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THE OSTEOLOGICAL PREPARATION AND CONSTRUCTION
OF A MAMMALIAN DEMONSTRATION MODEL

by

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Bachelor of Arts
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Approved by
A likely specimen, one of comparatively large size and complete development, was first obtained. Size, age, and development are important for the assurance of hardened bones and well developed teeth which are essential for a successful skeletal preparation. Such animals as the type to be used can often be procured by inquiring at the city police station where unwanted and stray animals are taken to be disposed of.

Killing, fleshing, macerating, degreasing, bleaching, and mounting are the necessary steps in producing skeletons of really high quality. Each of the above stages must be carefully performed and controlled. The completed preparation should be found strong and durably mounted in natural positions; it should be bleached a uniform ivory white, free from grease and lastly it should be preserved and protected with a transparent, water-proofing substance.

The cat was killed by placing it in an air-tight box of convenient size, which contained a chloroform-saturated piece of cotton. Death occurred in about three minutes.

Great care must be taken in the fleshing of the animal so that the connective ligaments are not cut which hold the bones in natural arrangement. Nevertheless, the flesh has to be removed thoroughly to prevent the bones from separating in the maceration process. In the procedure of removing the muscles, however, some of the connective elements were destroyed and had to be compensated for with wire when mounting.

The pectoral girdle and forelimb were first dissected out and then the pelvic girdle and hindlimb. The four limbs were next dismembered and the skull removed by carefully cutting between the atlas and condyles. In separating the right femur, or thigh bone, from the innominate bone, the head was broken off in the acetabulum. The limbs, trunk, tail, and skull were now fleshed.

The process of maceration (decomposition) which ordinarily follows, was not used in its entirety, due to the danger of destroying natural ligaments and cartilages which are essential to the proper setting of the bones. The bones, in spite of this, were allowed to stand in a porcelain pan covered with water which was maintained at room temperature for a period of three days until some decomposition had taken place. Complete maceration would require from eight to ten days. This partial decomposition of the flesh made it possible for further cleaning; however, in the maceration process no foreign substance, such as metal and wood, should be allowed to get into the pan as these will dis-color the bones. A metal weight was used to keep the bones submerged; and where it rested on the femur, a slight discoloration appeared that required extra bleaching.

The bones were now removed to a liquid-soap solution, as recommended in a process by "Wilder and Gage" (Anatomical Technology, Page 107) and boiled slowly for forty-five minutes. The liquid-soap solution was made up of the following ingredients which were heated together until a homogenous mixture was formed:

- Soft water - - - - - - - - - - - - - 2000 cc.
- Strong ammonia - - - - - - - - - 150 cc
- Nitrate of potash (saltpeter) - - - 12 grams
- Hard soap - - - - - - - - - - - - - 75 grams
This solution was used in a dilution of four parts water to one part soap mixture. After boiling, the remaining pieces of flesh were removed with fingers, scalpel, and stiff brush, care being taken to preserve the ligaments holding the bones intact. Boiling caused the separation of the cartilage from the last three ribs.

In order to clean out the spinal cord, the vertebral column had to be separated into its five respective regions: the cervical, thoracic, lumbar, sacral, and caudal. The skull was now cleaned and the bulk of the brain removed with a scalpel; the remainder with hot water, soap and brush. After the bones had thus been rendered clean and thoroughly washed they were held in their natural position for drying by running a stiff pointed wire through the vertebrae, forcing the point of the wire well into the sacrum.

Having done this, the vertebral column was bent into its natural shape but in so doing the Atlas and Axis separated from the remainder of the vertebral column.

After drying, the bones found to be greasy were placed in carbon tetrachloride for six to eight hours. Then, on removal the bones were plunged into hot (not boiling) water for about five minutes; the addition of a little ammonia helped to bring the grease to the surface.

Since a good skeletal preparation is distinguished by clean, white bones and by a correct and natural articulation, the steps of bleaching and mounting are very important.

The bleaching was done with Hydrogen Peroxide in a large-mouthed gallon jar. The mouth of the jar was large enough to permit the entry of the thoracic vertebrae and ribs intact along with the other bones of the specimen. The bleaching
required seven pints of Hydrogen Peroxide (17 Vol.-5%) to which was added a few drops of ammonia that brought about a more rapid reaction.

The mounting must be of such a type that it will be sturdy enough to withstand the handling by many classes of students. The finished bones were drilled, wired, and glued in the most natural position. The drilling was done with a one fifty-eighth inch drill, wired with Number 24-gauge wire, and the joints glued with Lepages colorless Aeroplane glue.

