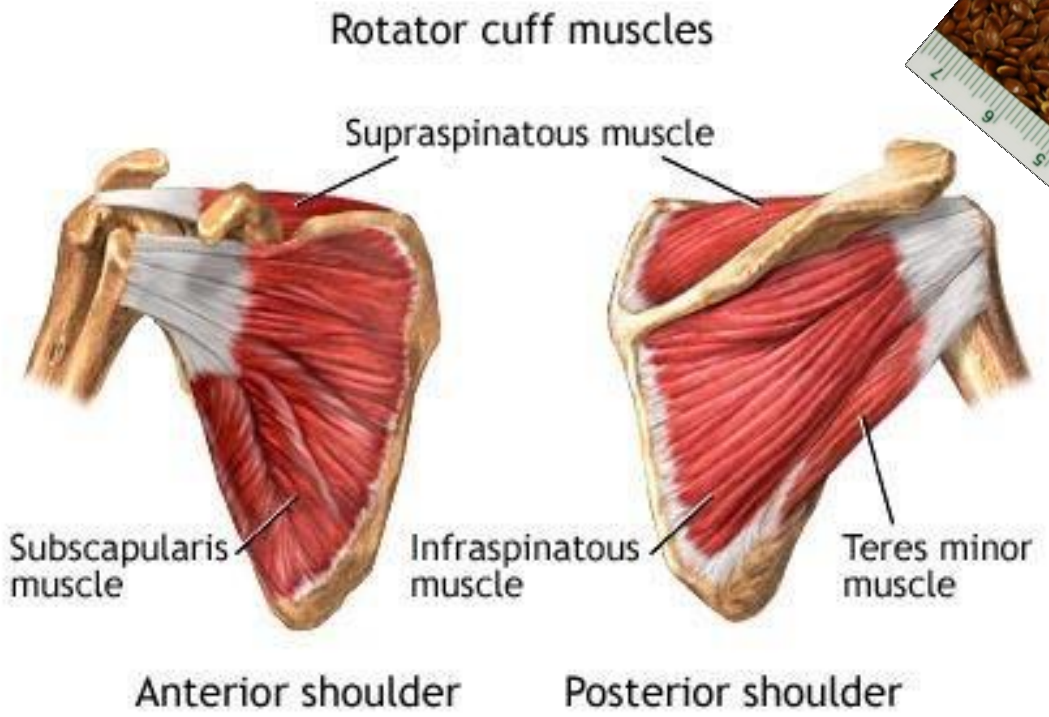
Scapular Form in Semi-Arboreal and Terrestrial Carnivores: How Climbing Affects the Shape of the Scapula

Ashley Wells

The Scapula



http://www.exerciseology.me/doug_kelseys_blog/2009/01/details-on-thoracic-spine-flexibility.html

