Plasticine Modeling as Alternative in Teaching Veterinary Anatomy

A.S.Saber; K.M.Shoghy and S.A.Mohammed

Department of Anatomy &Embryology, Faculty of Veterinary Medicine, University of Sadat City, Sadat City, Egypt

With 11 figures & 6 tables **Received January, accepted for publication February 2016**

Abstract

Coloured plasticine was used for making 3D anatomical and embryological plates with the aim of presenting an alternative method in teaching veterinary anatomy.

Many selected anatomical illustrations representing muscles of the thoracic and pelvic limb of the horse, head muscles of the horse, ox, sheep and camel, some embryology diagrams including sperm structure, types of ova and cleavage were used in this presentation. Moreover, the skulls of horse, sheep and dog were also used for shaping some of the facial and masticatory muscles.

In the introduction, light was shed on the common methods of teaching veterinary anatomy such as computer software, plastination, prosection, freeze drying, willed body donation program, the use of haptic simulator and CDs for sonographic, MRI and CT as well as radiographic images. Some of these methods were discussed from both the students and teachers points of view.

Keywords

Teaching, veterinary anatomy, embryology, plasticine modeling

Introduction

Traditional methods of teaching veterinary anatomy to undergraduate veterinary students are being challenged and need to adapt to modern concerns and requirements. There is trend to move away from the use of cadavers to new technologies as a way of complementing the traditional approaches and addressing resource and ethical problems. From these alternatives is the computer software, plastination of anatomical specimens, prosection, silyophilization, willed body donation program, the use of haptic simulator and the imaging facilities.

I. Computer software includes

a) *Comparative Anatomy of mammals, birds and fish*. This computer software covers an introduction to different systems of the body.

b) *MediClip Veterinary Anatomy*. This computer software consists of primarily surface and internal anatomy of all regions and systems, with depictions of some surgical and anesthesia techniques. Animals include horses, dogs, cats, birds, frogs, cows, pigs and goats. This well-known MediClip series contains 494 images created by some of the foremost medical and veterinary illustrators.

c) *Veterinary Neurosciences*- An interactive atlas. This computer software provides students with an interactive neuroanatomical atlas. Structures of the canine brain can be examined in high-resolution, 8-bit colour, myelin stained, transverse sections. Analogous gross sections of the sheep brain are instantly available with the click of a button. Both histological and gross views have interactive highlighting labels that allow the student to learn about over a hundred structures by either directly clicking on the image or on the structures name in a text list.

II. Plastination of Anatomy Specimens

This is a process by which natural specimens, after formalin fixation, are dehydrated and then infiltrated with silicone. The result is a durable, real anatomic specimen, which can last indefinitely for use in anatomy labs.

III. Prosection

Prosection is the dissection of a cadaver (human or animal) or part of a cadaver by an experienced anatomist in order to demonstrate for student's anatomic structure (Dorland's Illustrated Medical Dictionary, 2007). Using prosections, verses individual or groups of students dissecting their own cadavers and increasing the number of students studying a particular cadaver, decreases the overall number of animals used. No differences in learning are seen or demonstrable (Provo and Lamar, 1995).

IV. Freeze-drying (Silyophilization)

The idea of Freeze-drying (also known as lyophilisation, lyophilization or cryo-desiccation) is dehydration process typically used to preserve a perishable material or make the material more convenient for transport. Freeze-drying works by freezing the material and then reducing the surrounding pressure to allow the frozen water in the material to sublime directly from the solid phase to the gas phase.

Silyophilization is a process of lyophilization and silicone infiltration (rather than plastination) for preservation of tissues. It is stated to be environmentally safe and that the end result is a translucent, durable preserved specimen, which is resistant to compressive forces (Ocello et al. 1995).

V. Willed Body Donation Program

This program allows the owners of the animals who died of natural causes or were euthanatized for medical reasons to donate their animal's body to the faculty to be used in the teaching programs.

