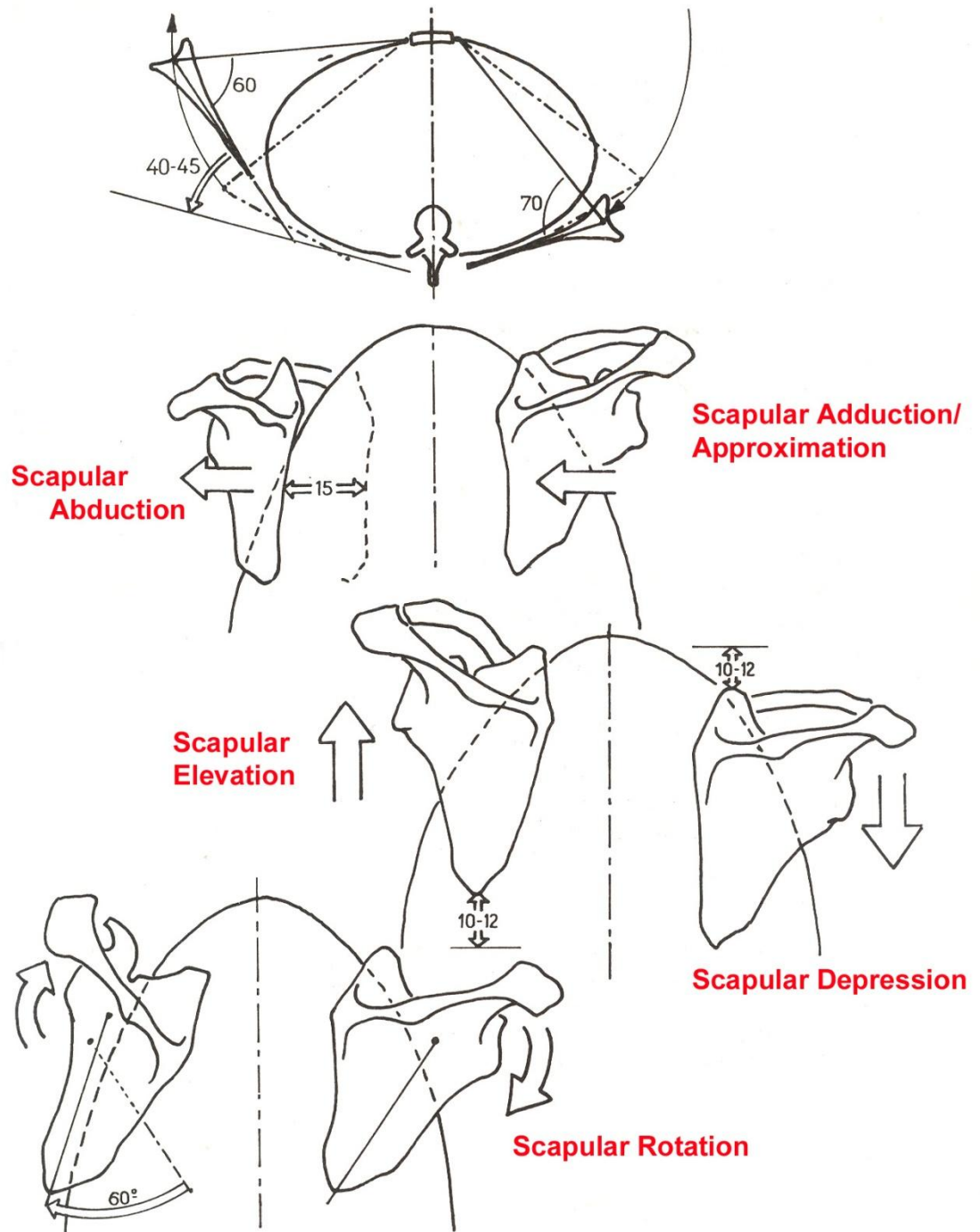


Major Concerns:

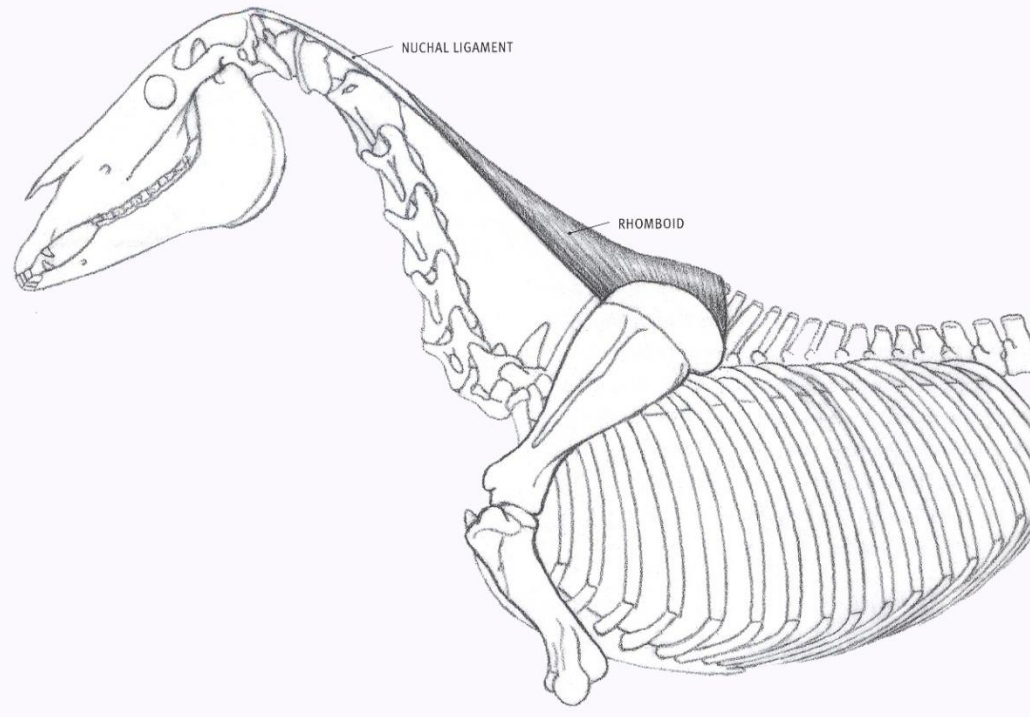
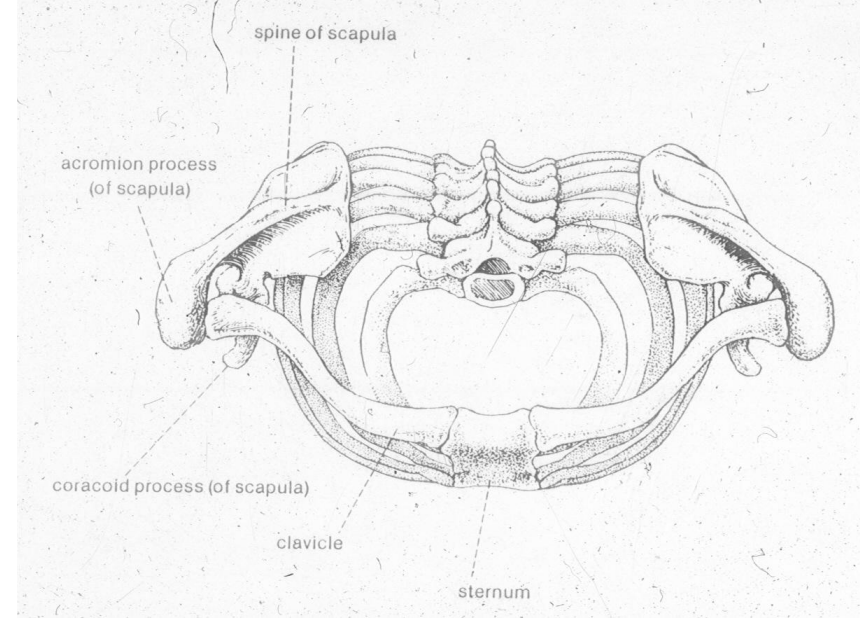
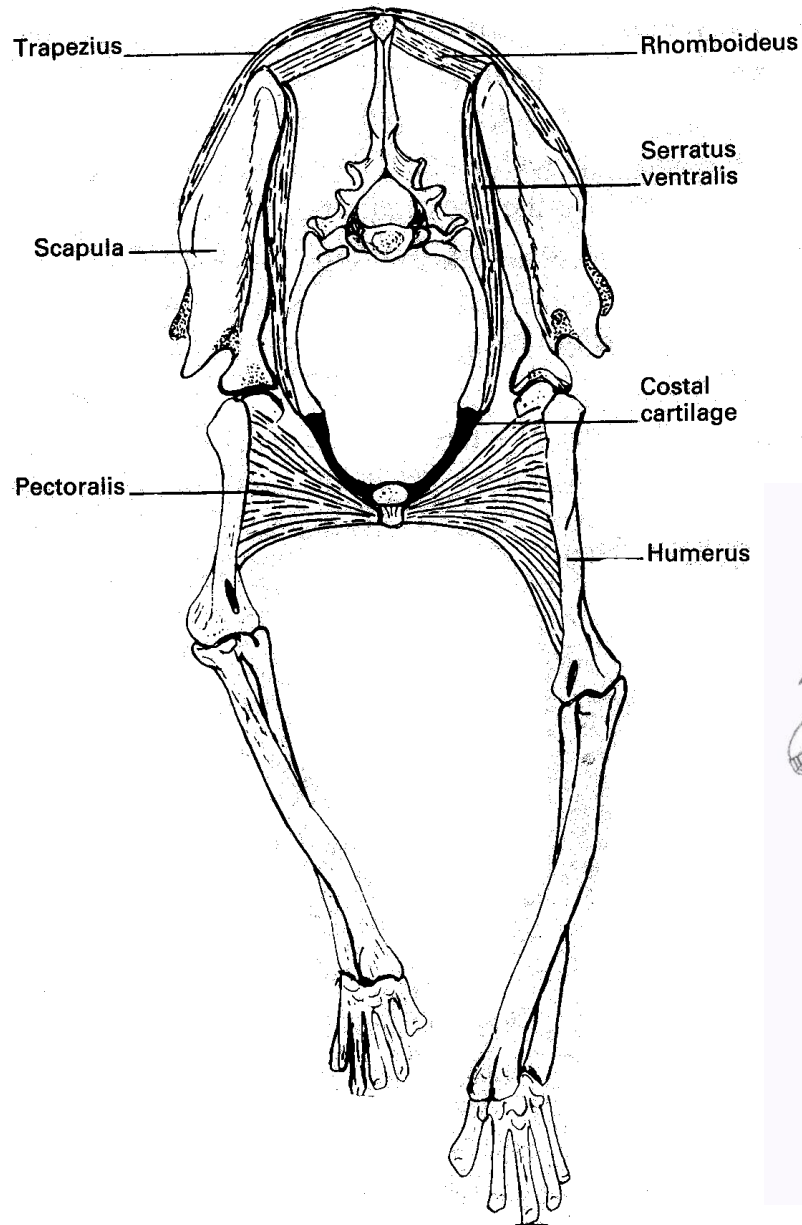
- Carnivores
- Small to Medium Herbivores
- Large Herbivores (Giraffes, Elephants, and others)
- Shoulders are (always) a Pain