Introduction

Procyon lotor

Urocyon cinereoargenteus

Vulpes vulpes

Introduction

Procyon lotor

Urocyon cinereoargenteus

Vulpes vulpes

Introduction

Procyon lotor

Urocyon cinereoargenteus

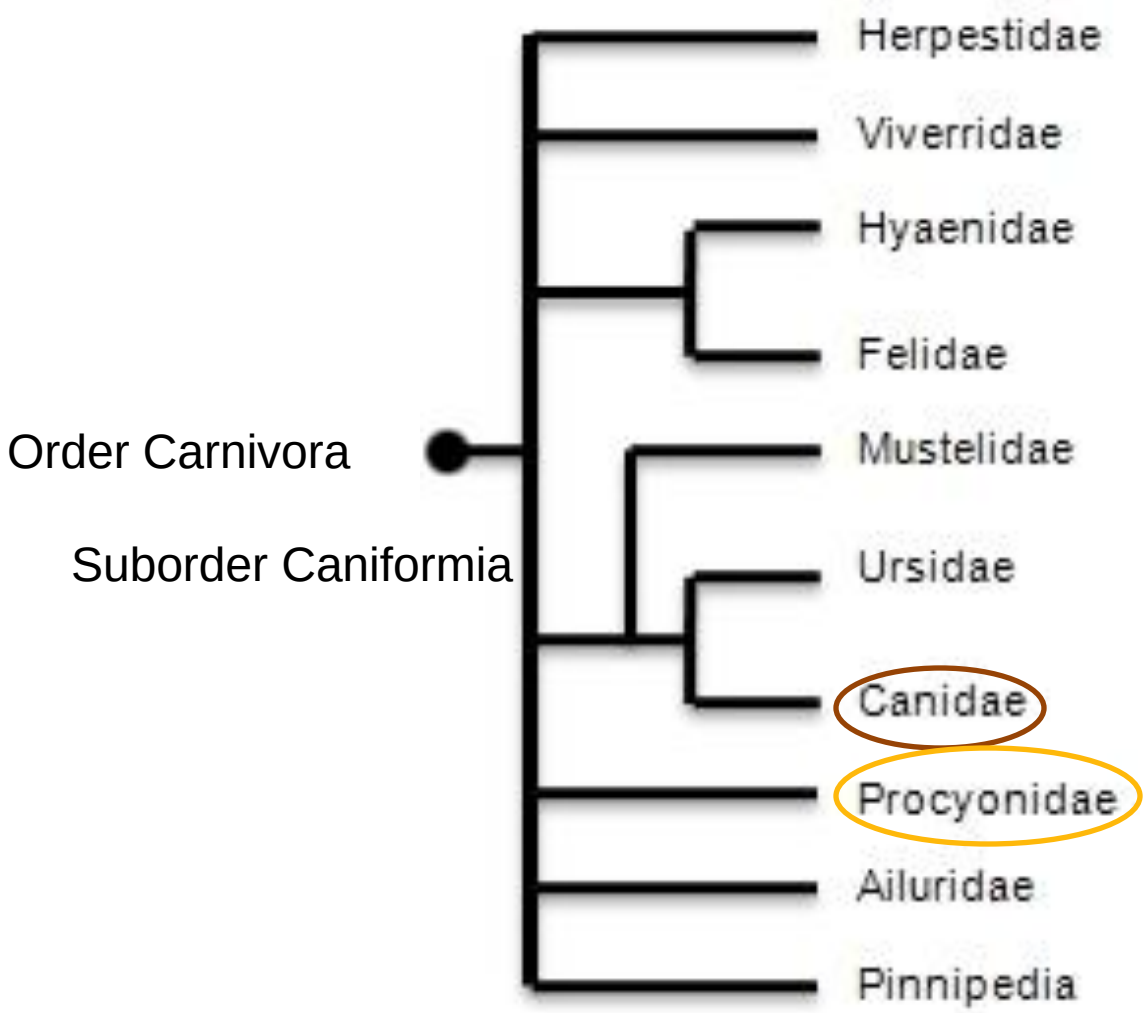
Vulpes vulpes

Introduction

Procyon lotor

Urocyon cinereoargenteus

Vulpes vulpes



http://susasverige.se/Calle/metazoa/laurasiatheria.htm

How is this Anthropology?

- Biological anthropology
  - Skeletal morphology
  - Methods
- Zooarchaeology
  - Apply to fossil remains

Hominoids

http://www.mesacc.edu/dept/d10/asb/origins/primates/index.html

Hylobatids

Gibbon
Siamang

Pongids

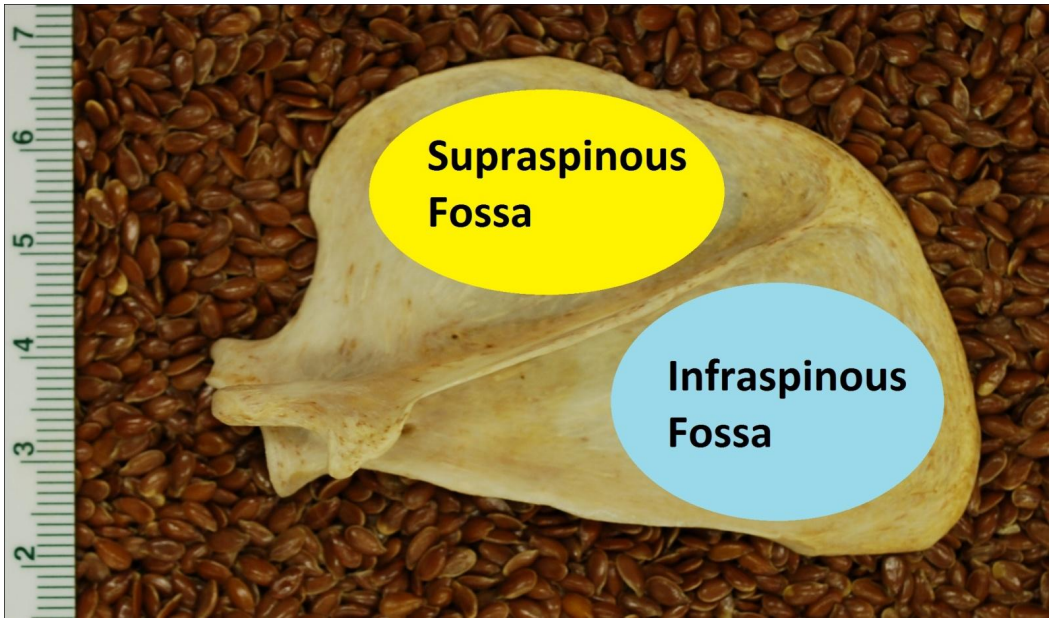
Orangutan
Gorilla
Chimpanzee

Hominids
(Bipeds)

Australopithecines
Humans

Research Questions

- Can the same patterns found in primate scapular morphology associated with locomotion be found in these carnivores?

