

# Cleaning and Preserving Animal Skulls

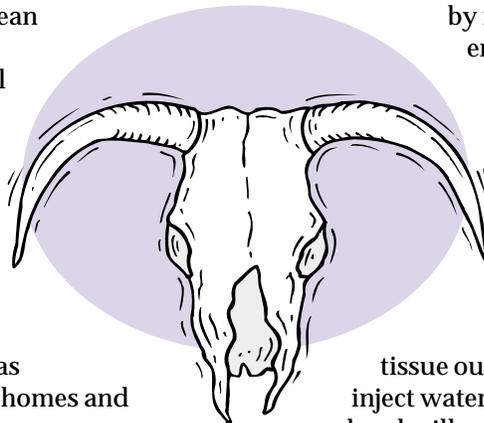


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There are several reasons to clean and preserve animal skulls. Often the examination of an animal skull is used to determine the species. Among the characteristics used to identify species, dentition (the number and description of teeth) is a key feature. The examination of dentition is much easier on cleaned skulls. Animal skulls are also valuable teaching tools. Also, animal skulls are frequently used as interesting, decorative displays in homes and offices.

Skulls can be used to teach students many aspects of an animal's life history including anatomy, diet, behavior, and habitat. Students can sketch skulls for art projects, measure skulls to practice math skills, tell stories about the animal, or research the life history of the animal. The actual process of cleaning and preserving animal skulls can be an additional hands-on learning experience for students. A separate publication *Wildlife Skull Activities* is available from the Arizona 4-H Youth Development publications catalog.

Regardless of the specific process used to clean skulls, the initial step is to skin the head and remove most of the flesh. Tissue may be removed with a variety of knives, scalpels and other tools, such as dental instruments, depending on the size of the head. It is not necessary to remove all the tissue, but the more flesh removed the shorter the processing time. When removing tissue, be careful not to scrape too hard and scratch bone surfaces or break thin bone tissue. Removing most of the brain tissue before processing will be beneficial. (See CAUTION statement at the end of this publication) This is especially true when processing skulls from young or very small animals with more fragile skulls. If most of the brain tissue is not removed, it may expand during processing and force the brain case apart. Removing brain tissue from skulls prior to placing them in a bug box, will greatly reduce the amount of odor produced. Soaking the skinned head overnight or for at least a few hours in warm water will facilitate removing the brain tissue. After the head has been soaked, the brain tissue should be broken apart or "scrambled." This scrambling can be accomplished



by inserting a wire with a loop at the end into the brain cavity and using a mixing action. The wire or other instrument can be inserted into the brain cavity through the opening at the posterior of the upper skull where the spinal cord passes through. Brain tissue can be washed out by filling the brain cavity with water and shaking water and tissue out. A large syringe may be used to inject water and suck out brain tissue. If the head will not be worked on immediately, it is best to keep it frozen until ready to process.

## Methods to Clean Skulls

### 1. Cold Water Maceration

Maceration is the simplest method and can work very well for most any skull. Maceration is simply soaking the fleshed-out skull in water until all the remaining flesh has been removed. The time required to remove all the flesh varies with the size of the skull and the temperature of the water. The ideal water temperature is about 90°F. Time may vary from a few days to several weeks. In this method, the skinned head is simply placed in an appropriate sized container (can, bucket, barrel, etc.), covered with water and left to stand. About 2 tablespoons of an "enzyme" laundry detergent per gallon of water will

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help de-grease the skull. Water should be added if evaporation has exposed part of the skull. The putrid water should be poured off periodically and replaced with fresh water. The water should be poured off through a sieve or wire screen to recover teeth that have loosened and fallen out of the skull. The skull may be removed from the water periodically and flesh may be pulled or rinsed off. Final cleaning can be accomplished with a tooth brush, dental pick, or similar tool. If the skulls are soaked outdoors, try to keep leaves, soot and other debris out of the water. These contaminants can discolor the skulls. After removing all the remaining flesh, a couple of 24 hour soaks in fresh water helps in eliminating odor. After all the soaking, let the skull dry thoroughly.

The advantages of cold water maceration is that it is easily done and will not damage or shrink skulls. The disadvantages are that it is smelly, very slow and teeth will most likely fall out.