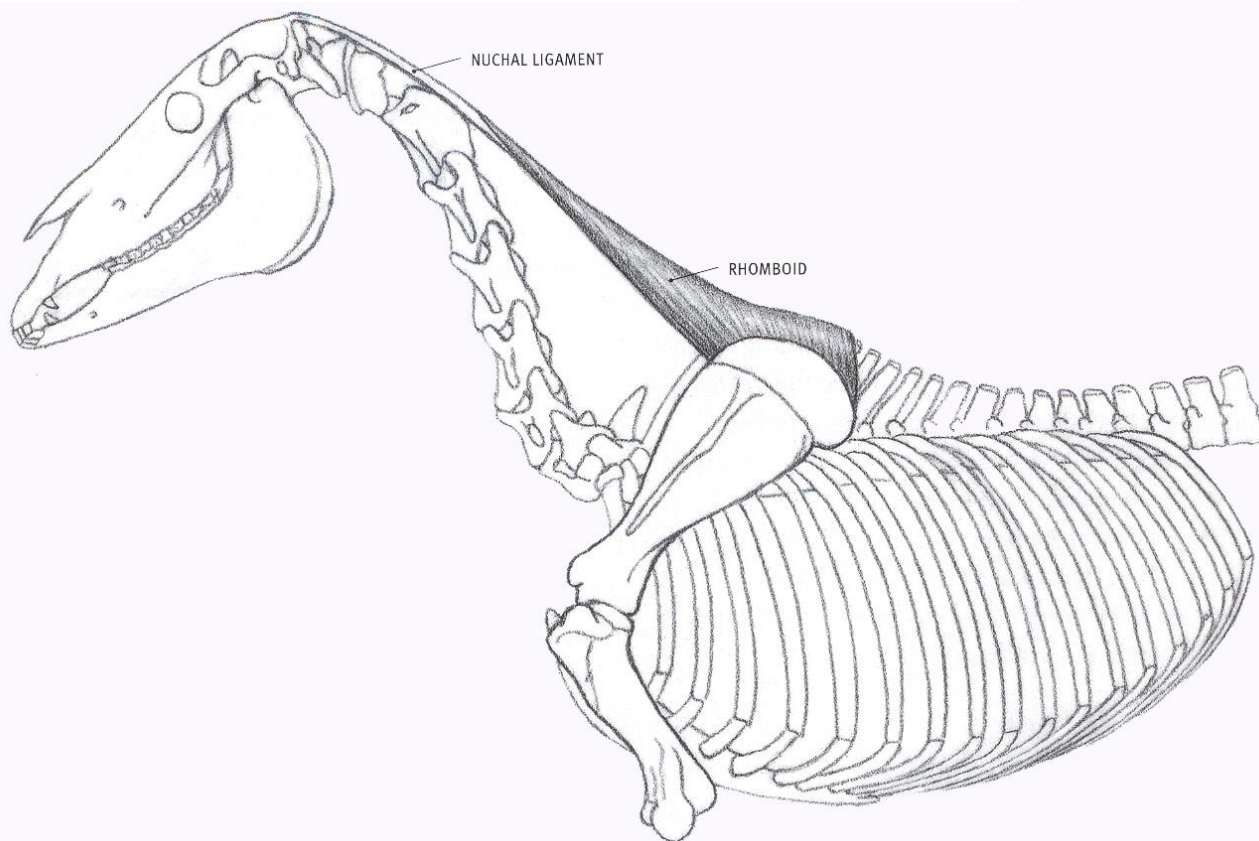
MOVEMENTS OF THE HUMAN SCAPULA

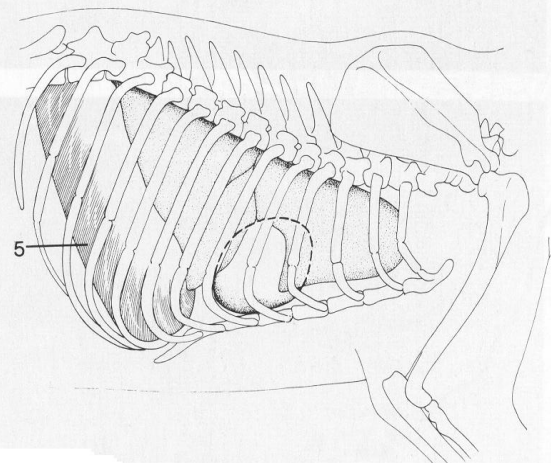
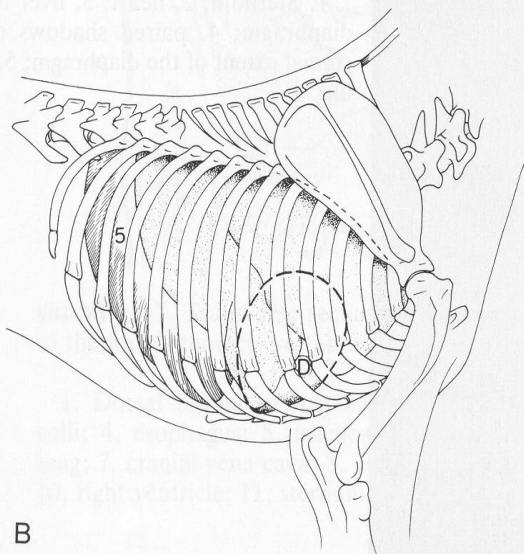
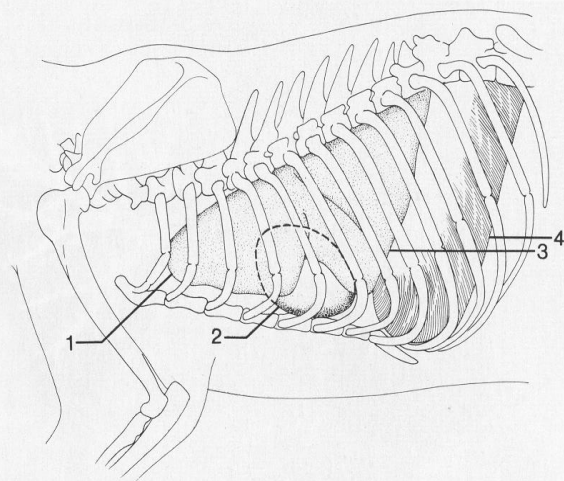
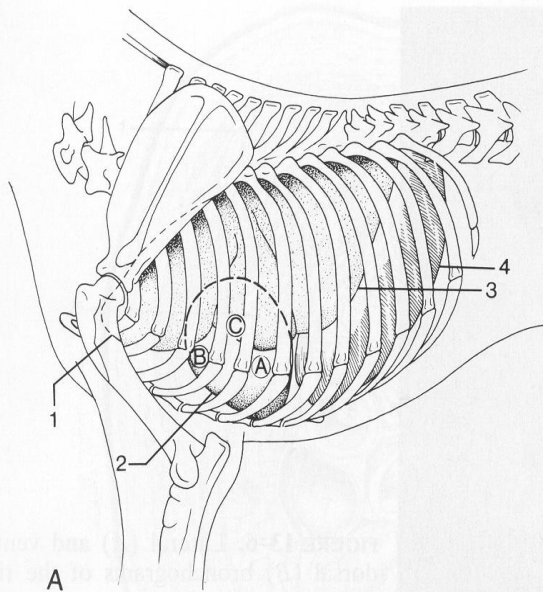
(More on this
in part iii.)

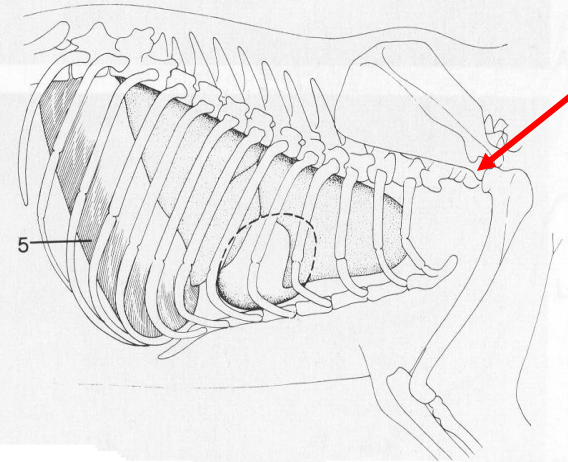
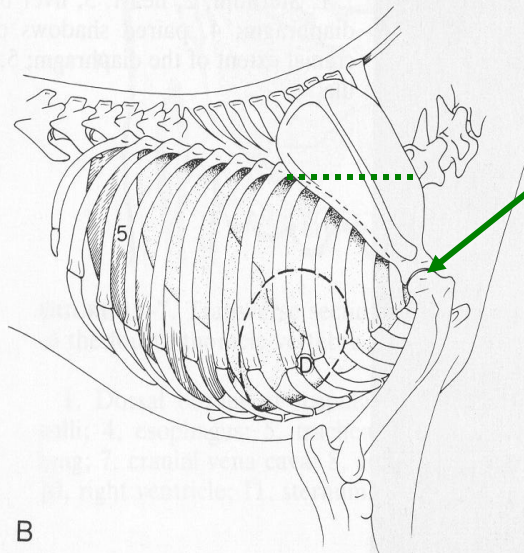
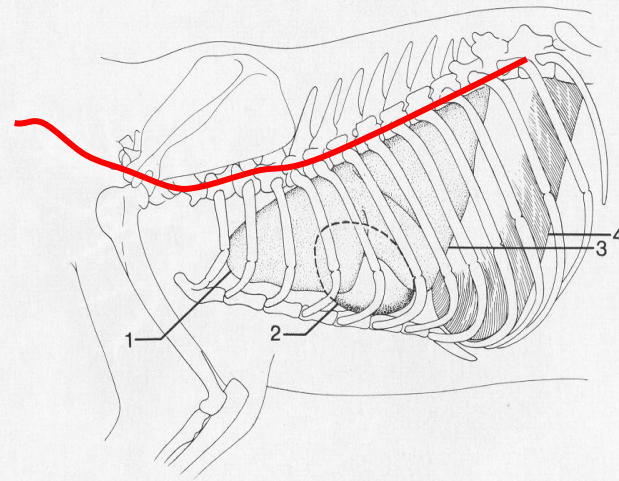
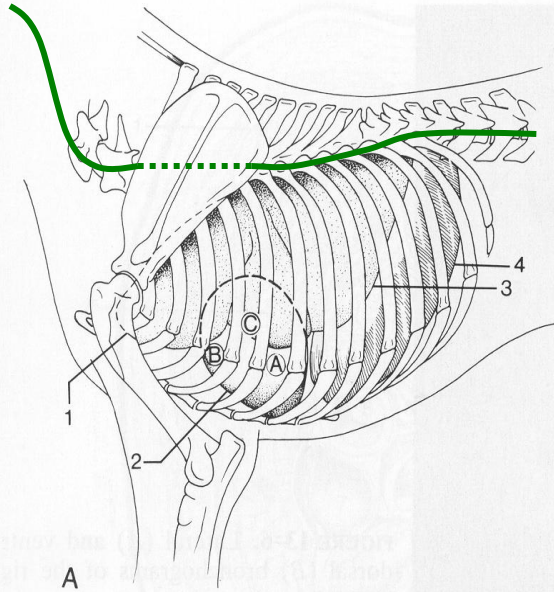


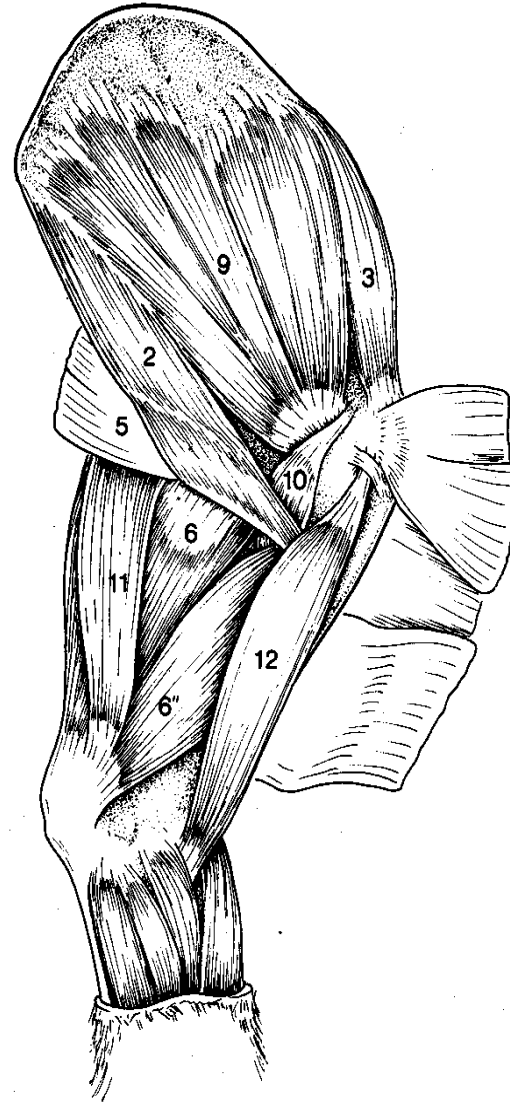
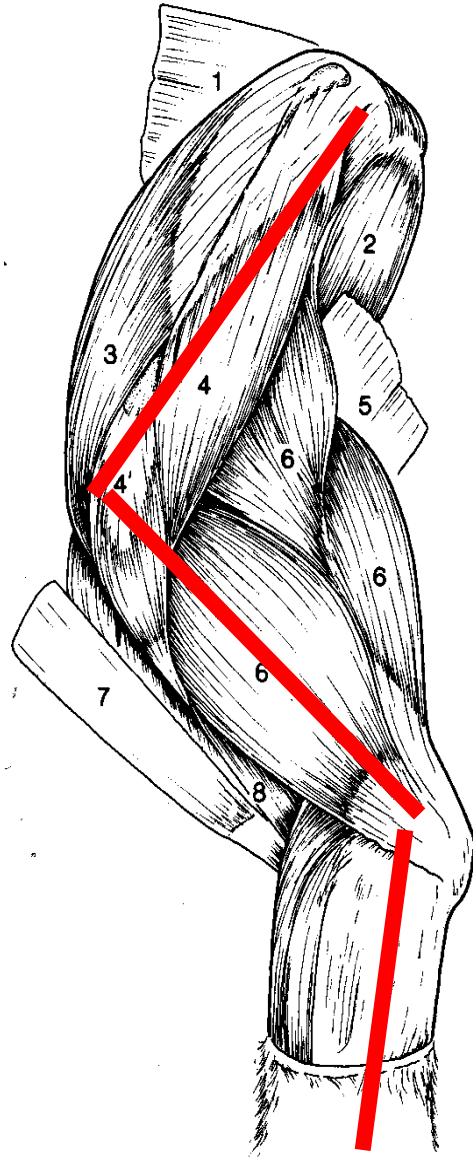
Shoulders are Always a Pain