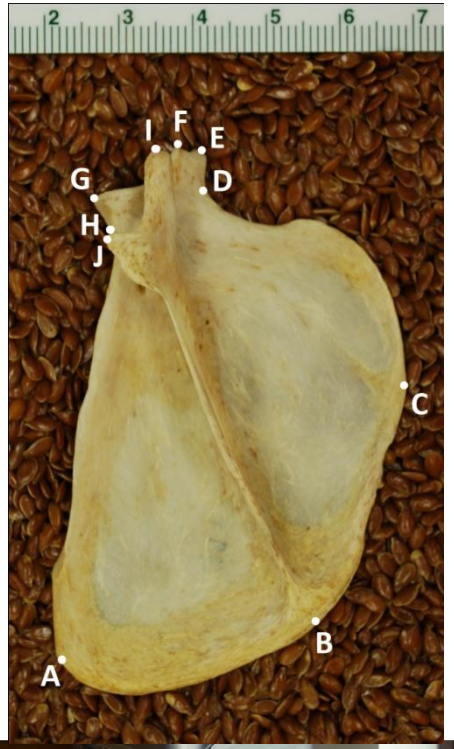


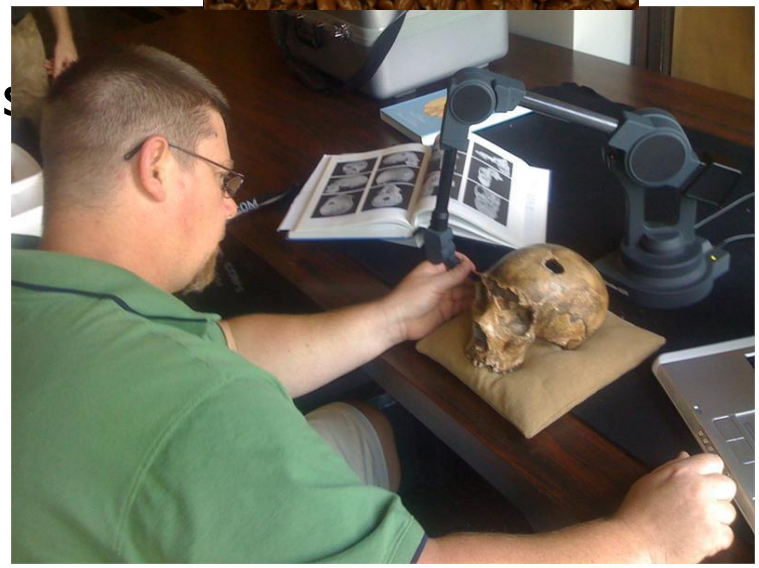
A large supraspinous fossa area is found in arboreal species

A large infraspinous fossa area is found in terrestrial quadrupeds

Methods

- Collection was from the Illinois State Museum
- Three-dimensional coordinate data were recorded for 10 landmarks
- The landmarks were then converted into 18 lengths
  - size adjusted
- Differences in lengths were tes for using analysis of variance

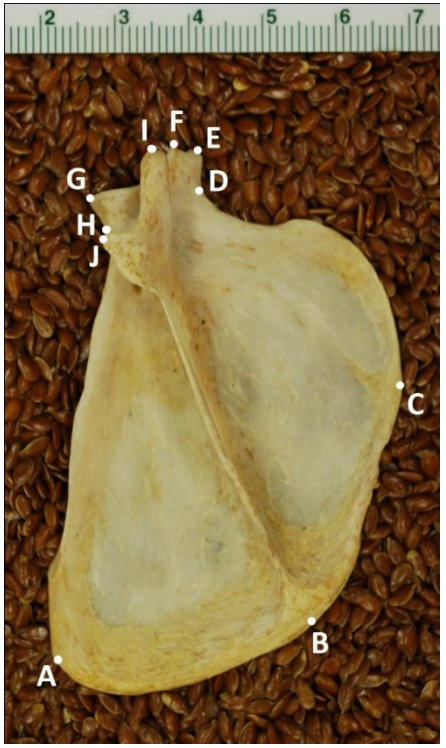




http://www.emicroscribe.com/products/solutions-for-anthropology-and-paleontology/typical-set-up-for-physical-anthropologist.htm

Methods

- Collection was from the Illinois State Museum
- Three-dimensional coordinate data were recorded for 10 landmarks
- The landmarks were then converted into 18 lengths
  - size adjusted
- Differences in lengths were tested for using analysis of variance

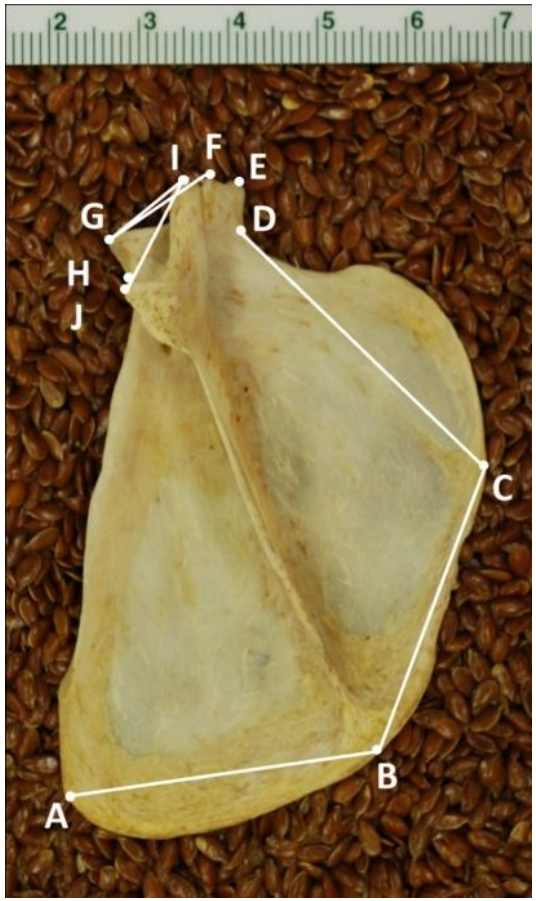


Landmarks	Length	
A-B	Infraspinous vertebral border	Infrav
A-C	Max length	Maxlen
A-G	Infraspinous axial border	Infral
B-C	Medial supraspinous border	Spramd
B-D	Max supraspinous	Spramx
B-G	Max breath	Maxbr
B-I	Max spine length	Mxspin
B-J	Proximal spine length	Prspin
C-D	Lateral supraspinous	Spralt
D-E	Coracoid height	Corcht
D-F	Neck to glenoid	Neckgl
D-H	Neck breadth	Neckbr
D-I	Neck to acromion	Neckacr
E-F	Coracoid to superior glenoid	Corcgl
F-G	Glenoid length	Gllen
F-I	Superior glenoid to acromion	Glacra
G-I	Inferior glenoid to acromion	Glacri
I-J	Acromion length	Acrlen

Results

- Between red and gray fox
  - Gray fox is significantly larger on the medial supraspinous border (B-C).
  - Red fox is significantly larger for both the infraspinous vertebral border (A-B) and the lateral supraspinous border (C-D).