## 2. Hot Water Maceration (“cooking”)

Cooking is simply a speeded up process of maceration. Cooking skulls in water must be done carefully and the skull checked often. Cooking should be done outdoors when possible. Boiling skulls can destroy disease causing organisms, but rigorous boiling can damage skulls. Larger, heavier skulls can be gently boiled and smaller, more delicate skulls should be gently simmered to prevent damage. After removing most of the flesh and removing the brain tissue as described earlier, simply cook the skull in enough water to cover the entire skull. The skull should be placed on a rack to avoid contact with the heat source. Adding the enzyme detergent, as indicated for cold water maceration, will de-grease skulls even better in the hot water. When cooking, check the skull frequently. The entire process can take from a few minutes to a several hours - again depending on the size of the skull. A good practice when using the cooking technique is to remove as much flesh as possible, cook for a short time, remove skull and clean off more of the tissue and repeat this process until the skull is clean. Tying a string to the skull will facilitate picking it out of the hot water. The cooked flesh is fairly easy to remove with a knife, scalpel, or pliers. It is important to check the cooking skull frequently. Cooking too long can damage skulls and actually dissolve bone tissue.

**IT SHOULD BE NOTED THAT HOT WATER MACERATION WILL LIKELY CAUSE SOME SHRINKAGE OF THE SKULL. THIS CAN BE IMPORTANT IF THE FINISHED SKULL IS TO BE MEASURED FOR SCIENTIFIC PURPOSES OR TO RECORD A TROPHY.**

The advantage of hot water maceration over cold water is that the process is much faster. A disadvantage is the potential for causing damage and shrinkage to the skull.

## 3. “Bug Box”

Several species of beetles in the genus *Dermestes* feed on dried flesh and can be very effective skull cleaners. Both the adult Dermestid beetles and the larvae feed on flesh, but the larvae consume a greater amounts of flesh and are much more efficient bone cleaners. A sufficient number of adult beetles to start a colony may be collected from the decaying carcasses of vertebrates that have been exposed outdoors for a few days.

When collecting Dermestids, avoid the various fly larvae (“maggots”). Fly larvae will not do a sufficient job of cleaning skulls and some maggots can stain skulls. Look for Dermestid beetle adults and larvae on carcasses which have been exposed for a period long enough to be dried out. Fly larvae or maggots will be legless, a lighter color, and will not have an obvious head. Dermestid larvae or “grubs” will have three pairs of legs, a darker gray to almost black color, a fuzzy appearance and have an obvious head. Adult Dermestids are 1/4" to 1/2" inch long, gray to black in color and may be mottled or banded.

After fleshing out a skull, place it in a cool, dry place until it dries — generally at least a day or two. After air drying, the skull can be placed in a “bug box” containing *Dermestes* and be cleaned extremely well without any damage to the skull. Very small and fragile skulls (e.g. bird skulls) may be damaged if left in the bug box too long. Monitor the progress periodically. The time required to clean a skull in a bug box will vary with the size of the skull, the size of the Dermestid colony, and the temperature in the box. The time required will vary from several hours for small skull to several weeks for larger skulls.

A bug box can be almost any container large enough to hold the skulls being cleaned. A steel drum, bucket or even a coffee can be used. Open top containers should be tightly covered with screen or other material to prevent the beetles from escaping. If a wooden box is used or constructed, the joints must be tight to prevent beetles from escaping. If a completely closed container is used, air holes must be provided. These air holes should be covered with screen. Put the skull and beetles in the box with an open bottle or pan of water to provide humidity. Using a wick made of cotton or similar material placed in the water source will provide the necessary moisture and prevent the beetles from drowning in the water. Placing the skull and beetles in the box

between layers of cotton or polyester batting provides an ideal environment for beetle activity. Using polyester batting will reduce the chance of infestation by carpet moths. Check progress periodically and wait.

Dermestids will be most active at a temperature of about 80 °F. Beetle activity will decrease significantly at very hot or very cold temperatures. If no skulls are available for the beetles to feed on, a colony may be kept alive for quite some time by feeding it dry dog food.

The major advantages of the bug box method of cleaning skulls are that the teeth remain in their sockets and skulls usually are not damaged. The disadvantage is the time required to complete the process.

## Bleaching Skulls

After the cleaning process, skulls may be bleached or left their natural color. Bleaching can remove small pieces of tissue and other debris from inside skull cavities. Bleaching also removes most of the odor of the skulls. However, severe bleaching can make skulls look unnatural and remove certain characteristics such as the teeth stains in herbivores. Severe bleaching may also break down bone tissue. Some bleaching is probably best, but not enough to make them completely white.

