Realization of an osteological montage of domestic animals at the Museum of Anatomy of the Inter-State School of Veterinary Sciences and Medicine of Dakar

Abstract

The present study aims to perform osteological mounting of ~~major~~ domestic animals of the more well-known groups. To realize the different osteological mounts, we used a non-ligamentary mounting method. This technique consists in gluing the bones next to each other on a wooden or metallic structure. The bones are drilled and reinforced with aluminum wire. This method was preceded by a preparation step that included fleshing, degreasing, and rinsing. At the end of our study, 29 skeletons of bovids (including sheep, goats, and cattle), equids (horses), poultry, ~~suidae~~suids, ~~carnivores~~carnivorans, camelids, leporids and wild animals were reconstructed.

Comment [R1]: No whitening methods were used?

Key words: Assembly, Osteological, Museum, Animals, Domestic, EISMV, Dakar

I. Introduction

Veterinary anatomy is the science that studies the structure and morphology of animals, especially domestic animals. It seeks knowledge of the structures that make up living organisms by specifying their situations, ~~their~~ forms, ~~their~~ relationships, ~~their~~ functions, ~~their~~ and particularities. Descriptive in nature, it is one of the important pillars of biomedical knowledge, especially since the search for abnormalities in organs presupposes that the organs of the healthy animal are perfectly described and known **(DYCE, 1996).**

Veterinary osteology is ~~the first~~a major component and the first with which students become familiar during their apprenticeship in veterinary medicine. Indeed, bones are the passive organs of locomotion. Hard, rigid, yellowish-white in colour, they give attachment to the muscles, which act on them like levers. They also serve to protect certain fragile organs (central nervous system, heart, lungs). Finally, they have an important role as reservoirs of mineral substances and their marrow is involved in the production of the figurative elements of the

Formatted: Indent: First line: 0.49"

blood. A skeleton is the framework of the body, consistingmade up of all the bones of an animal, a framework thatand provides gives the individual its general shape and dimensions. The possession of aA bony skeleton is one of the main characteristics of vertebrates **(BARONE, 1999).**

Unfortunately, osteology is mainly onlycan only be learned from the remains of dead animals. The process of teaching (or learning of) or even the transmission of veterinary osteology requires the realization of osteological assembly which, through a fine and reliable reconstruction, reproduces almost perfectly the particularities of the aspecies. It is an very effective tool for understanding osteology and a reliable technical support to students and veterinary practitioners. Therefore, Iit is only rightly accepted that the anosteological montage, in addition to enriching the museum's osteotheque (bones classified by type that can be used for comparative study), serves as an educational support for students and veterinary practitioners.

To accomplish this,It is therefore to do this that we proposed to carry out osteological montages in the museum of osteology of the Inter-State School of Veterinary Sciences and Medicine in Dakar. The general objective of this study is to contribute to the learning of osteology students in order to perfect their knowledge.

Comment [R2]: Keep in mind that scanning and x-rays can now allow us to see the skeletons of living organisms.

Formatted: Indent: First line: 0.25"

II. Materials and Methods

II.1. Period and Study Area

Our study took place at the EISMV Museum in Dakar from January 01, 2022 to December 31, 2023

II.2. Equipment

II.2.1. Animal Material/Specimens

We used bones from the anatomy collection of the EISMV in Dakar. It should be remembered that these bonesis noted that these specimens were acquiredas a are the result of successive dissections carried out on domestic animals from the creation of the School veterinary school to the present day.

II.2.2. Technical laboratory equipment

The material used is a classic osteological assembly kit. It consists of a drill, a gluing gun, glue, screws of different sizes, aluminum wires, a screwdriver, black paint, metal and wooden brackets.

II.3. Methods

II.3.1. Preparation methods

To carry out the various osteological assemblies, we used a non-ligament assembly method. This technique consists of gluing the bones next to each other on a wooden or metal structure. The bones are pierced and reinforced with aluminum wire.

The assembly began with a morphological study of the remains of the animal from the dissections. ~~He~~ This continued with a complete fleshing, a step that consists of removing as much soft-tissue (including flesh, muscles and tendons) as possible from the skeleton.

The bones are then immersed in a series of hot baths to degrade the last remains of flesh. Once clean, they were dried and then degreased with soda and bleached ~~into seed~~ to enhance whitening.

Thus, 500 g of soda and 500 g of seed bleach were needed to degrease and bleach a complete skeleton of large animals (equines and cattle). These bones were soaked for 48 hours in bleach and soda solutions.

II.3.2. Assembly method for osteological assembly

Depending on the type of bone to be assembled, the duration and the use of the assembly, different types of glue can be used.

- Thermal glue is used for temporary bonding. The setting time is a few seconds and the glue can be detached on its own or mechanically.
- Cyanoacrylate or epoxy glue is used for permanent bonding (e.g. when a bone is broken).
- Wood glue (acrylic) is used for long-surface bones (teeth, nasal bones, ~~flat~~ limb bones, ribs). Indeed, this type of glue takes a long time to dry, so you have time to adjust it. It is reversible with hot water.