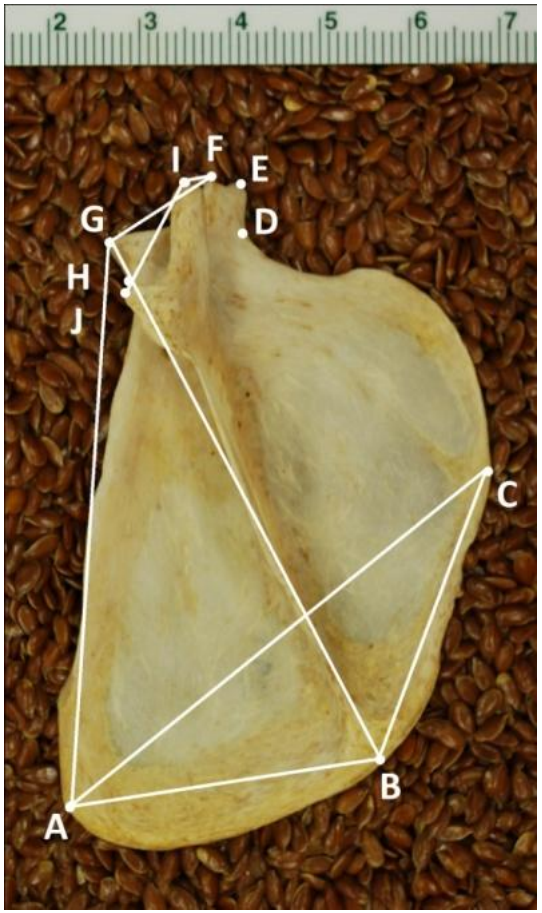
Red vs gray



Results

- Between the raccoon and gray fox
  - The raccoon is larger for most of the lengths that are significantly different including most notably the medial supraspinous border (B- C).