VI. The use of haptic simulator

Haptic (touch) technology i.e. the haptic cow, which allows the student to feel a 3D computer-generated virtual environment, provides a novel way to address some of the new challenges in teaching anatomy. This method is mostly used to understand the bovine internal anatomy and 3D visualization and to learn the bovine rectal palpation (Baillie et al., 2010).

VII. CDs for sonographic, MRI and C.T images as well as radiographic images.

This program includes images for the whole parts of the body in some domestic and wild animals. It is developed to match the new methods introduced in the veterinary field as to give idea about the normal anatomical structure.

As most of the aforementioned methods are so expensive, a cheaper alternative method situated between the traditional methods (i.e. using anatomical atlases, charts and wet formalin preserved preparations) and the 3-D method was suggested in this article. The alternative is the use of plasticine in modeling some of the anatomical and embryological lessons as to give the students the 3-D images impression.

Materials and Methods

The material used for making 3D anatomical and embryological plates is the coloured modeling clay (plasticine). Plasticine is a putty-like modeling material made from calcium salts, petroleum jelly (soft paraffin) and aliphatic acids. The name is a registered trademark of Flair Leisure Products plc. Plasticine is used extensively for children's play, but also as a modeling medium for more formal or permanent structures (Wikipedia, 7/7/2011).

Some illustrations from anatomy atlases representing the muscles of the thoracic and pelvic limbs in the horse, muscles of the head in the horse, ox, camel sheep and dog were chosen, redrawn on bigger or the same scale (about A4 size or A3). Red plasticine clay was used to form the shape of each individual muscle on the redrawn plate. The tendnous origins or insertions of some muscles were modeled by white plasticine and the bones by yellow and lymph nodes or salivary glands by green. The muscle fibers directions were marked with sharp knife to give the second dimension effect. Then after, the muscles, bones and other structures were labeled with numbers and legend. The plasticine plates were then displayed on a plastic base.

On the skulls, some muscle groups were chosen also and modeled with red plasticine, the muscle fibers directions were declared and the whole group of muscles were labeled and legend as done with the plates.

The plates and models were used in the anatomy labs and museum in the first semester (Figs 1-10). This investigation involved demonstrators and students attending regularly scheduled practical anatomy courses. During the labs the experimental group of students of the first year used prosected, wet limbs preserved with classical fixative solutions together with the plasticine model plates for revision. Students of the second year assigned to both control and experimental groups as they used only the prosected wet specimens in the first year and used both methods in the second year, so they can evaluate the efficacy of using the plasticine models and plates.

The plasticine plates and bone models (prepared by the first author) used in this investigation were shown in table (1).

The students were also asked to carry out some plates as a homework and artistic activity in the same time and encouraged to do that by counting some points from the semester evaluation program.

Results & Discussion

The anatomical plates modeled by using the plasticine clay are shown in figs 1-10.

The initial goal of this idea was to determine whether the use of palsticine plates and plasticine on bones benefits anatomy learning and teaching or not.

The notion that anatomy as a basic science should remain traditional in its learning approach and classic in its content, can no longer be supported due to the recent advancements in electronic media (Pawlina and lachman, 2004).

Interesting results of a questionnaire distributed by Jastrow and Hollinderbäumer (2004) to the medical and dental students in Johannes Gutenberg University in Mainz, Germany demonstrates that 94.9% of the students use personal computers; 91.6% of 85.8% who own a computer have access to the internet. The internet is used at least once a week by 70.1% of students for private and by 59.9% for study purposes. Offers of course-relevant material (Workshop Anatomy for the internet) are of major interest. CD-ROMs with anatomy applications are used by 58.9% of the students. The findings of this questionnaire demonstrate high demand for computer-aided instruction and anatomy applications offered on the internet and CD-ROMs. The student's main focus of interest was found to be examination-relevant material and supplemental study material for courses offered locally. The survey demonstrates also that books are clearly preferred to obtain an overview of new material and for effective study and examination preparation, whereas the use of CD-ROMs for study purposes described as more motivating and were reportedly never used for study purposes by 41.1% of the students.