All of these glues are transparent, making it easy to take photos without glue-related artifacts.

Comment [R3]: It would be useful to clarify what type of glue is used here. Although you clarify below that multiple types are used depending on the desired outcome, it may then be useful to just state here as "various types of glues".

Comment [R4]: This section should work through more of a chronological order, so start with the dissections and cleaning of the skeletons and bones, and then move on to the assembling of the bones into potential mounts.

Comment [R5]: Start with this paragraph and move the first paragraph of this section to after the degreasing and whitening of the bones.

Formatted: Indent: First line: 0.49"

Comment [R6]: This may be an aside, but while bleach is very good at killing any remaining pathogens, it also works to break down the organics in the bones and is very difficult to fully neutralize afterward. This often leads to the bones continuing to slowly breakdown over time, including over years. While it doesn't work to the same level of whitening and doesn't do as good at ensuring the bones are sterilized, using hydrogen peroxide, including stronger concentrations of it, are a much safer way to whiten bones and don't lead to them continuing to breakdown over time. Not something that necessarily matters in this exact instance, but something that may be desired if more specimens are needed in the future. May also be something to make note of within the paper itself, but not necessarily needed here.

The reassembly was done on a metal support structure that was made as discreet and as non-intrusive as possible. It is used to keep the skeleton in ~~its~~ a desiredposition. The bones are threaded and fixed with rods, wires and screws. The assembly must remain reversible to make it possible in the future to consult the whole or only part of the skeleton.

After reassembly, the various supports were painted black to bring out the shine of the bones.

Formatted: Indent: First line: 0.49"

Comment [R7]: Presumably this was also done to make it clear what makes up the skeleton versus what makes up the armature and supports.

Formatted: Indent: First line: 0.25"

III. Results

Following the preparation process, ~~At the end of our study, we obtained~~ different osteological skeletons were obtained. In ~~all~~total, 28 ~~carcasses~~ specimensof bovids (sheep, cattle, and goats), ~~horses~~ equids(horses and donkeys), poultry, ~~suidae~~suids, ~~carnivores~~carnivorans, camelids (dromedary camels) and lagomorphs (rabbits) were mounted.

Table 1: Skeletons mounted at the Museum of Anatomy of the EISMV in Dakar.

Cash	Number
Bovidae (Sheep)	4
Bovidae (Cattle)	2
Bovidae (Goats)	2
~~Equines~~ Equidae(Horse)	2
Equidae (Donkey)	2
Poultry (chicken, duck, etc.)	10
Suidae	2
~~Carnivores~~Carnivora	2
Camelidae (Dromedary)	1
Lagomorpha (Rabbit)	1
Wild animals (Derby Elk)	1
Total	**29**

For the skeletons of small ruminants, ~~different~~ skeletons of sheep and goats were mountedin different postures ~~were mounted~~ **(Figures 1A, B, and C).**

Comment [R8]: If possible I would use images without overlayed text.

Figure 1: Skeletons of small ruminants assembled at the EISMV Anatomy Museum.

Comment [R9]: I removed the images so the file would be small enough to upload, but I am not suggesting to remove these figures from the paper.

Comment [R10]: Within this figure caption, explicitly state what is in Figure 1A, 1B, and 1C.

As far as the cattle skeletons are concerned, skeletons simulating zebu on pasture were set up **(Figures 2A and B).**

Figure 2: Skeleton of cattle (zebu) assembled at the EISMV Anatomy Museum in Dakar.

Comment [R11]: Within this figure caption, explicitly state what is in Figure 2A and 2B.

~~As far as equines are concerned~~Concerning equids, skeletons simulating ~~gallon~~ horses rearing up have been mounted **(Figure 3).**

Figure 3: Skeleton of ~~equines~~ equidmounted at the Anatomy Museum of the EISMV in Dakar.

~~As far as camelids are concerned~~In regards to camelids, a dromedary camel skeleton has been mounted **(Figure 4).**

Figure 4: Skeleton of camelid~~s~~ mounted at the ~~anatomy~~ Anatomy ~~museum~~ Museum of the EISMV in Dakar

~~As far as carnivores are concerned~~Among carnivorans, cat and dog skeletons have also been assembled **(Figure 5).**

Figure 5: Skeleton of ~~carnivores~~ domestic catassembled at the Anatomy Museum of the EISMV in Dakar.

~~As far as poultry is concerned~~For birds, different species of poultry have been mounted, including pigeons, chickens and ducks **(Figure 6).**

Figure 6: Skeletons of poultry mounted at the Anatomy Museum of the EISMV in Dakar.

Comment [R12]: Within this figure caption, explicitly state what is in Figure 6A, 6B, 6C, and 6D.