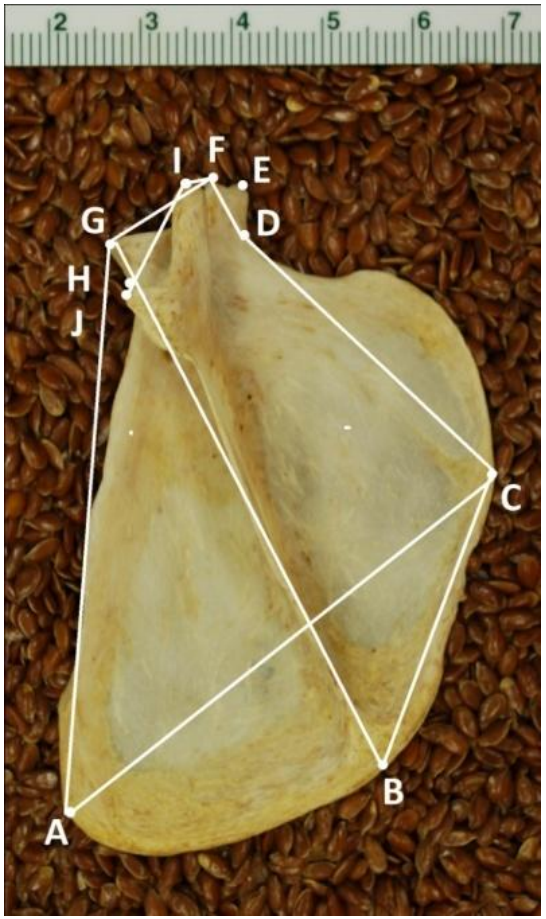
Raccoon vs gray



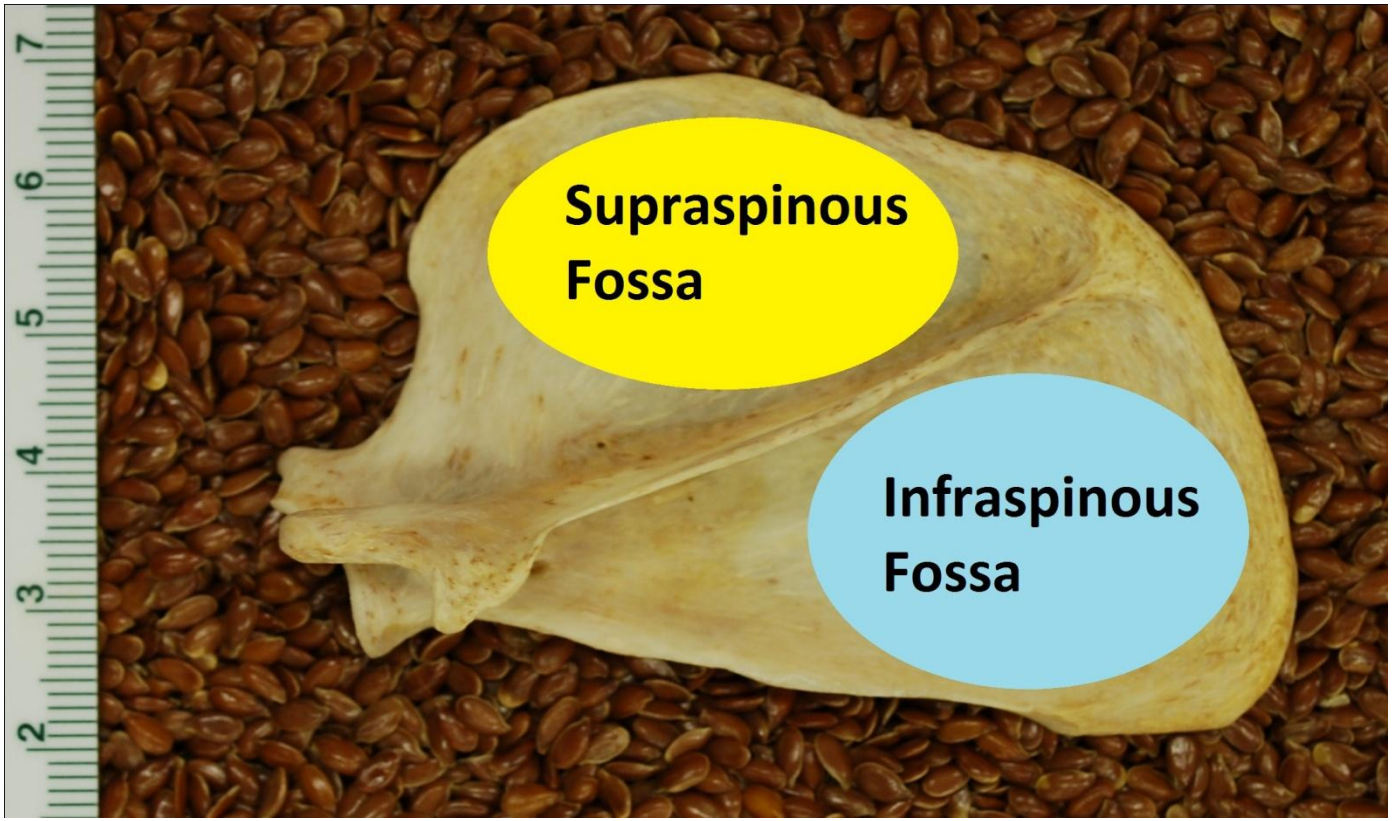
Results

- Between raccoon and red fox
  - The medial supraspinous border (B-C) is significantly larger in the raccoon.
  - Red fox is again larger for the lateral supraspinous border (C-D).