That was the students's point of view in using the new technology in learning anatomy, however we can't neglect that:

- Dissection defines anatomy and teaches essential skills that support the development of a student across the spectrum of veterinary medical education.
- It provides students with the opportunity to verify their learning, trust their observation, and appreciate the concept of variability as it presents itself and not as it is presented to them.
- Dissection provides the platform for the independent lear-ning and independent thinking that underpins the development of diagnostic aptitude.
- Dissection through the gross anatomy course includes team -building, co-operative learning, and the development of leadership skills for the students.
- Dissection can thus play many roles in the educational process.

The preliminary results of this method and the interaction of the students show that the use of cross-sectional plasticine plates to understand ultrasound, computerized axial tomography (CT), and magnetic resonance imaging (MRI) was beneficial as other authors have indicated also (DeBarros, et al., 2001; Magiros et al., 1997; Latorre et al., 2001,and Latorre et al., 2002).

The efficiency of using these models will be tested by a questionnaire designed to be distributed to the students as well as the demonstrators and supervisors in one semester.

However, the challenge is to keep both the traditional methods in learning and teaching gross anatomy as well as to use the imaging facilities, the modern technology and any available method in learning and teaching anatomy.... but to which extent?

The answer depends on the capability (of both institutions and students) to get these modern facilities to apply it. This opinion is also shared by other authors (Mizer et al, 2002;

Parker, 2002 and Reeves et al., 2004).

Conclusion

- Using the plasticine plates as an alternative method stimulates student's interest in learning animal anatomy and improves the teaching effect.
- Sharing of the students to replicate the plasticine plates given to them -as homework- motivates and intensifies their manipulating skills as well as increasing the number of plates used in the anatomy labs year after year.
- The plasticine plates could be remodeled if misused.
- Plasticine is quit cheap if compared with other anatomical plastic or silicon models and not toxic or harmful.

References

Bailliem S; Crossan A.; Brewster S, May SI and Mellor D. (2010): Evaluating an automated haptic simulator designed for veterinary students to learn bovine rectal Palpation. The Journal of the Society for simulation in healthcare: Vol. 5, No 4: 261-266.

De Barros N. Junqueira Rodrigues C.; Junqueira Rodrigues A.; De Negri Germano M.A. and Guido Cerri G.(2001): The value of teaching sectional anatomy to improve CT scan interpretation. Clin Anat 14: 36-41.

Jastrow H. and Hollinderdaeumer A. (2004): On the use and value of new media and how medical students assess their effectiveness in learning anatomy. Anat Rec Part B 280: 20-29.

Latorre R.; Vázquez J.M.; Gil F., Ramirez G., López-Albors O.; Orenes M.; Martinez-Comariz F. and Arencibia A. (2001): Teaching anatomy of the distal equine thoracic limb with plastinated slices. J Int Soc Plastination 16: 23-30.

Latorre R.; Vázquez J.M.; Gil F., Ramirez G., López-Albors O.; Ayal M. and Arencibia A. (2002): Anatomy of the equine tarsus: a study by MRI and macroscopic plastinated sections (s10 and p40). Paper presented at the 11th International Conference on Plastination. San Juan, Puerto Rico, July 14-19m 2002.

Magiros M.; Kekic M. and Doran G.A. (1997): Learning relational anatomy by correlating thin plastinated sections and magnetic resonance images: preparation of specimens. Acta Anat 158: 37-43.

Mizer L.A.; Farnum C.E. and Schenk P.D. (2002): The modular resource center: integrated unites for the study of the anatomical sciences in a problem-based curriculum. Anat Rec Part B 269: 247-256.

Ocello P.; Render J. and Rosenstein D. (1995): A new method for preserving ocular tissue for veterinary education. American College of Veterinary Ophthalmologists (Transactions) 26: 115 (September).

Parker J.M. (2002): Anatomical dissection: why are we cutting it out? Dissection in undergraduate teaching. Aust. NZJ Surg 72: 910-912.

Pawlina Wojaciech and Lachman Nirusha (2004): Dissection in learning and teaching gross anatomy: Rebuttal to McLachlan. The Anat Rec (Part B: New Anat.) 281B: 9-11.