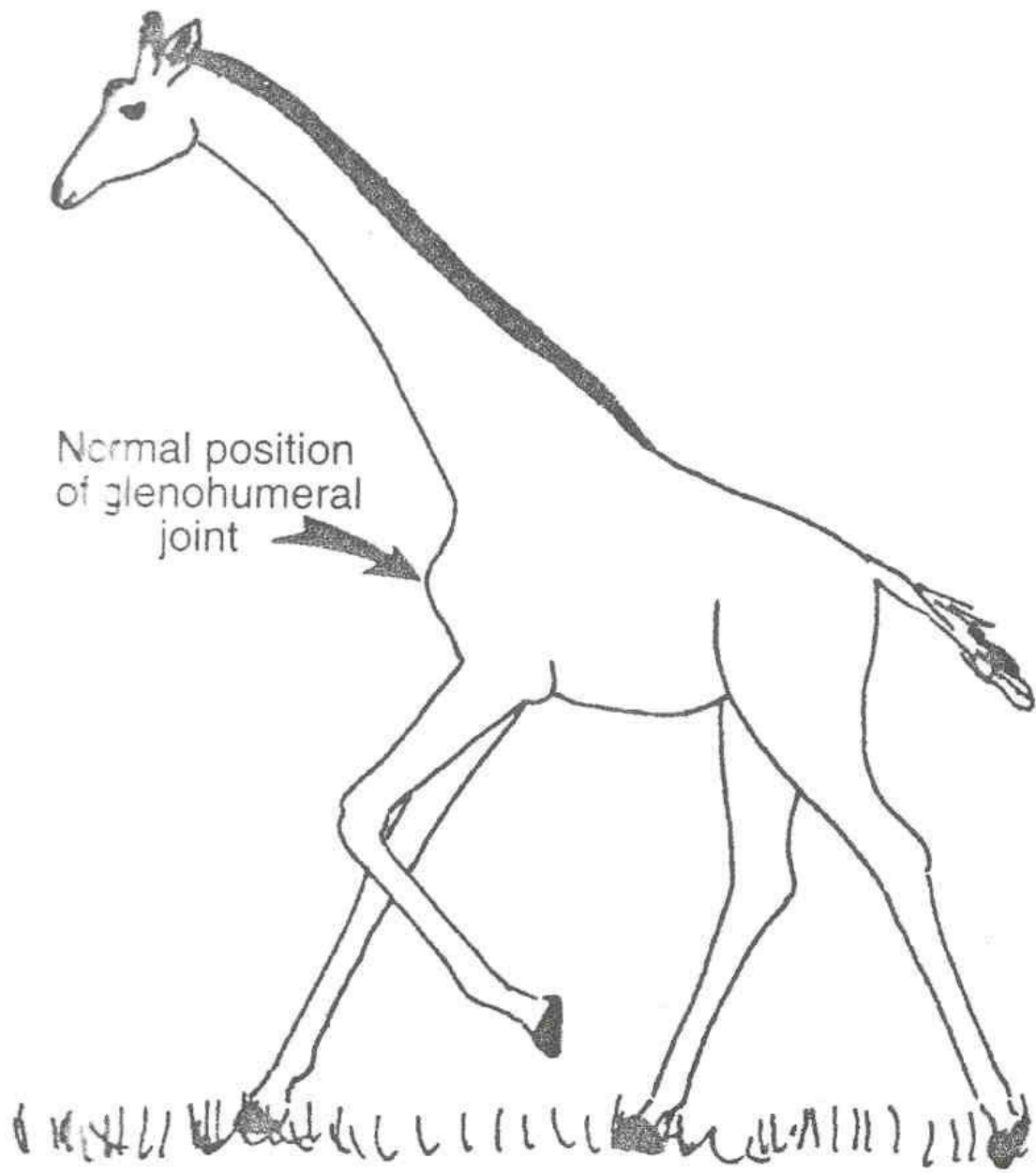
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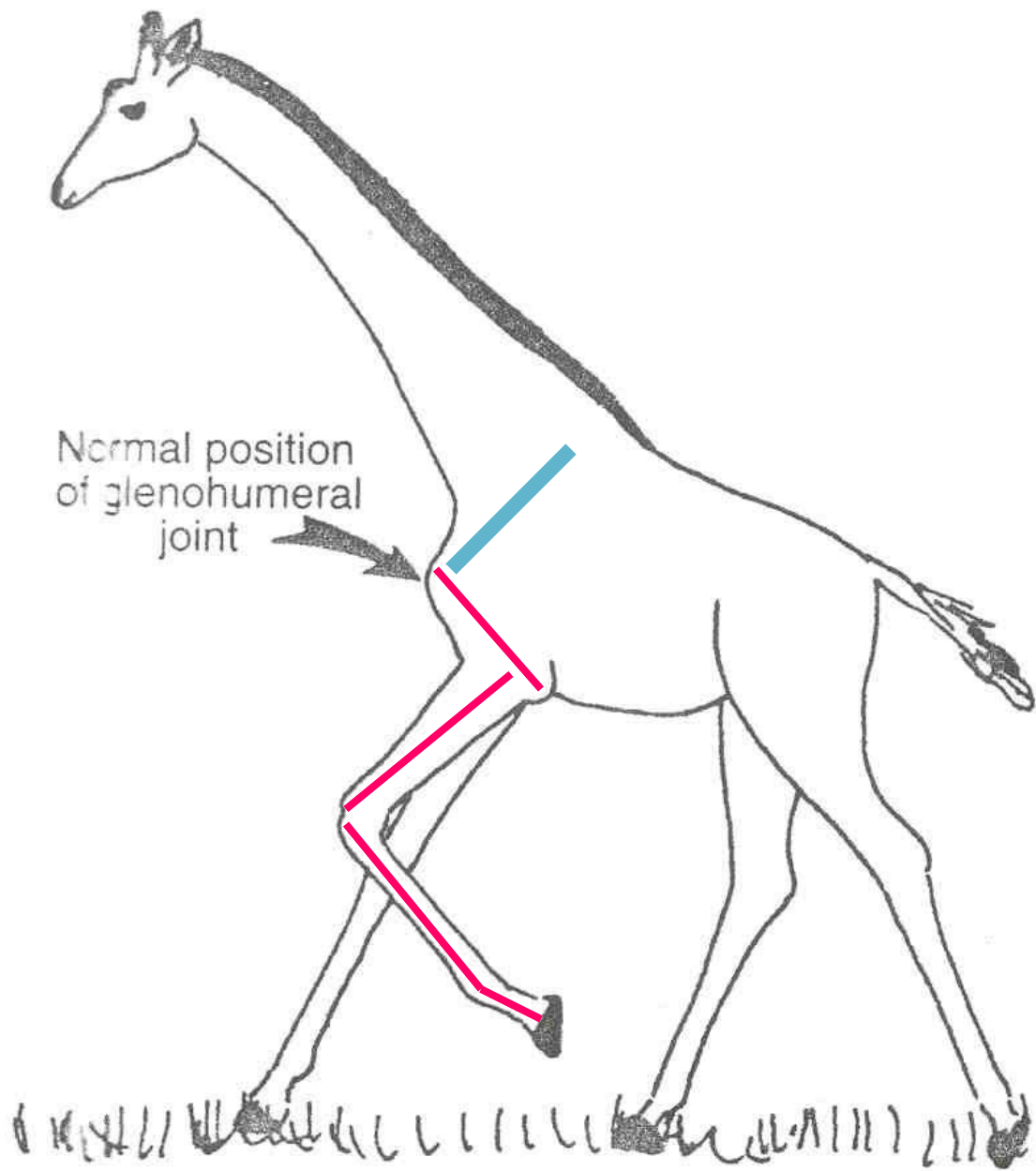