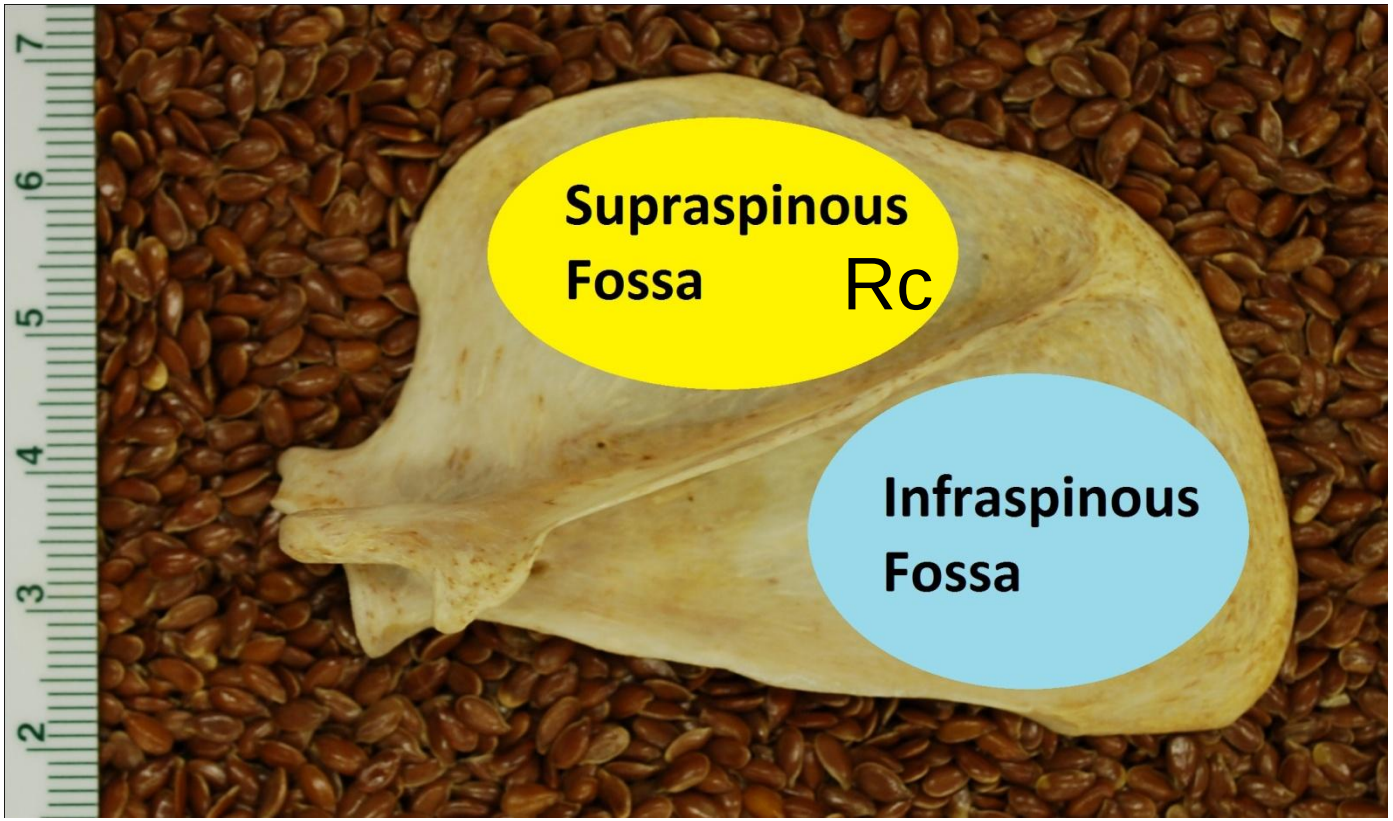
Raccoon vs red



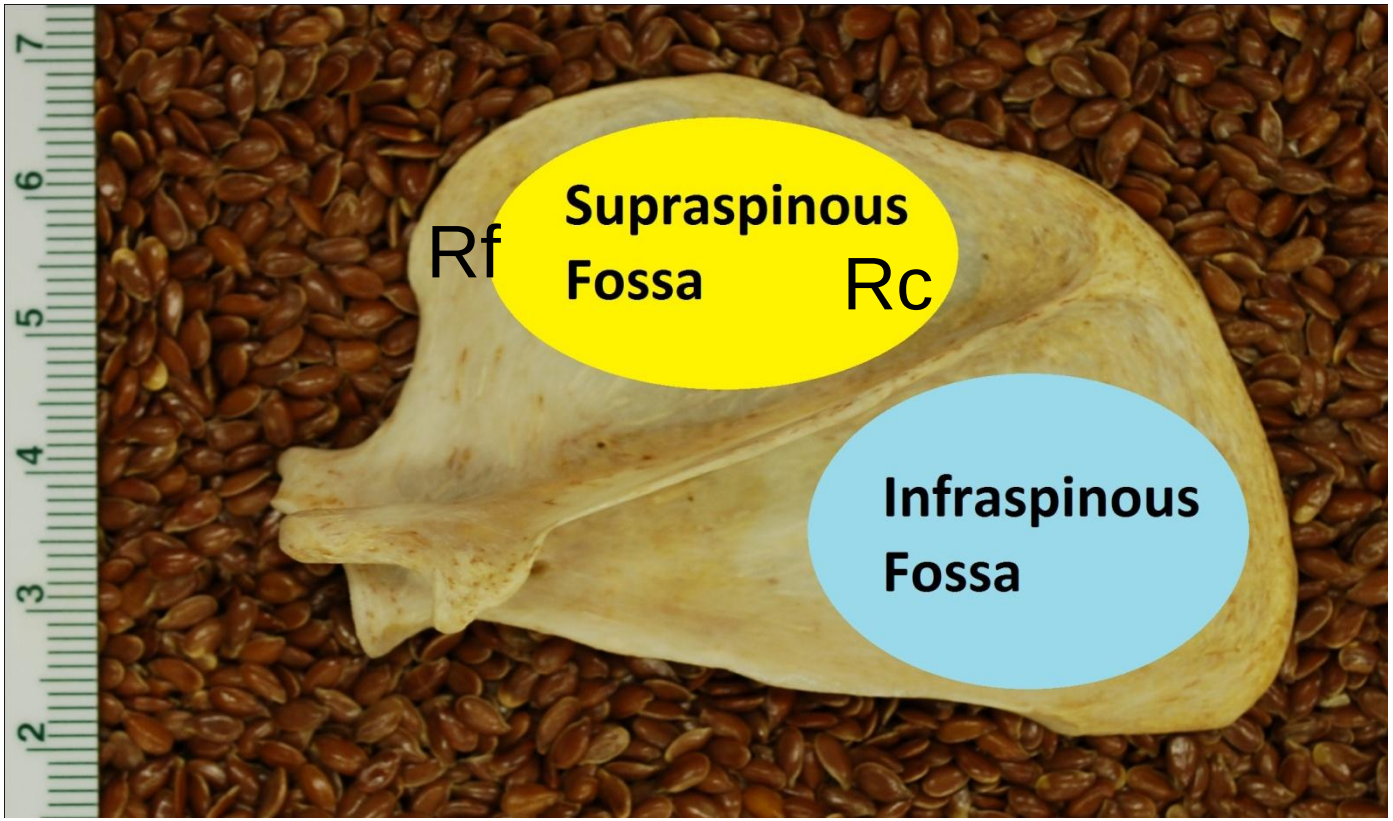
Discussion



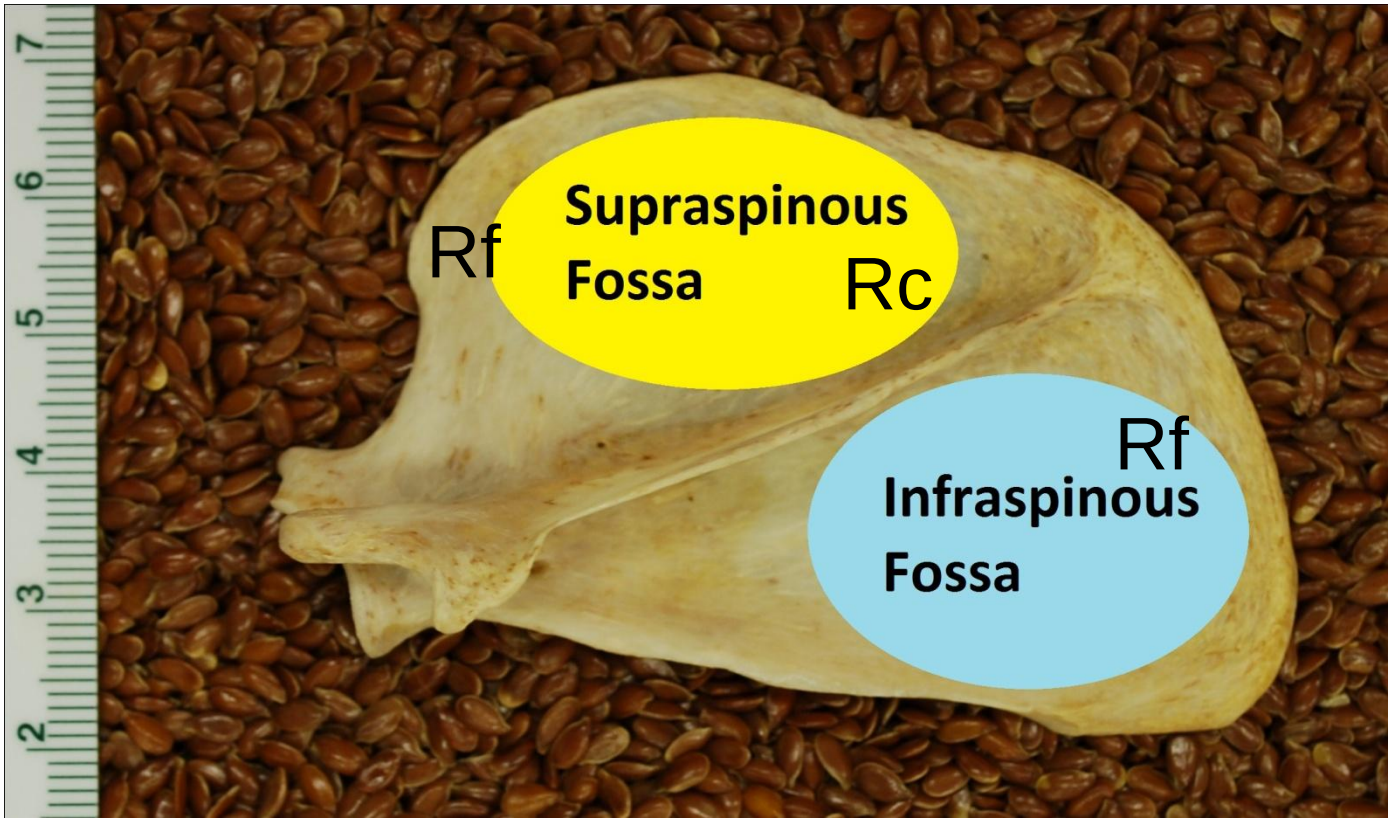
Discussion



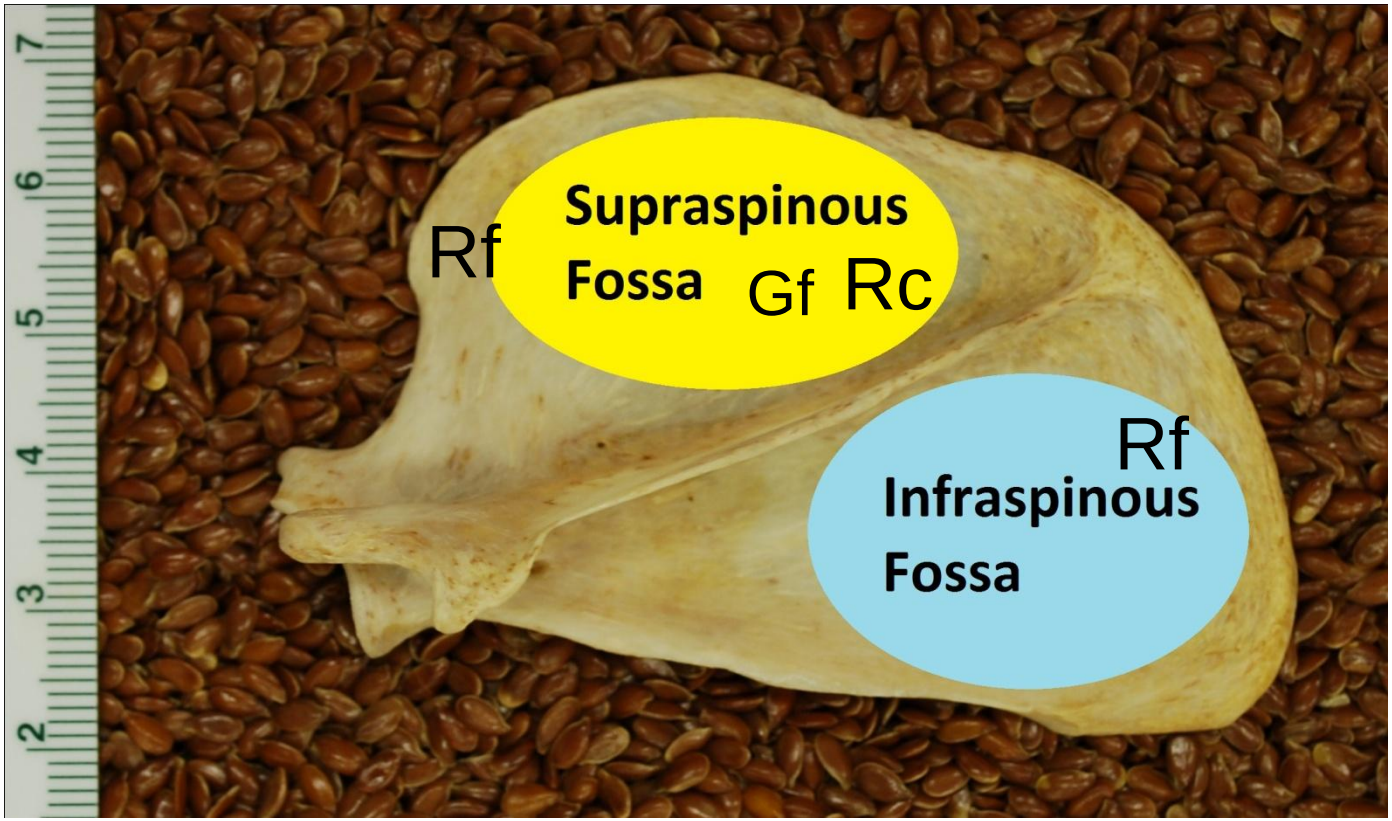
Discussion



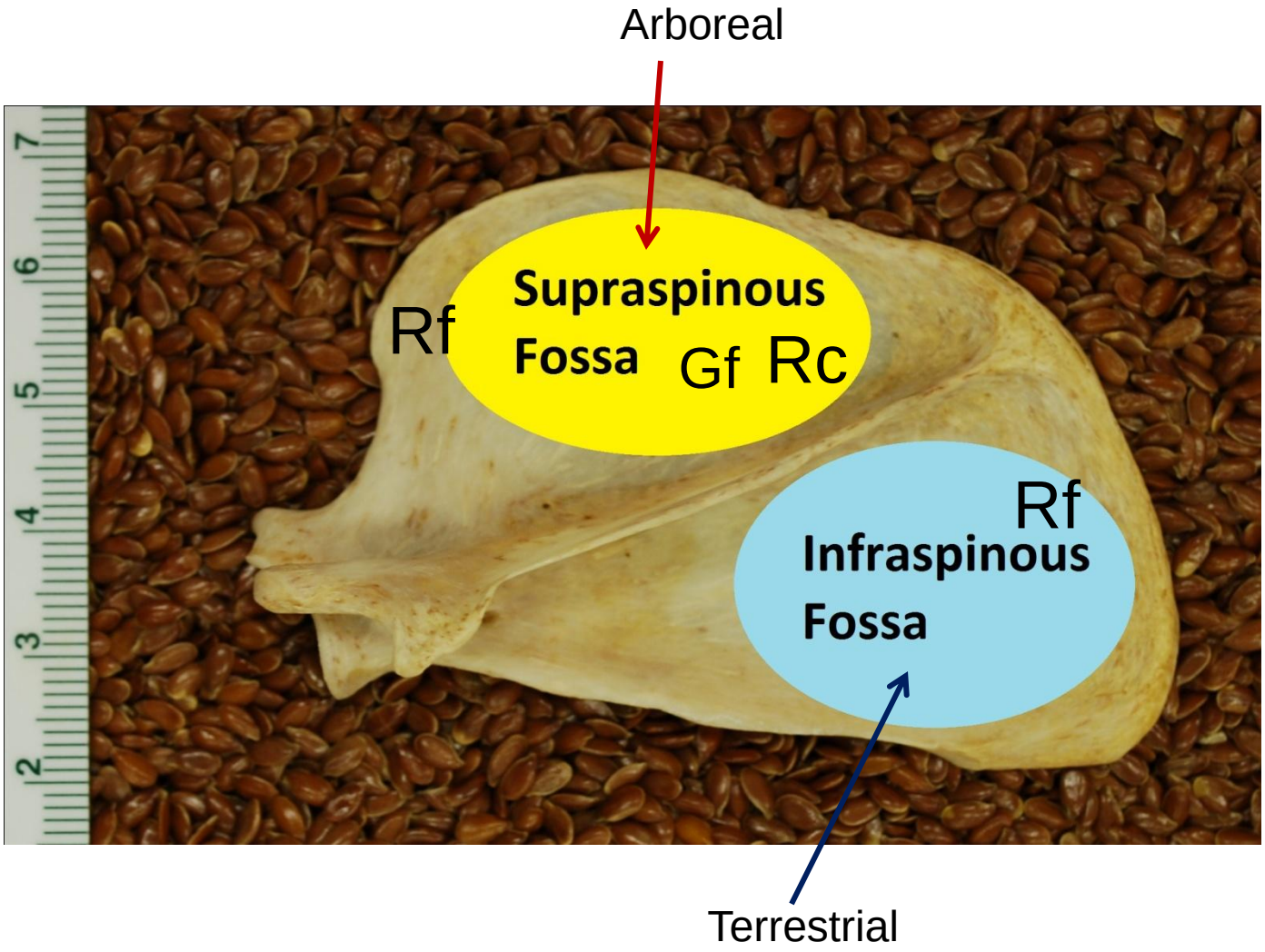
Discussion



Discussion



Discussion


Arboreal
Rf
Supraspinous
Fossa
Gf
Rc
Rf
Infraspinous
Fossa
Terrestrial

Conclusions

- Some of the patterns observed are consistent with the patterns seen in primate species
- Generalizations made about scapular shape can be used to describe fossil species
- Larger supraspinous fossa
  - Arboreality-climbing
- Larger infraspinous fossa
  - Terrestrial-quadrupedalism
- Future studies
  - Allometry
  - More species

Acknowledgements