"Prosection." In *Dorland's Illustrated Medical Dictionary.* 30th ed. Douglas Anderson, ed. Philadelphia, Pa.: Saunders, 2007. ISBN 0721601464

"Prosection" From Wikipedia, the free encyclopedia (5/7/2011: 5:45 pm)

Provo J.A. and Lamar C.H. (1995): Prosection as an approach to student-centered learning in veterinary gross anatomy. JAVMA 206(2): 158-161.

Reeves R.E.; Aschenbrenner J.E.; Wordinger R.J.;Roque R.S. and Sheedlo H.J. (2004): Improved dissection efficiency in the human gross anatomy laboratory by the integration of computers and modern technology. Clin. Anat. 17: 337-344.

Corresponding address:
Prof. Dr. Ashraf Sobhy Saber
saberashraf_2@yahoo.com

Table (1): Plasticine plates and bone models distributed to the students

	Academic Year	Plasticine plates and Models used
1	The first year (Anatomy)	• Muscles of the shoulder region of horse. • Muscles of the thigh region in horse. • C.S. in the thoracic limb in horse. • C.S. in the pelvic limb in horse.
2	The first year (Embryology)	• Sperm structure. • Fertilization. • Cleavage types. • Gastrulation.
3	The second year (Anatomy)	• Some muscles of horse, dog and sheep (on skulls) • Facial muscles of horse, camel, ox, dog, sheep (plasticine plates)

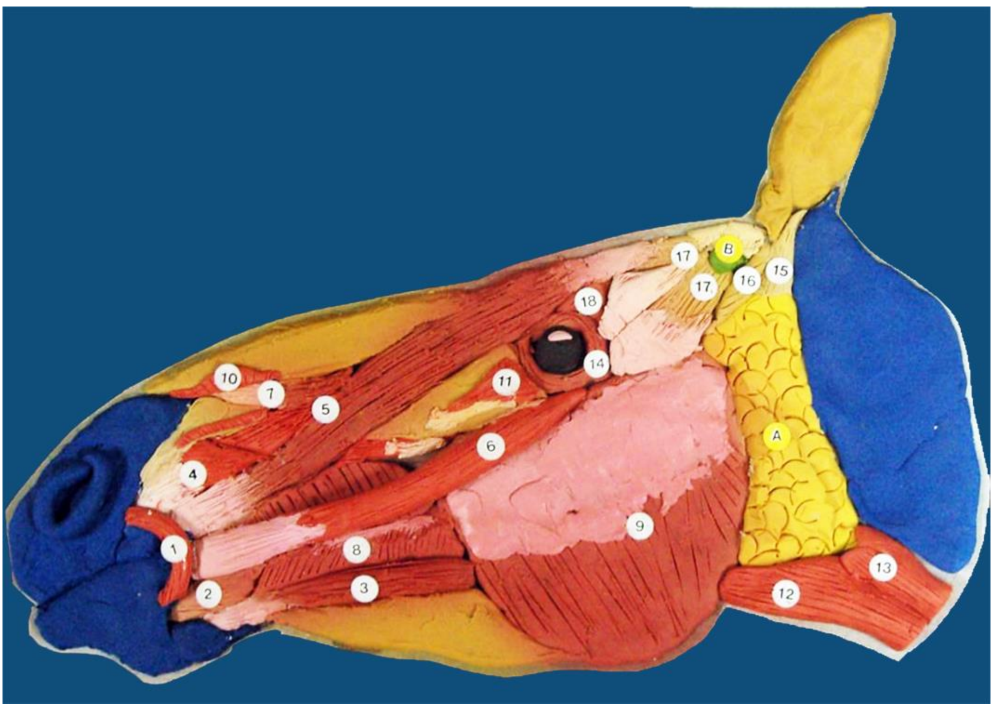


Fig (1): Plasticine plate of superficial muscles of the face of the horse (left view).