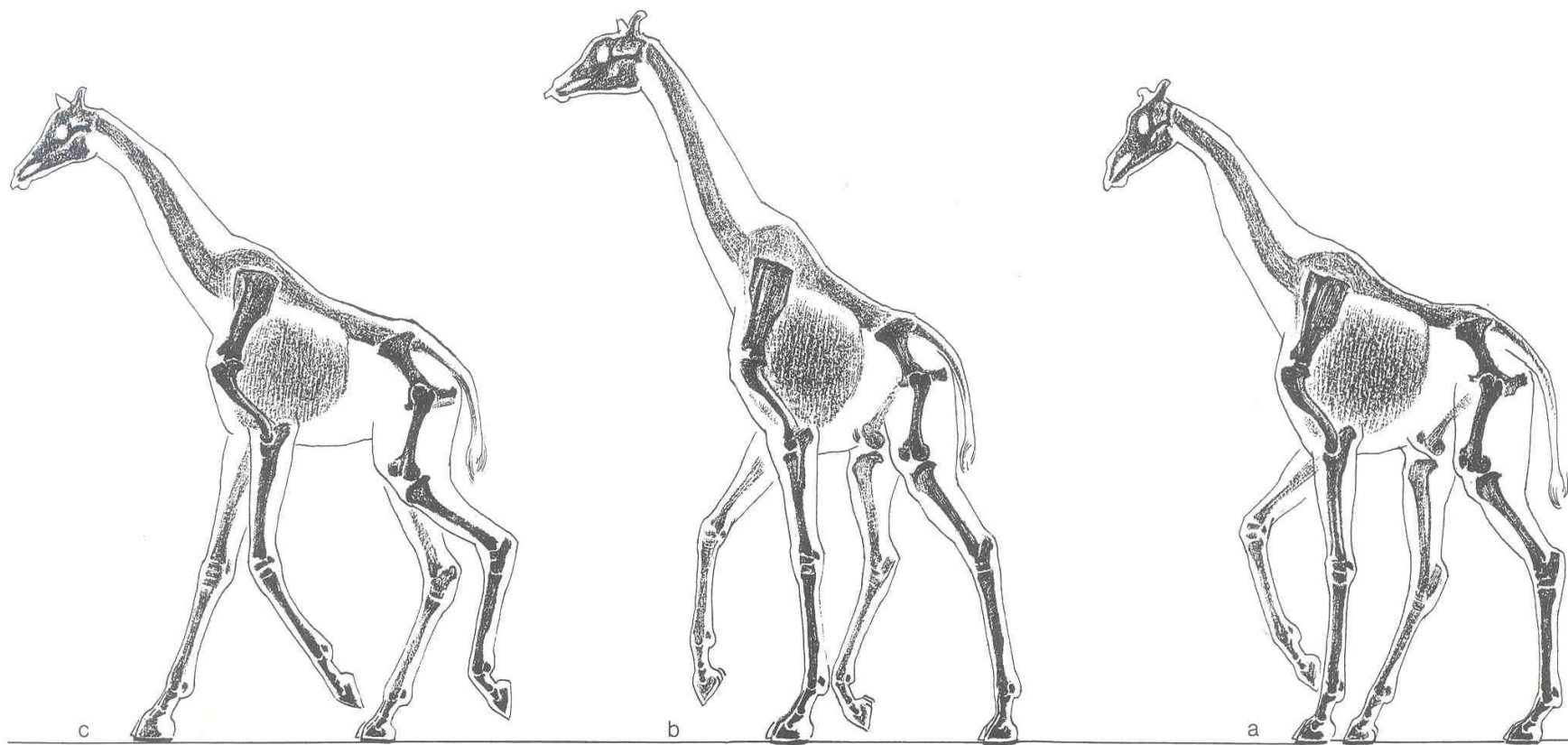






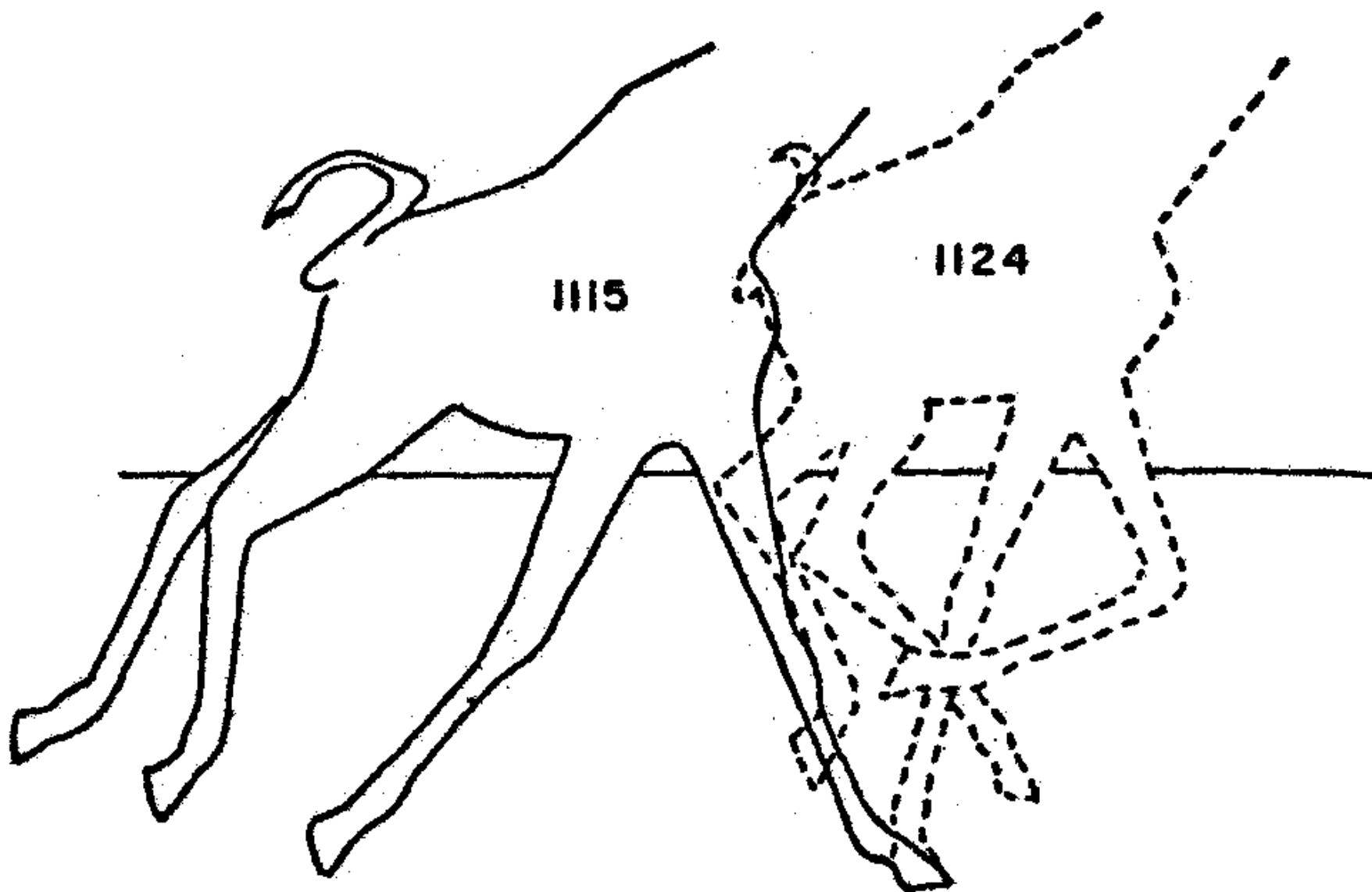
Normal position
of glenohumeral
joint

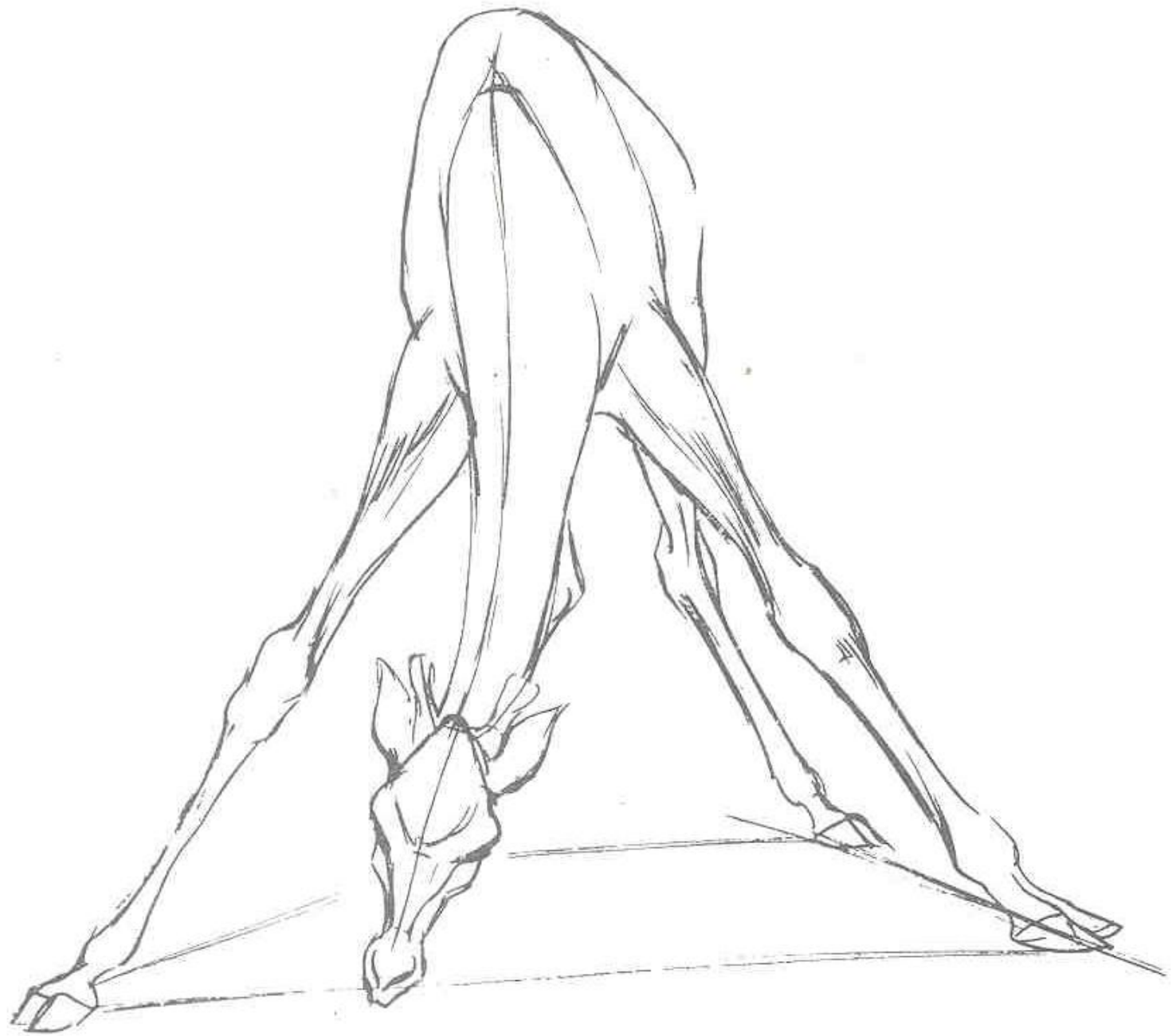




III5

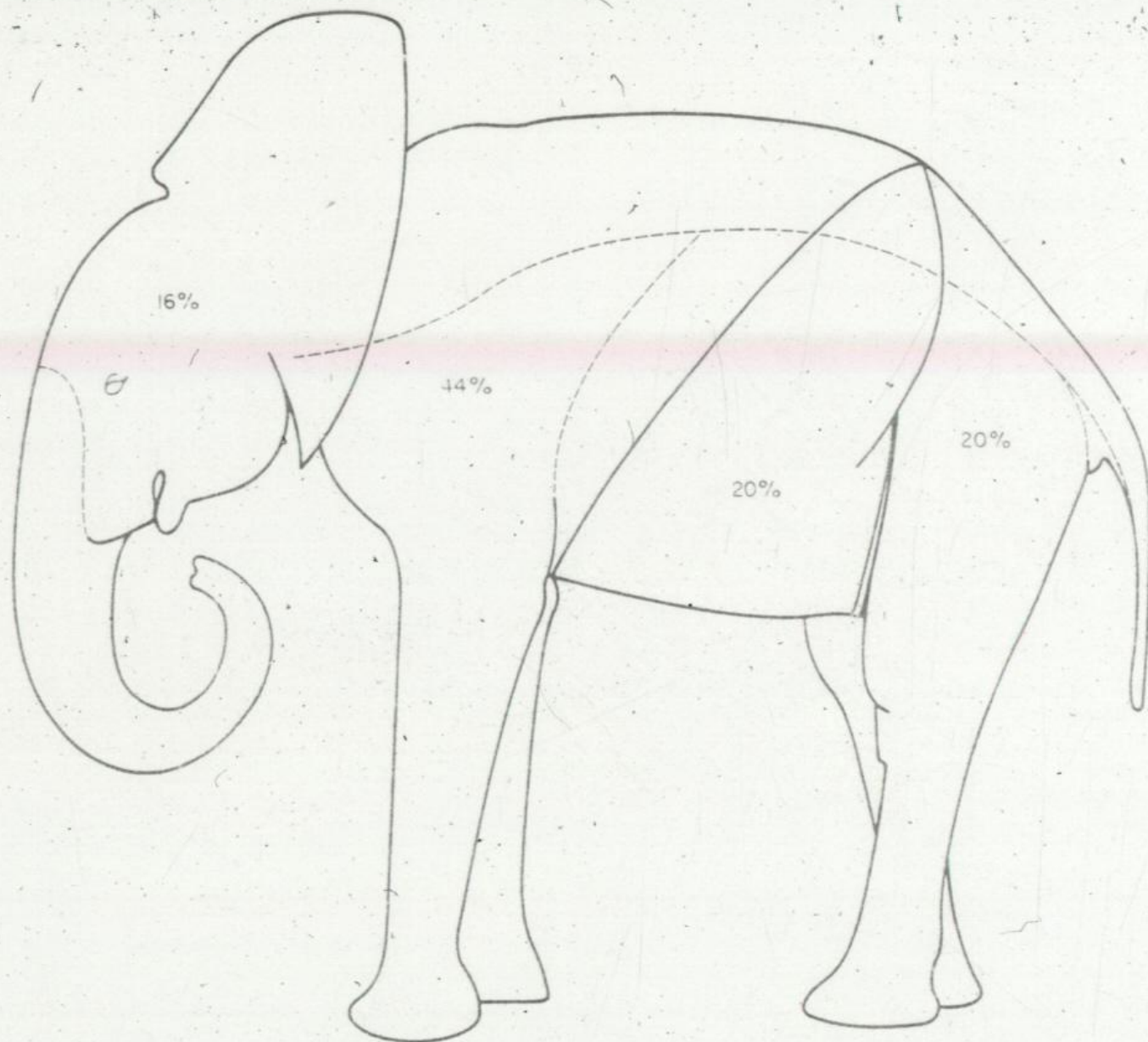
II24





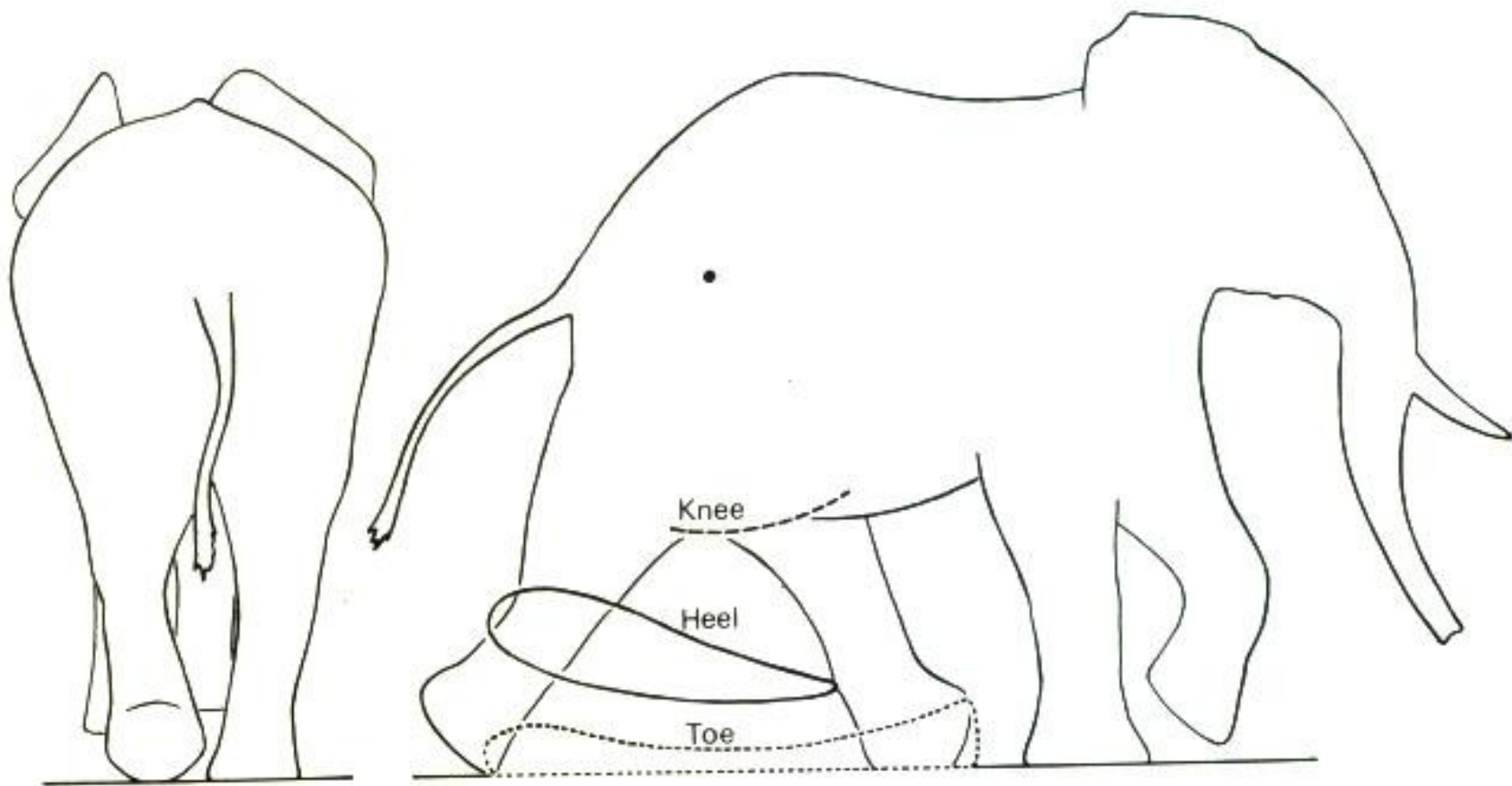


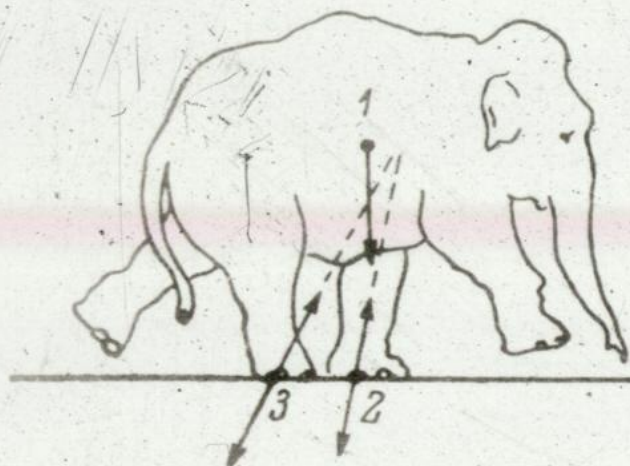




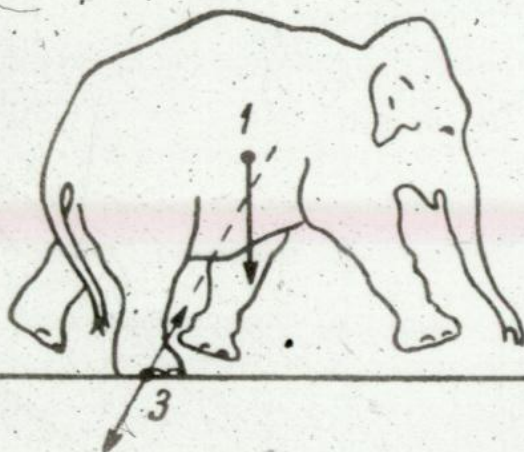
Approx 60% carried
on fore legs

Approx 40% carried
on hind legs

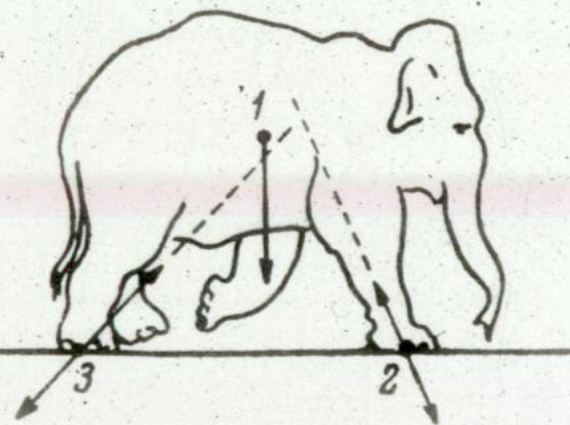




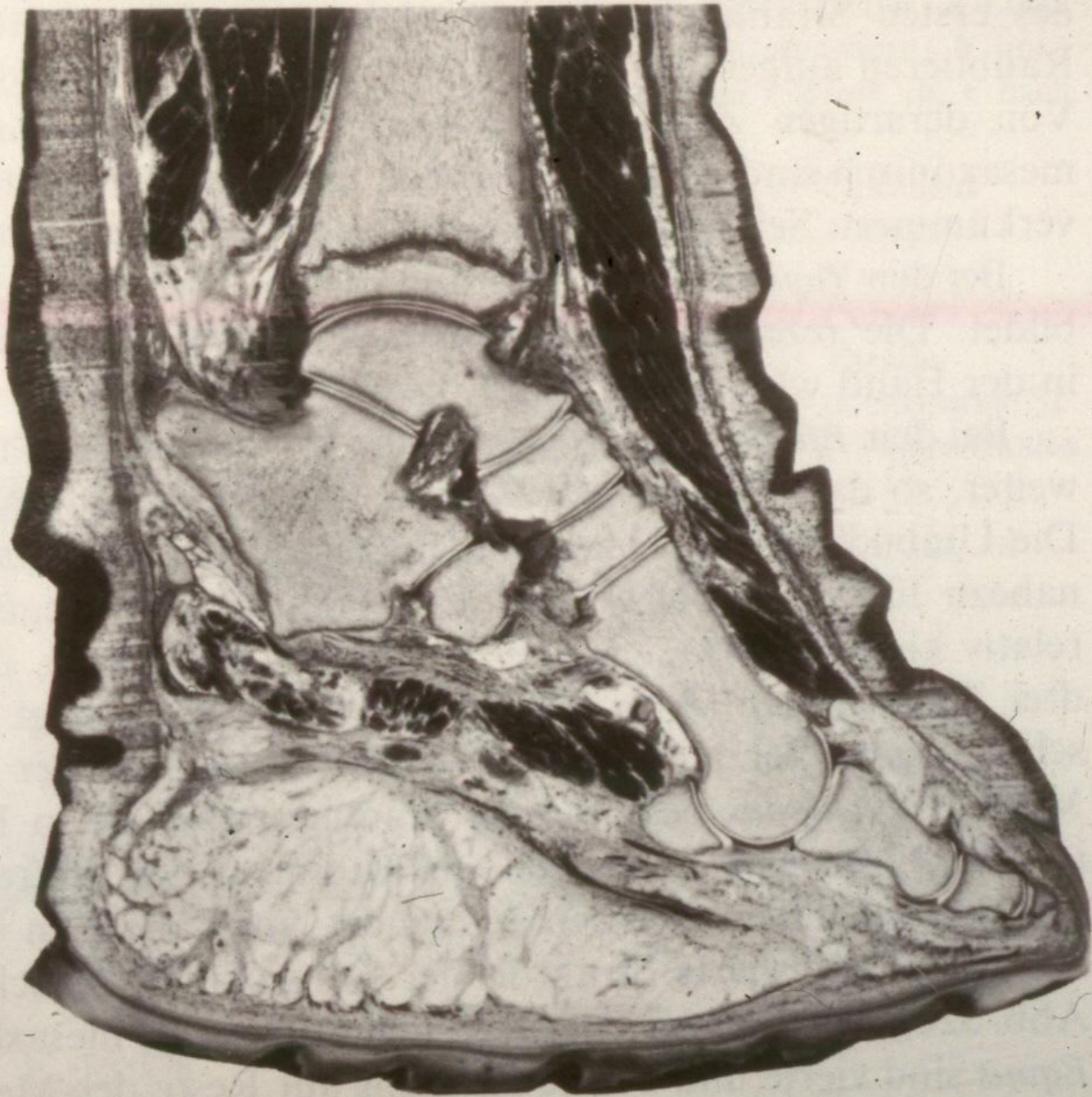
A



B



C

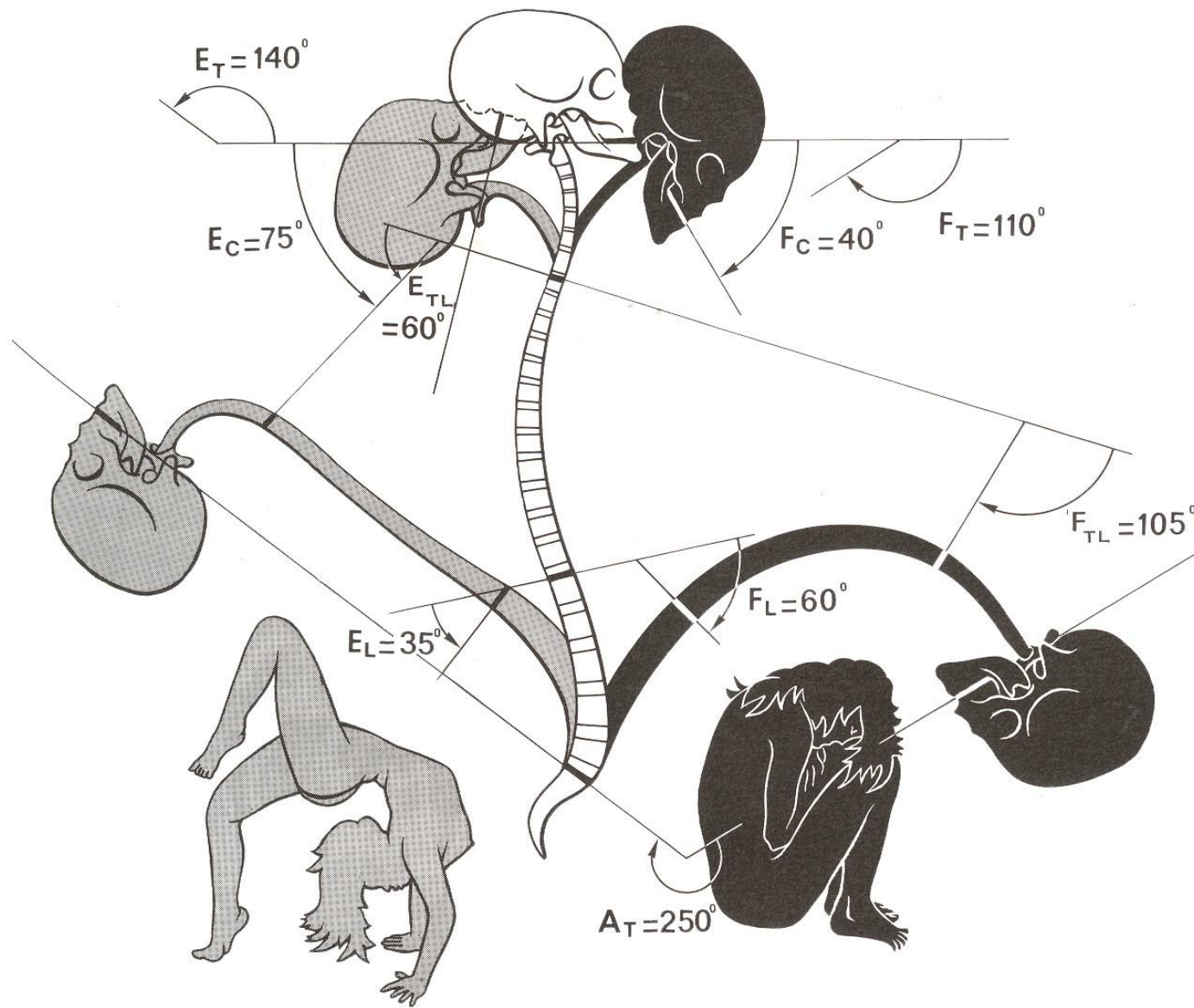




animex workshops 2010

SKELETONS for ANIMATORS and RIGGERS