The finished specimen was made to stand on a black-painted wooden stand with the aid of metal tubes riveted in the base.

The more important bones were labeled with black India Ink and the complete skeleton given a liberal coat of white shellac which will prevent the lettering from being rubbed off when used in laboratory study and demonstration. The shellac also acts as a water-proofing substance which provides protection from the ravages of dirt and atmosphere, makes them easier to keep clean, and adds greatly to the life of the preparation.
CONCLUSION

In a brief resume a few advisable comments might be presented to aid in a like preparation at a later date. The following outline is submitted to show in an orderly sequence the procedures to be followed:

The materials necessary for the mechanics of the project should be first obtained so that time between steps may be utilized to an advantage. By this is meant such materials as the board for the mounting-base, metal tubing, paint, shellac, wire, glue and other things which will be needed for the completed specimen.

The worker, in beginning, should allot himself sufficient time to kill, skin and flesh the animal without interruption. Great care should be taken in the dismembering of the bones to avoid breaking them as happened in the case of the femur. Broken bones necessitate the repetition of the operations undergone thus far with a new animal.

The maceration process is unnecessary and undesirable since the cooking accomplishes the same purpose, requiring far less time and skill. The cooking is best carried out just under the boiling point of the liquid soap mixture and should be carefully watched; the cat should be removed at fifteen to twenty minute intervals and cleaned as much as possible until the flesh is entirely removed. By following such a method of cooking the cartilage and ligaments can be better preserved, especially those holding the ribs which are very difficult to handle when disarticulated.

The vertebral column should be cleaned without separating; likewise the foot bones should be maintained intact since wiring of these is very had and gluing not to satisfactory. This will result in an easier and more permanent mounting.

When completely clean and degreased the bones should be bleached after
first extending a wire through the vertebral column and carefully bending it into its natural form.

Following labeling and shellacing process, the skeleton should be mounted. The wiring should be done with a heavier gauge wire than was used, preferably a twenty-gauge which was not obtainable at this time because of war shortages.
OSTEOLOGY

The internal supporting framework of the body or endoskeleton is to be considered here. This consists of (1) an axial portion comprising the skull and vertebrae column and (2) an appendicular portion which supports the appendages.

The axial skeleton consists of:

1. **SKULL** - divisible into cranium or brain case which protects the organs of special sense, and a **visceral skeleton** which supports the respiratory apparatus and includes the facial bones.

2. **VERTEBRAE COLUMN** - serves as a supporting axis for the body. Its structure, however, is such to allow movement since it is composed of a number of movable parts, the vertebrae. Five types of vertebrae are recognized: (1) seven **cervical vertebrae** in the neck, (2) thirteen **thoracic vertebrae** in the chest which articulate with the ribs, (3) seven **lumbar vertebrae** in the loins, (4) three **sacral vertebrae** in the pelvis region which form a single bone called the **sacrum** and (5) a variable number of **caudal vertebrae** posterior to the sacrum and comprising the tail.

The ribs support the walls of the trunk and are united with the breastbone, namely the sternum. The nine anterior pair of ribs articulate separately with the sternum and are called **true ribs**; the last three pair are united with one another ventrally and are called the **false ribs**.

The appendicular skeleton consists of:

1. **ANTERIOR EXTREMITIES**:
   a. **Pectoral girdle** - a paired structure made up on each side of the scapula and clavicle.
b. Foreleg - made up of three divisions: the proximal division is formed by the humerus. The middle division is formed by the radius and ulna which articulate with the distal end of the humerus. The distal division of the foreleg is formed by the carpus or wrist, and manus or hand. There are seven carpals arranged in two rows. The hand is composed of the five metacarpal bones and the five digits which are made up by a number of bones, the phalanges.

2. POSTERIOR EXTREMITIES:

a. Pelvic girdle - formed by the union of right and left innominate bones. The innominate is divisible into three portions: the ilium, ischium, and pubis which meet and ankylose in a deep socket called the acetabulum into which the head of the femur fits. The largest foramen in the skeleton, the obturator foramen, is situated between the ischium and pubis.

b. Hindleg - made up of three divisions: a proximal made up of the femur on the anterior, distal end of which is the patella or knee-cap; A middle division formed by tibia and fibula, and a distal division formed by the tarsus or ankle and the pes or foot. The largest of which is the calcaneus or heel bone. The skeleton of the foot is composed of five metatarsal bones and four digits, each of which has three phalanges.