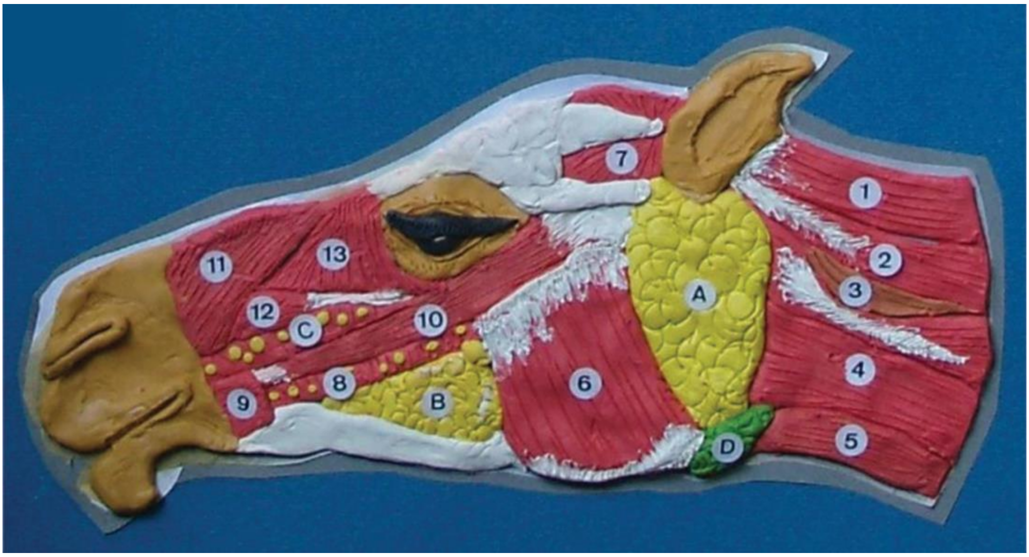


Fig (2): Plasticine plate of superficial muscles of the face of the camel (left view).

Fig (3): Plasticine plate of superficial muscles of the face of the cow (left view).