- i overview**
- ii case study (Schell Games and Disney Feature Animation)**
- iii particularly troublesome joints**



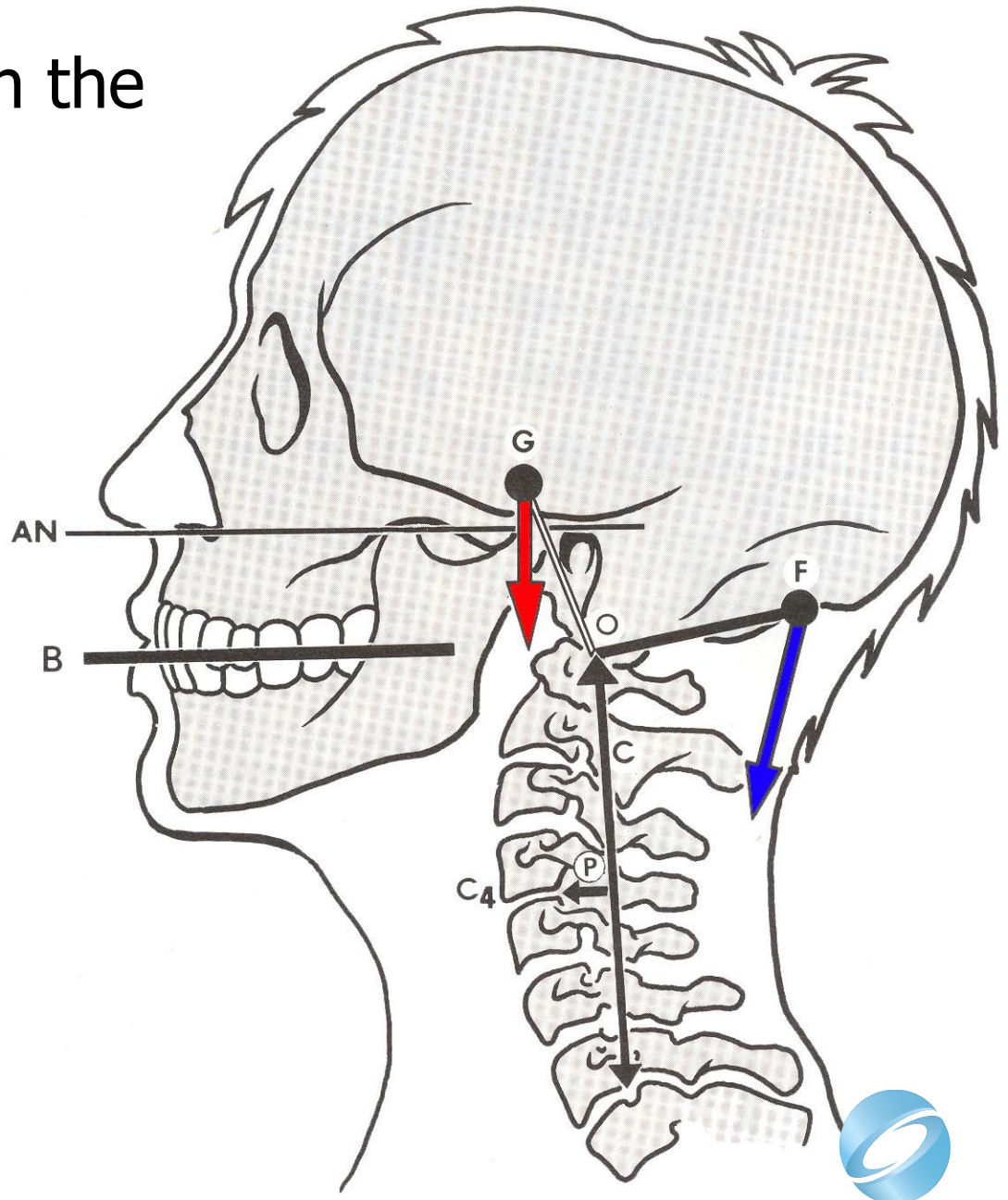
Support of the Skull on the Vertebral Column:

Your art teacher told you the skull is like a sphere balanced on a column constructed of four curves. (Well, sort of...)

Articulation of skull with backbone is the fulcrum.

Overall weight of skull, including slightly larger frontal and face regions causes head to tilt slightly forward of fulcrum.

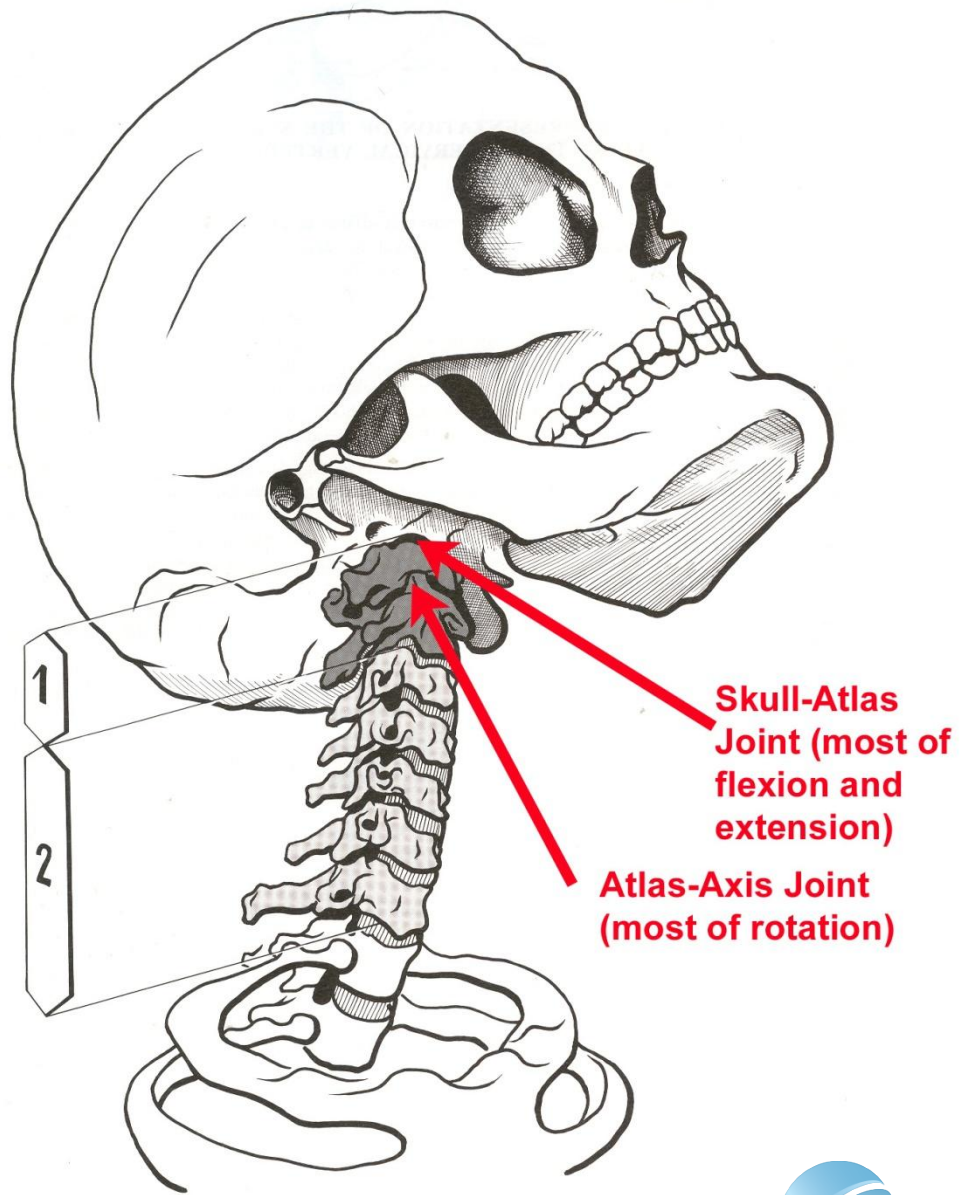
Posterior neck muscles provide balancing forces (as do some others).