As far as ~~leporidae~~ Leporidae ~~are~~ is concerned, a rabbit skeleton has been assembled (Figure 7).

Figure 7: Skeleton of rabbit~~s~~ mounted at the EISMV Anatomy Museum in Dakar.

~~As far as the suidae are concerned~~Regarding Suidae, a pig skeleton has been mounted **(Figure 8).**

Figure 8: Pig skeleton mounted at the EISMV Anatomy Museum in Dakar.

~~As far as wild animals are concerned~~Among wild animals, a derby elk (also known as the giant eland; *Taurotragusderbianus*) skeleton has also been mounted **(Figure 9).**

Comment [R13]: Particularly with wild animals I suggest including the scientific name to make things clearer as common names can vary.

Figure 9: Skeleton of the derby moose (*Taurotragusderbianus*) mounted at the anatomy museum of the EISMV in Dakar.

IV. Discussion

Veterinary anatomy is the science that studies the structure and morphology of animals, especially domestic animals. Osteology, or the study of bones, forms the basis for learning anatomy for students. The montage of articulated skeletons, beyond its role of enriching the

Museum's osteotheque, contributes to serving as an educational learning medium for students, clinical veterinarians and for anyone wishing to deepen their knowledge of ~~Anatomy~~anatomy.

We used a ~~so-called~~ non-ligament mounting method utilized by ~~such as~~ **BARRAQUAND ~~(2010), in 2010~~** ~~in~~ on martens (*Martes*),~~and marten and by~~ **DURBEC ~~(2012)in 2012~~** ion night monkeys (*Aotustrivirgatus*), and by **MORLAR ~~(2010)in 2010~~ on** roe deer (*Capreolus capreolus*).

Our assembly technique, ~~the~~ a non-ligament method of the skeleton with a hot glue gun, has the advantage of being non-destructive by keeping the bones, especially the articular surfaces, intact and restoring the thickness of the cartilages and intervertebral discs. In addition, it is less difficult to implement than drilling and wire techniques. The combination of these two processes, which are inexpensive and easy to set up, has made it possible to limit the creation of chemical and organic waste, as **Lacoste-Garanger ~~et al.,~~ (2013),** who carried out an osteological assembly in the emperor penguin (*Aptenodytes forsteri*), has ~~so well remarked~~previously mentioned.

It ~~should be~~is also noted, however, that **LACOSTE-GARANGER ~~et al. in~~ (2013),** used a variant of our method involving predators, in particular the giant ~~predel~~ petrel (*Macronectes giganteus)*and, especially, amphipods. ~~In addition~~Additionally, unlike our technique, **LACOSTE-GARANGER ~~et al. (2013)~~** immersed the carcass in seawater, to take advantage of the salinity of the sea and amphipods instead of soda and bleach as in our technique. ~~This~~ There technique has the advantage of being less polluting and using natural components.

V. Conclusion

Our study consisted of making osteological montages of articulated skeletons according to the facilities present at the museum of the anatomy-histology-embryology department of the Inter-State School of Sciences and Veterinary Medicine of Dakar. Techniques used in the present study~~This technique~~ will make it possible to make osteological montages of other animals, including wild animals in order to enrich the museum~~;~~ and provide additional resources for students and researchers.

VI. References

1- **BARRAQUAND C., 2010.** Radiographic and osteological atlas of the marten (*Martes martes*) and the ~~marten~~ fouine (*Martes foina*) (Doctoral dissertation).

Formatted: Indent: First line: 0.49"
Formatted: Font: Italic
Formatted: Font: Italic
Formatted: Font: Italic
Formatted: Font: Italic
Formatted: Indent: First line: 0.25"
Formatted: Font: Italic
Formatted: Font: Italic
Formatted: Font: Italic

2- **DURBEC, C.**, **2012.** Radiographic and osteological atlas of the night monkey (*Aotustrivirgatus*). Thesis, Ecole Nationale Vétérinaire de Toulouse - ENVT, 2012, 136 p.

3- DYCÉ K.M., SACK W.O AND WENSING C.J.G., 1996. Text Book of Veterinary Anatomy. Second Ed.

4- **LACOSTE-GARANGER N.et al., 2013.** Assembling a skeleton of an Emperor Penguin (Aptenodytes forsteri) skeleton in Adelie Land (Antarctica): interest of amphipods in the bones cleaning, Cahier d'AnatomieComparée, 2013 (5): 1-17, C@C All rights reserved.

5- **MORLAT S., 2010.** *Radiographic and osteological atlas of roe deer (Capreolus capreolus L.)*. 2010. Doctoral thesis.

6- **BARONE R., 1999.** Comparative anatomy of domestic mammals. Volume 1: Osteology. *Paris: Vigot Frères*, 428.

Formatted: Font: Italic

Comment [R14]: Add the names of the other authors here, including Lanshere J. and Lewden A.