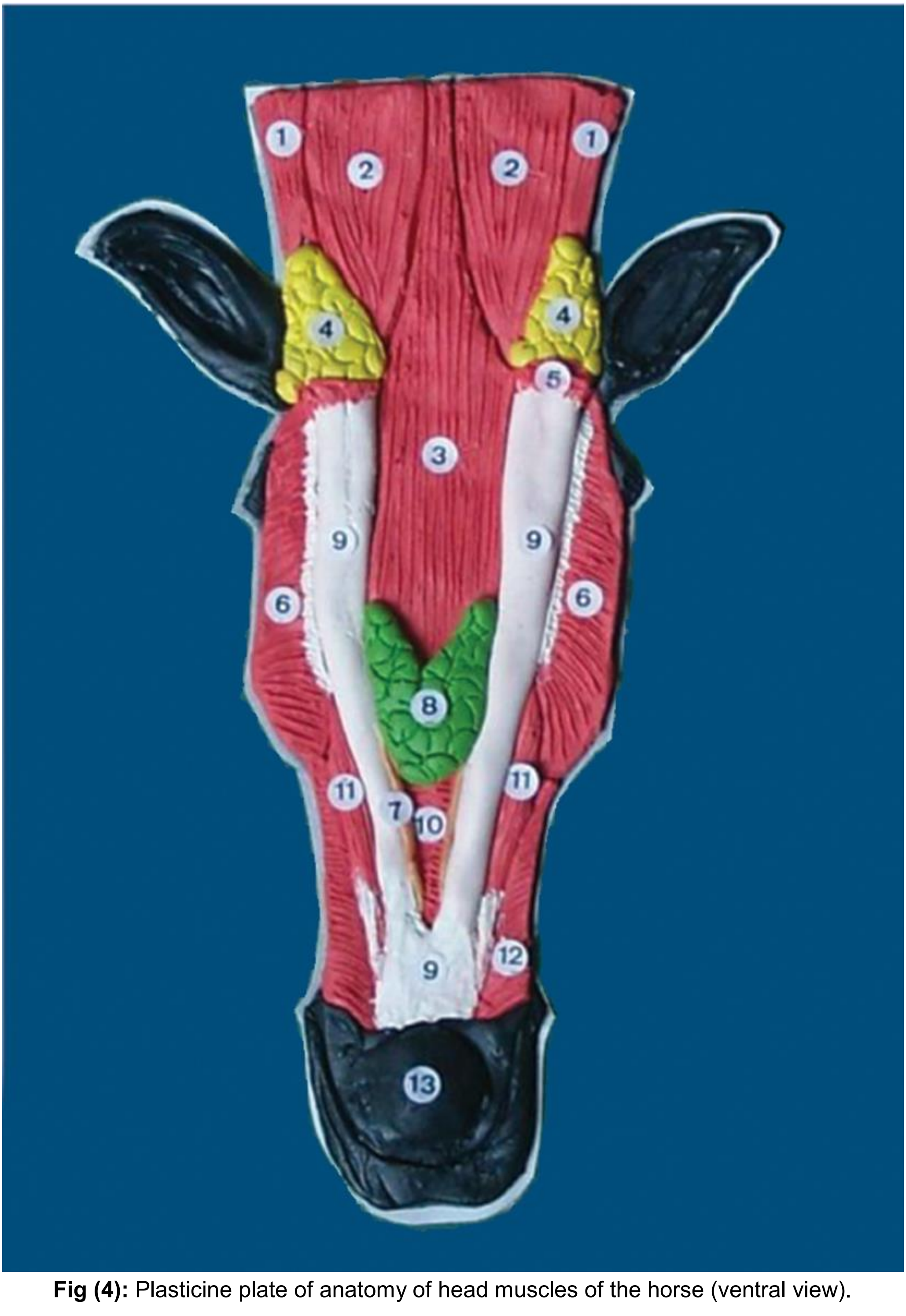
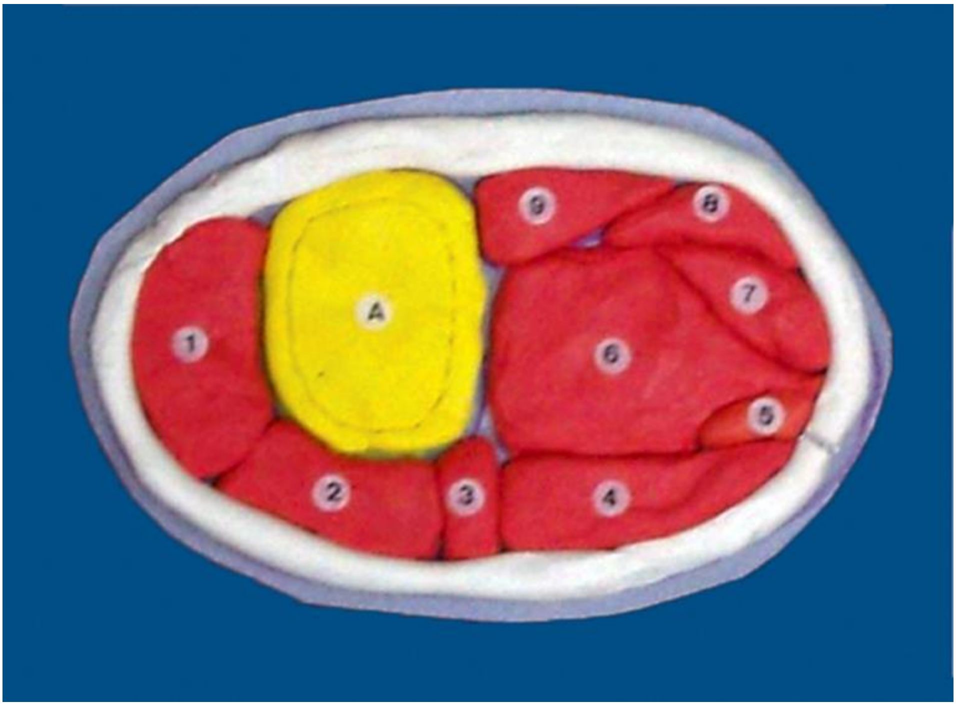
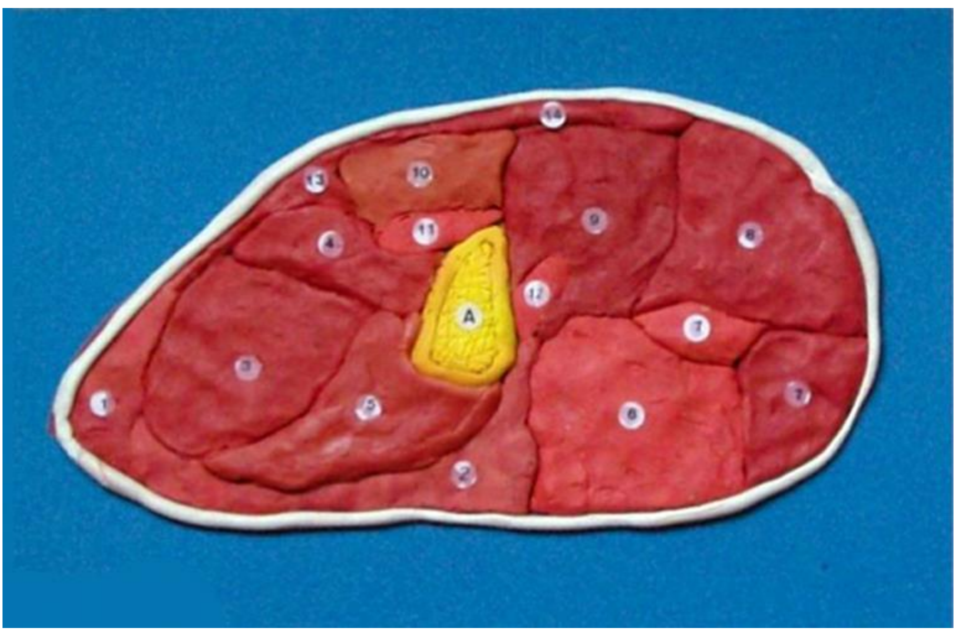