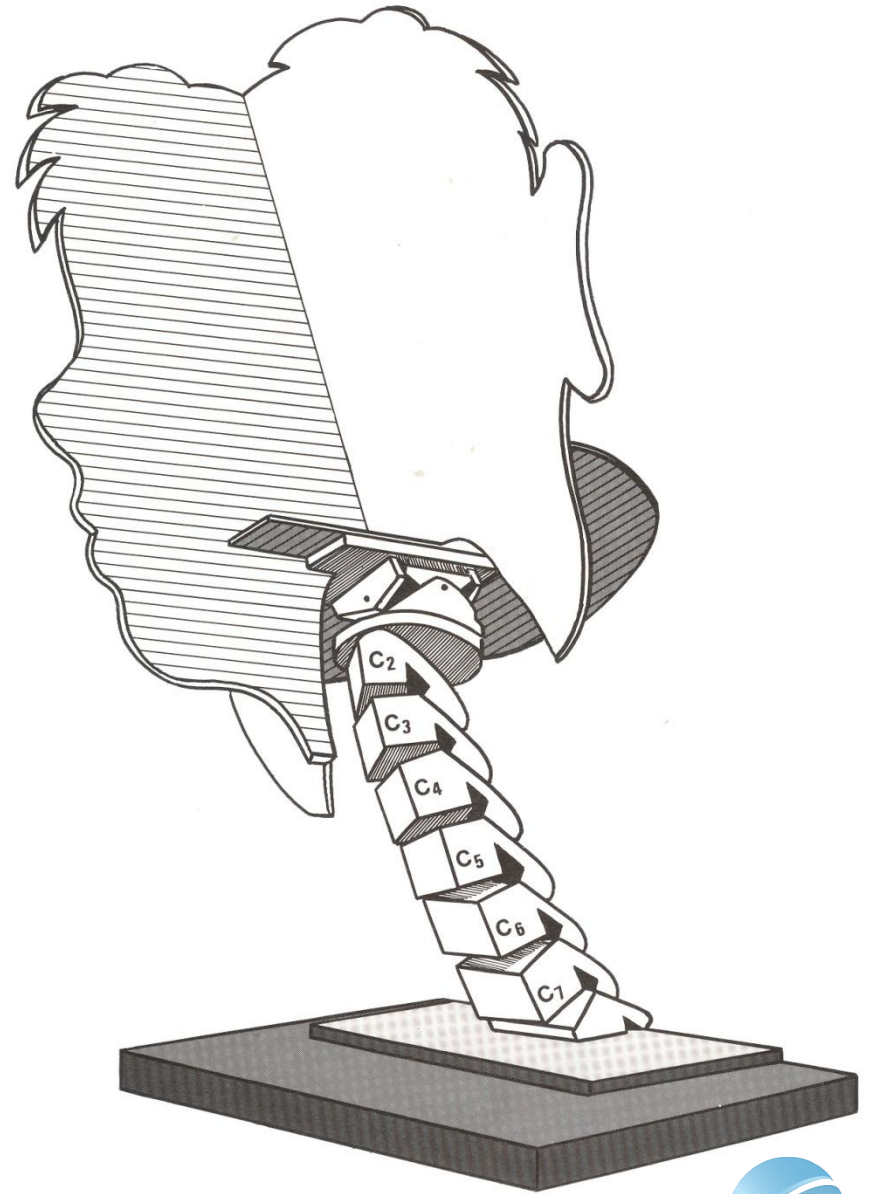
Most of the neck's elements (cervical vertebrae) act in an additive manner (Region 2).

However, the two superior-most elements, the **ATLAS** and **AXIS** vertebrae respectively (Region 1), are highly specialized providing movements that are extremely characteristic of mammals in general and humans in particular.

Atlas-Axis
Region



Note the difference in representation of potential movements of the first two elements and their integration with the skull.

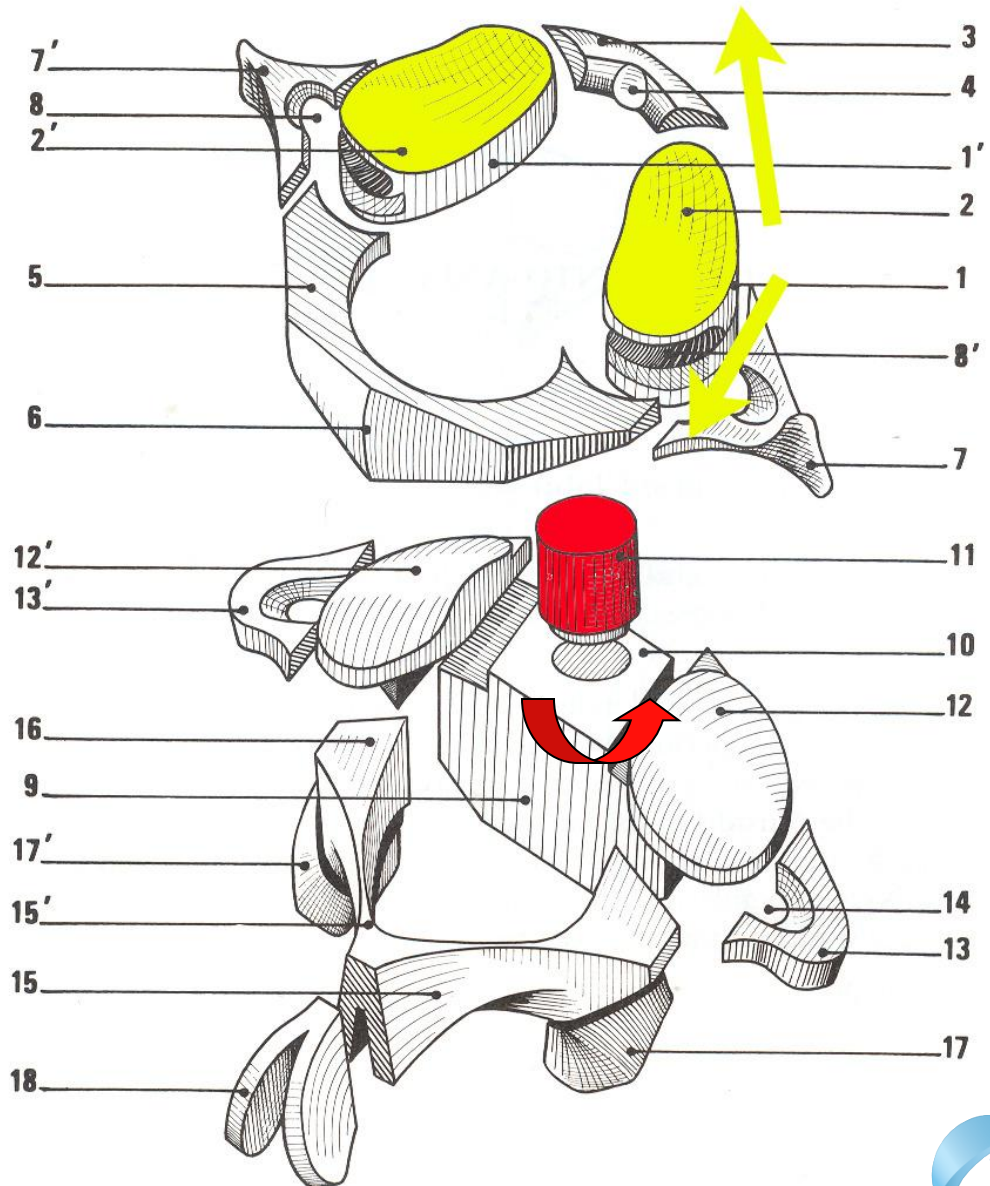


ARTICULAR SURFACES OF THE ATLAS-AXIS COMPLEX:

Flexion and Extension take place at the joint between the skull and the atlas vertebra.

Rotatory movement takes place at the atlas-axis joint.

Combining these movements into one functionally rigged joint presents the danger of the organism acting like a "bobble-head" doll.



MOVEMENTS OF THE SKULL-ATLAS-AXIS COMPLEX:

AXIAL ROTATION:

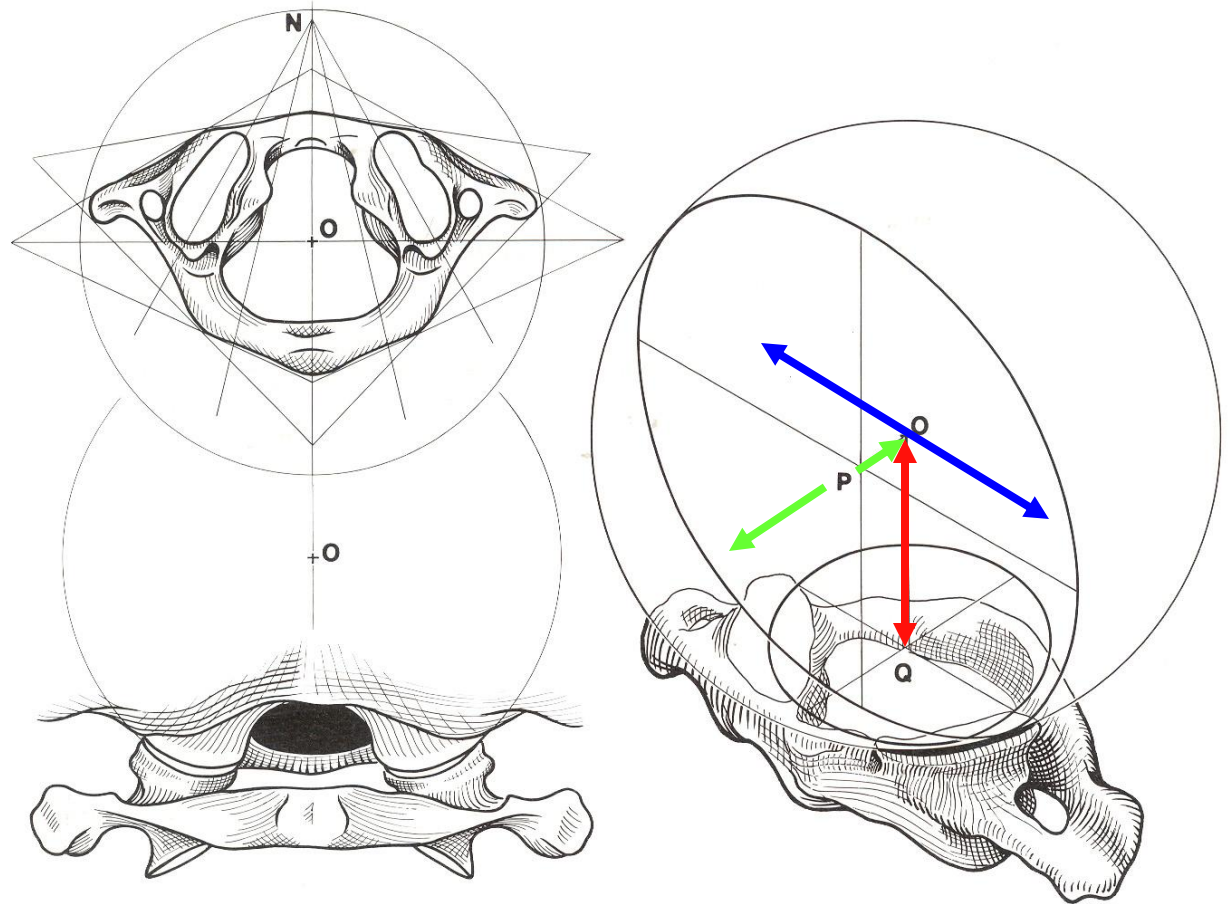
About vertical axis QO

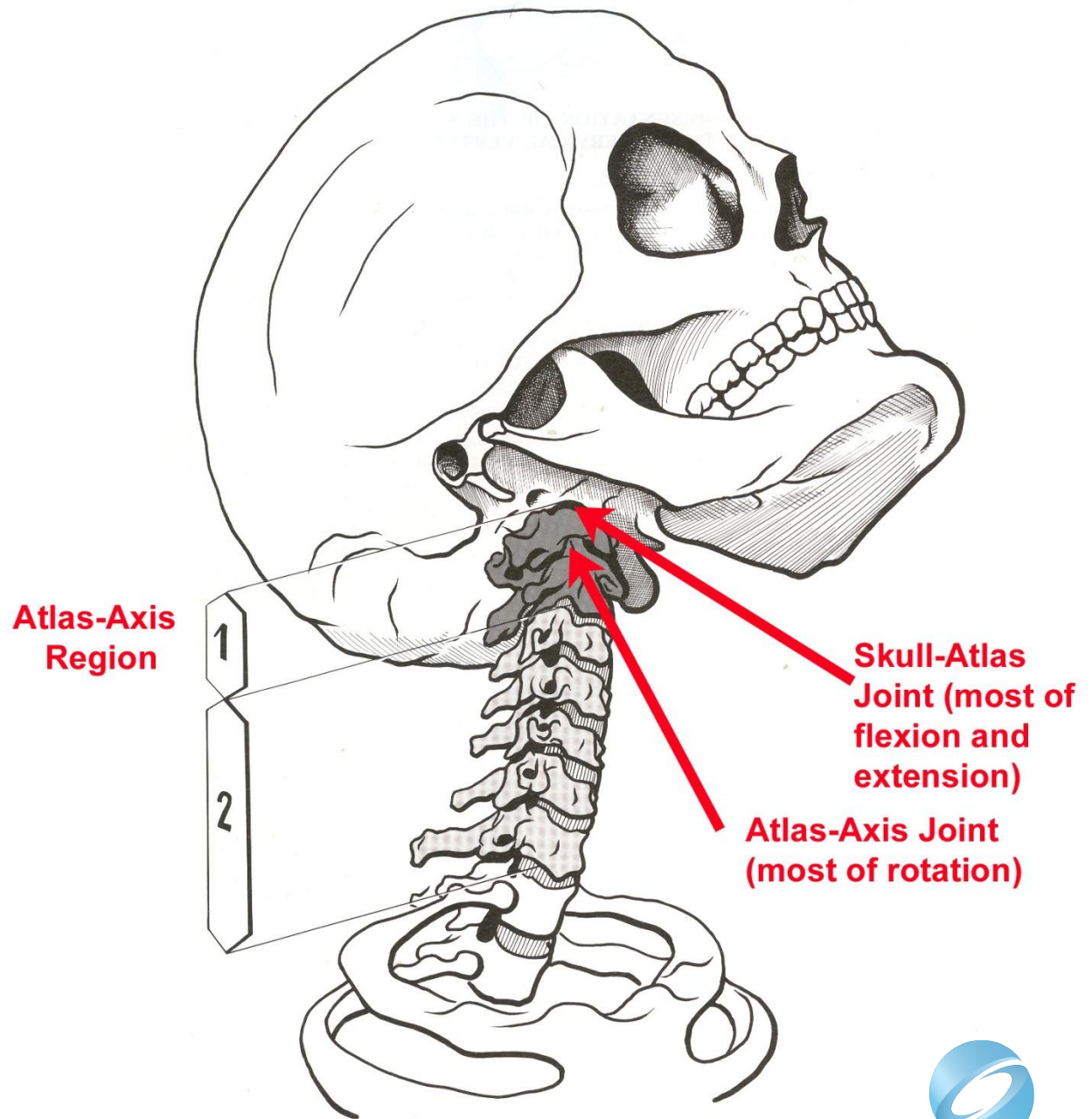
FLEXION/EXTENSION

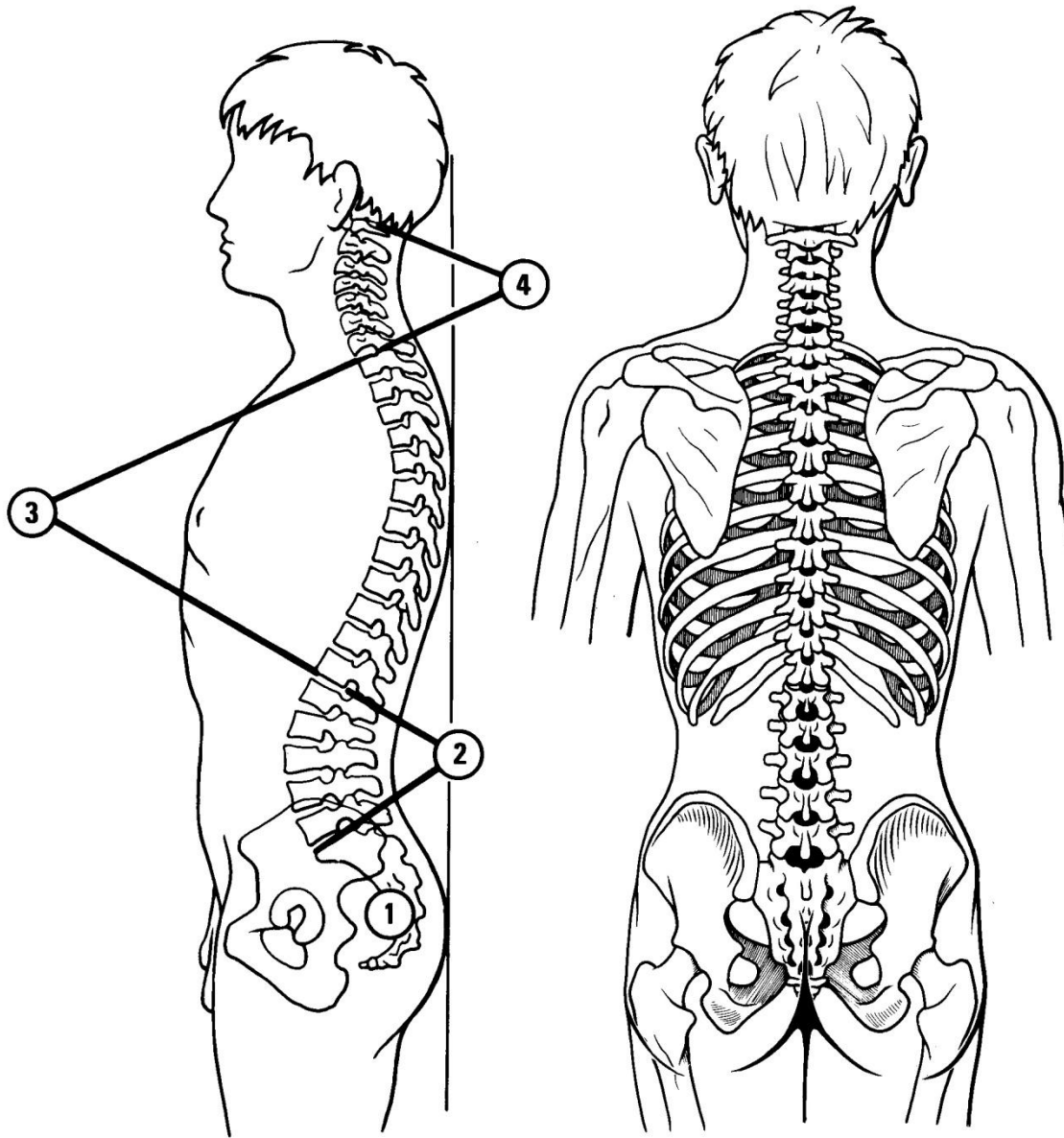
About transverse axis passing through O

LATERAL FLEXION

About an antero-posterior axis PO.



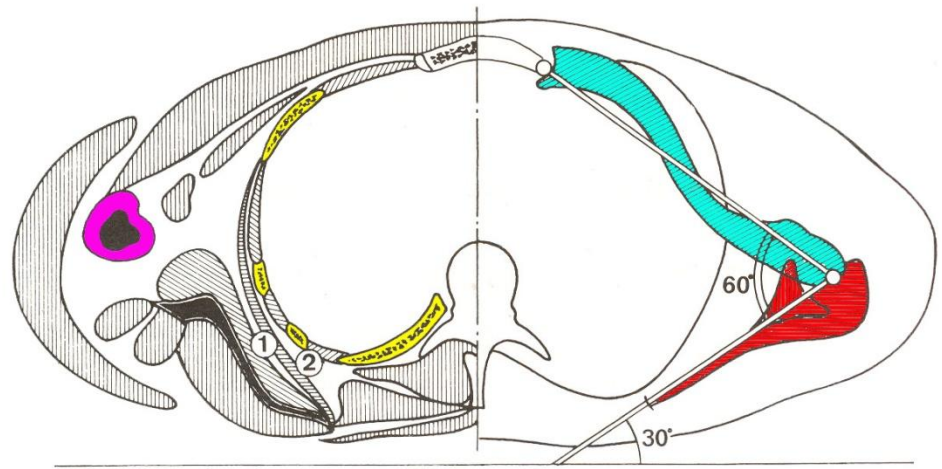




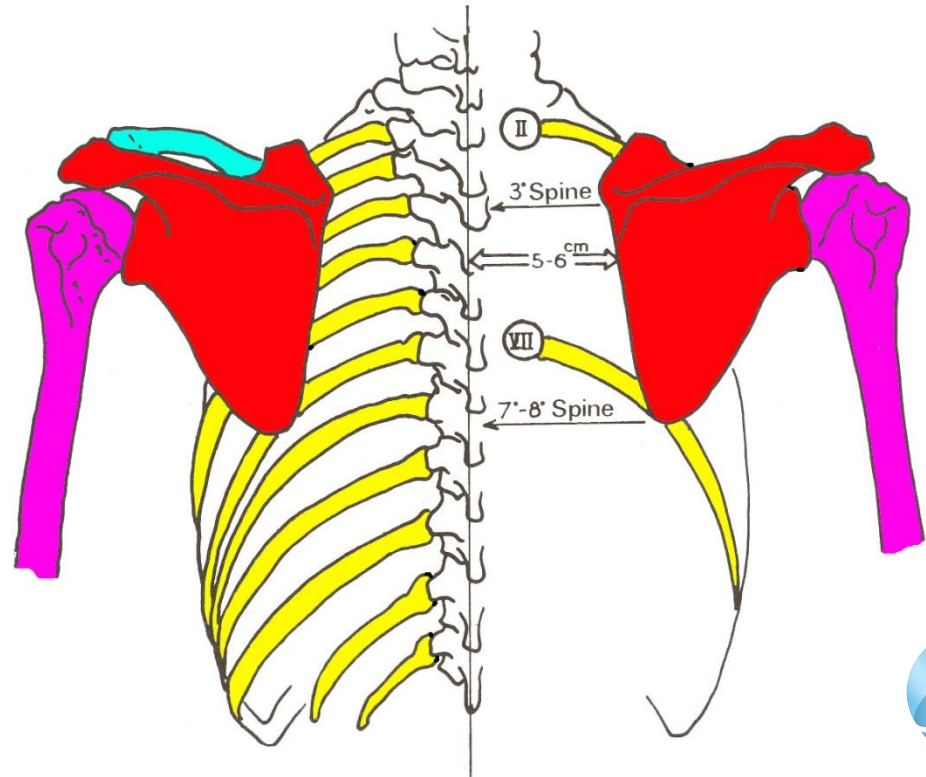
Note position of scapula on dorsal (back) side of ribcage.



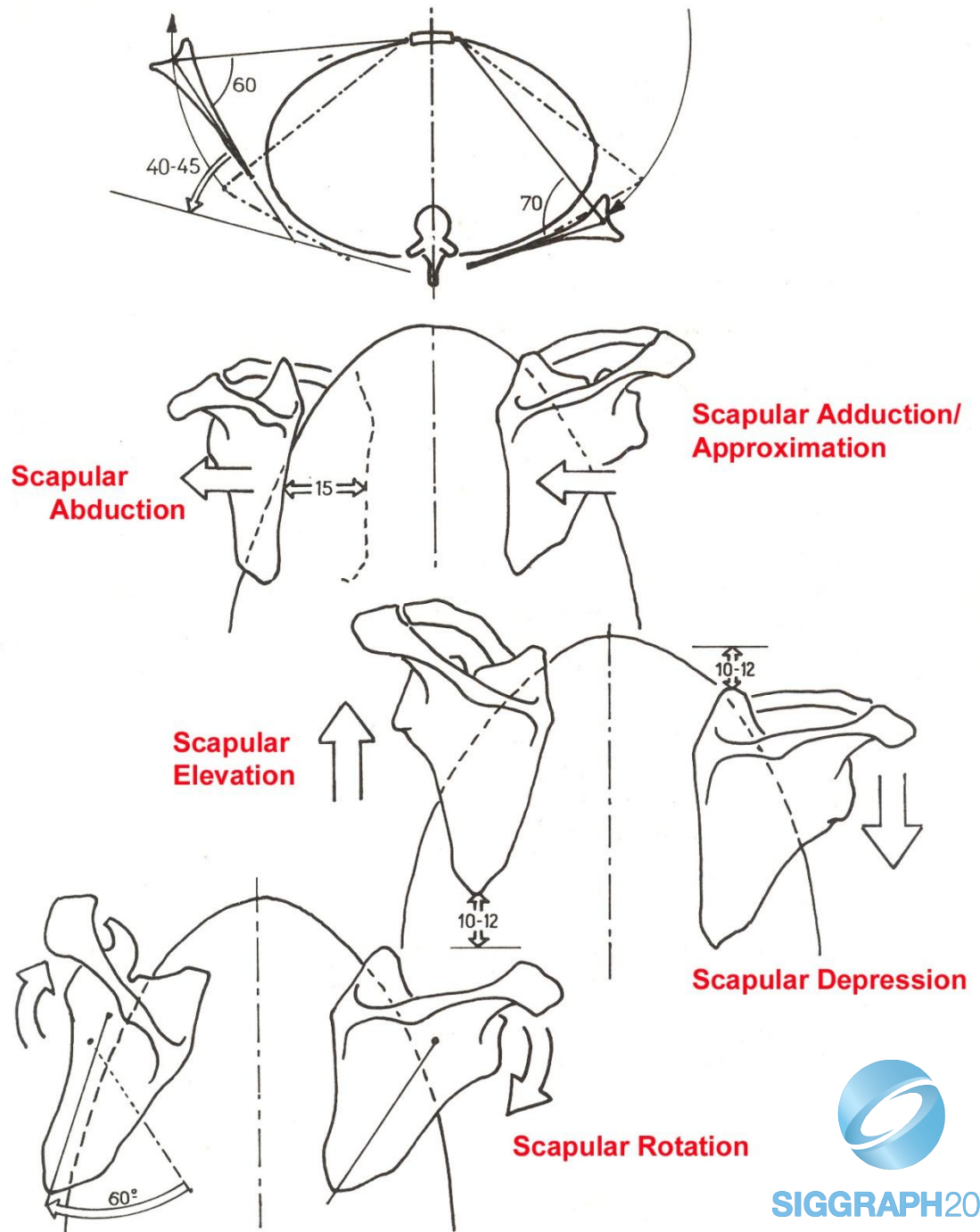
Note position of **scapula** on dorsal (back) side of ribcage.



The **clavicle (collar bone)** is on the ventral (front) side of the ribcage.