- I would like to thank the Illinois State Museum for the use of their collections and Mary Ellen Sydow and Jesiah Watkins who measured the fox scapula. Also, I would like to thank Dr. Luci Kohn for the opportunity to work in her lab and guiding me step by step through this study, Dr. Jen Rehg for her motivational talks and Dr. Julie Holt for acting as my personal review committee. Lastly, I would like to thank the URCA program for this opportunity and the College of Arts and Sciences and Department of Biological Sciences for funding this study.

References

Evans HE, Hermanson JW (1993) The muscular system. In: *Miller's Anatomy of the Dog.* 3rd ed. Philadelphia, PA: Saunders. p. 258-384.

Fritzell EK, Haroldson KJ (1982) *Urocyon cinereoargenteus*. Mammalian species 189, 1-8.

Jungers WL, Falsetti AB, and Wall CE (1995) Shape, relative size, and size adjustments in morphometrics. Yearbook of Physical Anthropology 21, 137-161.

Lariviere S, Pasitschniak-Arts M (1996) *Vulpes vulpes.* Mammalian species 537, 1-11.

Larson SG, Stern JT (1989) Role of Supraspinatus in the Quadrupedal Locomotion of Vervets *(Cercopithecus aethiops):* Implications for Interpretation of Humeral Morphology. *American Journal of Physical Anthropology* 79, 369-377.

Lotze JH, Anderson S (1979) *Procyon lotor*. Mammalian species 119, 1-8.

McClearn D (1992) Locomotion, posture, and feeding behavior of kinkajous, coatis, and raccoons. *Journal of Mammalogy* 73(2), 245-261.

Taylor AB (1997) Scapula form and biomechanics in gorillas. *Journal of Human Evolution* 33, 529-553.

Questions?