Fig (4): Plasticine plate of anatomy of head muscles of the horse (ventral view).

Fig (5): Plasticine plate of shoulder and arm muscles of the horse, lateral surface

Fig (6): Plasticine plate of thigh muscle of the horse, lateral surface (right).





Figs (7,8): Plasticine cross section plate of the thoracic limb of the horse at the level middle of the radius (upper) & Plasticine Cross section plate of the left pelvic limb of the horse at the level below the hip joint (lower).

Figs (9,10): Plasticine shaping of some muscles of the face on the skulls of the dog (upper) and horse (lower).

Figs (11): Plasticine shaping of some muscles of the face on the skull of the sheep.

Animal species in this Issue

Gray wolf or Grey wolf (*Canis lupus*)

Kingdom: Animalia & Phylum: Chordata & Class: Mammalia & Order: Carnivora & Family: Canidae & Subfamily: Caninae, Genus: ***Canis*** & Species: ***C. lupus***

The **gray wolf** or **grey wolf** (*Canis lupus*), also known as the **timber wolf** or **western wolf**, is a canid native to the wilderness and remote areas of North America and Eurasia. It is the largest extant member of its family, with males averaging 43–45 kg, and females 36–38.5 kg. Its winter fur is long and bushy, and predominantly a mottled gray in color, although nearly pure white, red, or brown to black also occur.

Compared to its closest wild cousins (the coyote and golden jackal), the gray wolf is larger and heavier, with a broader snout, shorter ears, a shorter torso and longer tail. The wolf's legs are moderately longer than those of other canids, which enable the animal to move swiftly, and allow it to overcome the deep snow that covers most of its geographical range.

The gray wolf is a social animal, whose basic social unit consists of a mated pair, accompanied by the pair's adult offspring. The average pack consists of a family of 5–11 animals (1–2 adults, 3–6 juveniles and 1–3 yearlings), or sometimes two or three such families, with exceptionally large packs consisting of 42 wolves being known.

Source: Wikipedia, the free encyclopaedia