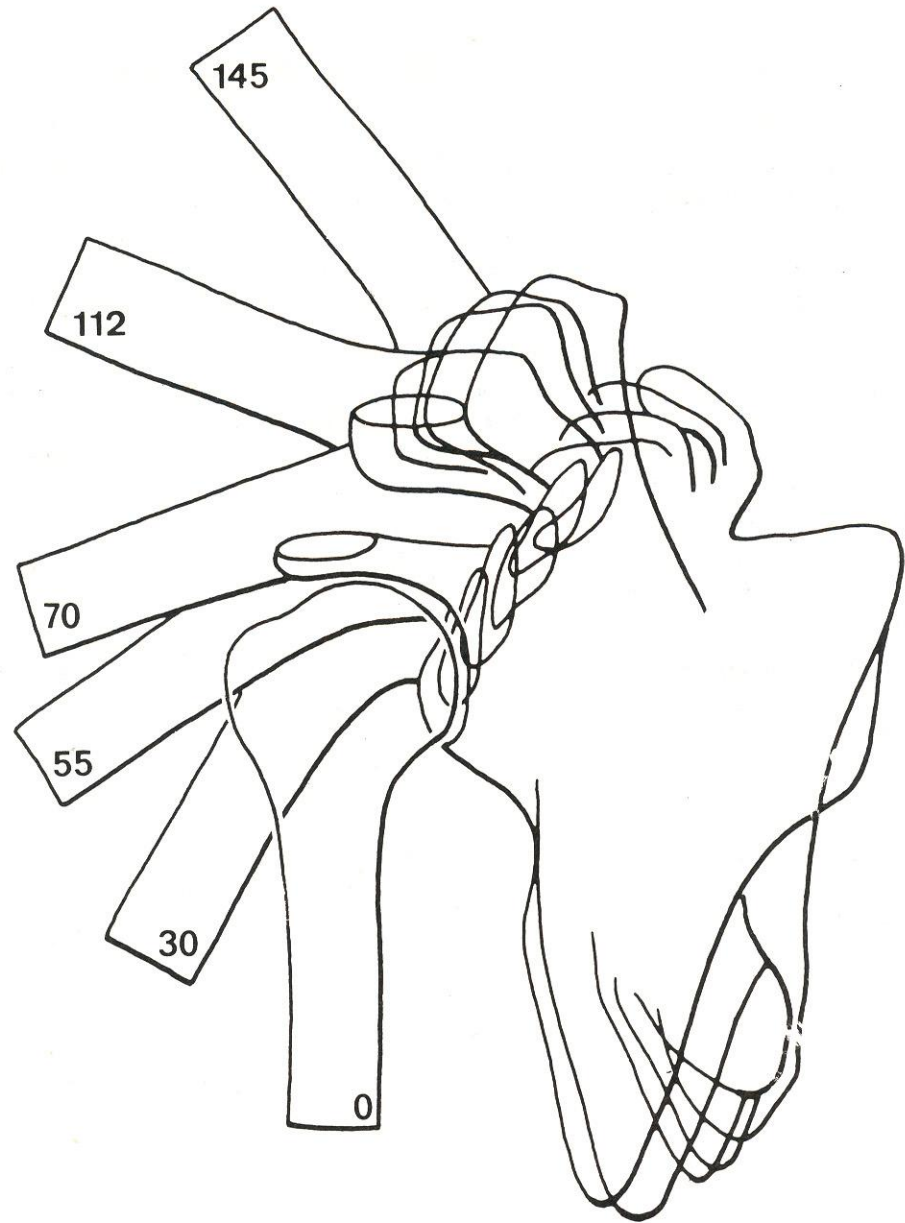
MOVEMENTS OF THE HUMAN SCAPULA



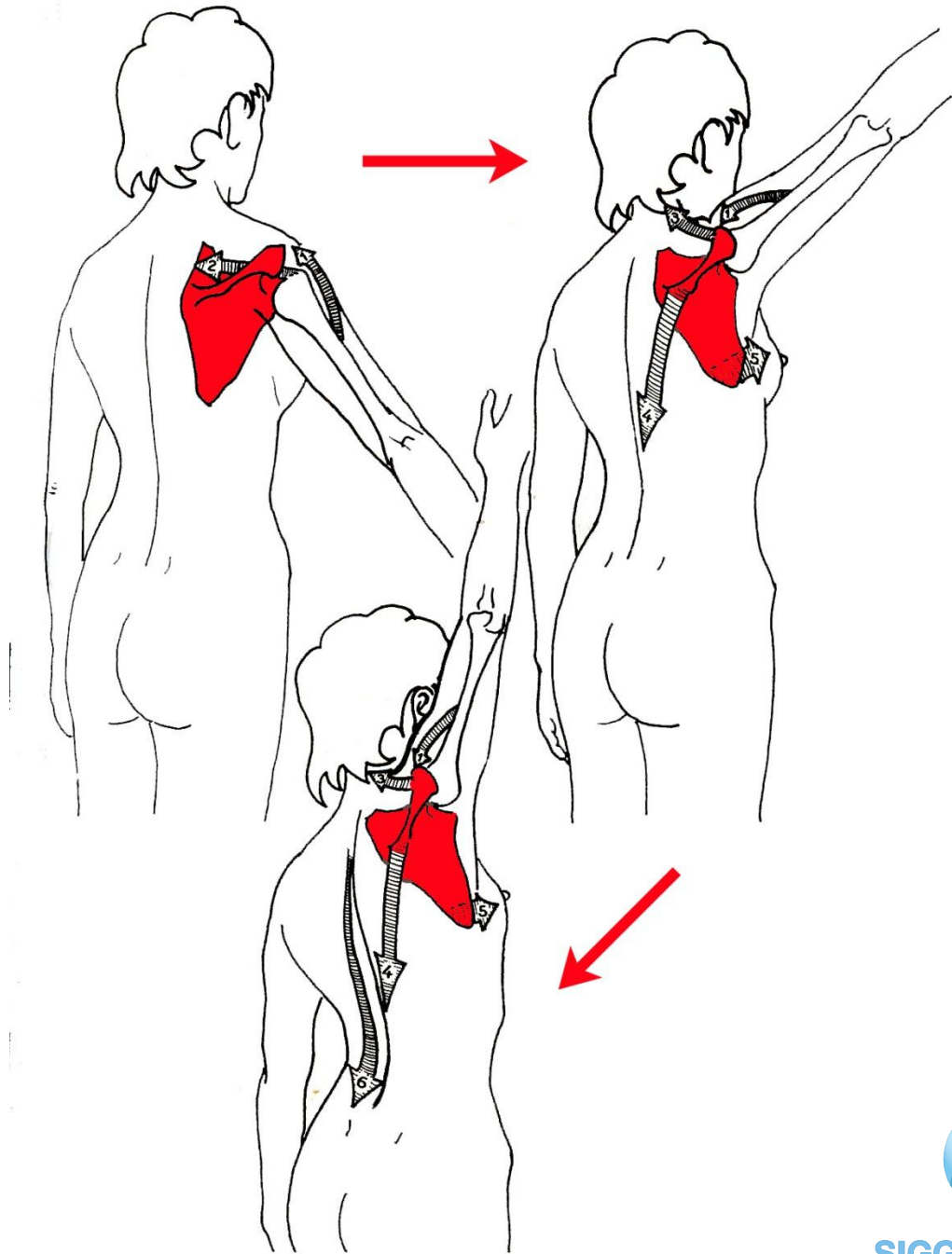
The movements of the scapula (shoulder blade) and humerus (upper arm bone) are necessarily linked. For example:

When the arm is abducted and elevated, the scapula must rotate laterally.

Failure to show this can make the upper body look extremely stiff and artificial.

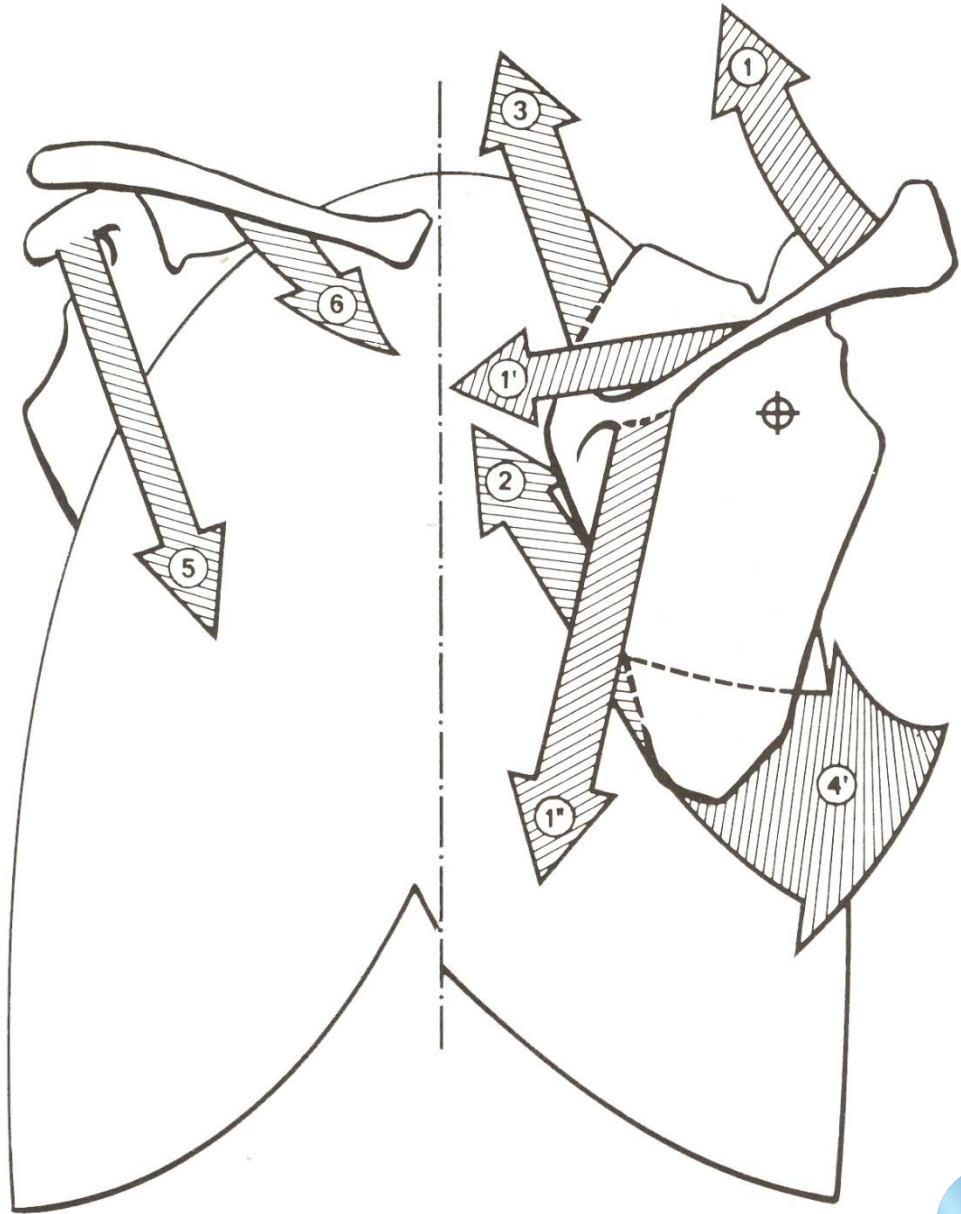


When the arm is abducted and elevated, the **scapula must rotate laterally**.



Muscular Structures Acting on the Shoulder Girdle:

1. Trapezius
2. Rhomboids
3. Levator scapulae
4. Serratus anterior
5. Pectoralis minor
6. Pectoral major
and Subclavius

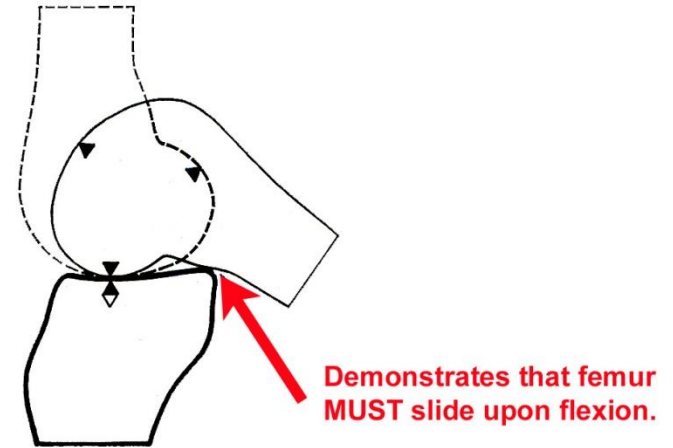


The knee is not a simple hinge joint:

- In order for the knee to flex maximally, the femur (thigh bone) must slide fore and aft on the lower supporting tibia (shin bone).
- The knee is more properly considered a “ball and plate joint”.
- A small amount of rotation can occur at the knee when the knee is maximally flexed (bent).

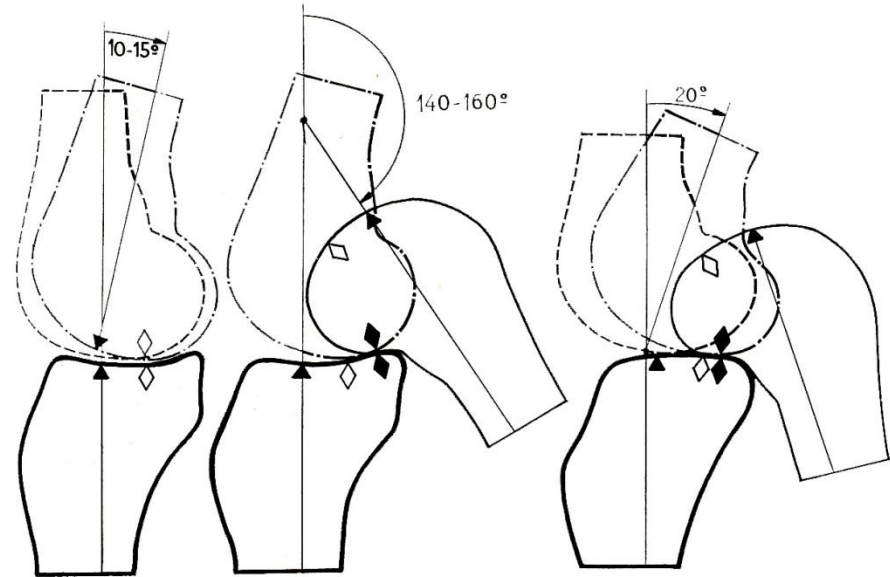


In order for the knee to flex maximally, the femur (thigh bone) must slide fore and aft on the lower supporting tibia (shin bone).



The knee is more properly considered a "ball and plate joint".

The femur slides back on tibial plateau as the knee joint flexes.



View of Medial Condyle
(inner side of knee)

View of Lateral Condyle
(Outer side of knee)