Air-dried skulls may be bleached by soaking them in an approximately 3% to 6% solution of hydrogen peroxide. Hydrogen peroxide solutions that are used to bleach hair can be purchased from beauty supply stores. The concentration of hydrogen peroxide in these products is usually expressed as "volume." 20 volume is approximately 6% hydrogen peroxide, 30 volume is approximately 9% and 40 volume is approximately 12%. These products can be diluted with water to the desired concentration. The time required to bleach the skull will vary with species and the whiteness desired. When using hydrogen peroxide, most of the bleaching process will have been completed when the solution stops bubbling. After the skull is bleached to the desired whiteness, it should be rinsed with water and allowed to dry completely.

Hydrogen peroxide can cause serious damage if it comes in contact with your eyes. If this occurs, flush the eyes with plenty of water and contact a physician immediately. Hydrogen peroxide can irritate skin and rubber or latex gloves should be worn when immersing hands into the peroxide solution.

Chlorine bleaches should not be used because they can dissolve bone tissue. Skulls may also be bleached by simply setting them out in the sun.

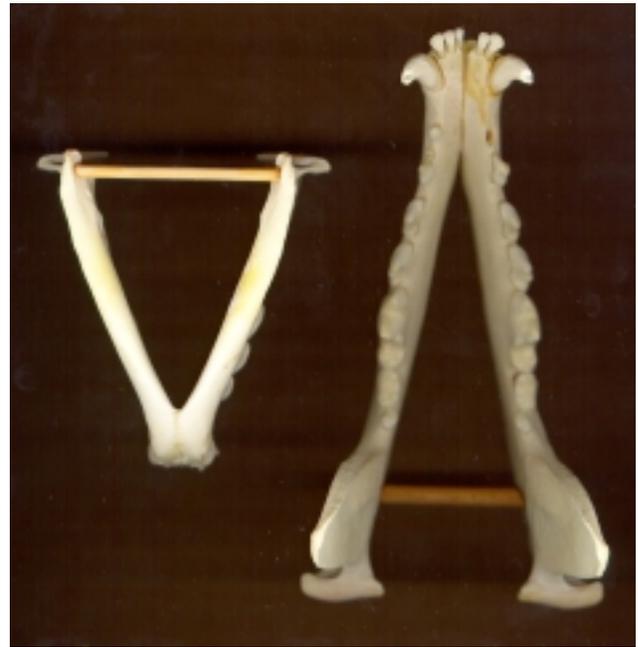


Figure 1

## Preserving Skulls

After the cleaning and bleaching process, thoroughly dry skulls may be preserved and finished very nicely by complete immersion in, or brushing on, a mixture of ½ clear lacquer and ½ lacquer thinner.

Aerosol spray cans of clear polyurethane may also be used to finish skulls. Apply several very light coats of the spray, allowing each coat to dry before applying the next. Continue this until the desired finish is reached.

Another very acceptable solution to preserve and finish a skull is a mixture of ½ common white glue and ½ water brush over the entire skull.

If several skulls of the same or similar species will be kept, it is advisable to mark the mandibles (lower jaw) and the corresponding maxilla (upper jaw) with a unique number or other identification so they can be matched up correctly if separated or mixed with other skulls. This marking should be done before preserving the skull with lacquer or other finish.

The point at which the two halves (mandibles) of the lower jaw meet often breaks apart during processing or with repeated handling. The mandibles can be glued back together and the jaw can be strengthened by gluing a small dowel between the posterior ends of the jaw. (Figure 1)

## Preserving Teeth

The enamel on teeth in skulls has a tendency to crack. Avoid subjecting the teeth to rapid temperature changes, such as placing a cold skull in very hot water. If teeth do crack, especially canines, fill the cracks with a clear drying glue.

Teeth will frequently fall out or become loosened in the processing. These can be glued back in with any good quality, clear drying glue. Teeth can be glued back into their respective sockets after the skull and teeth are thoroughly dry. If most or all of the teeth in a skull fall out, replacing teeth in their proper socket in the jaw can be accomplished through careful trial and error. The correct placement of teeth becomes much easier with experience. In many species some of the empty tooth sockets are larger than the tooth. The tooth fits very loosely without much contact surface to glue. This is especially true of large canine teeth. This can be overcome by soaking a small piece of a cotton ball in glue and wrapping the cotton around the tooth root before placing the tooth in the socket.

Another precaution is to replace teeth correctly in the sockets of teeth that naturally overlap from upper jaw to lower jaw. These would primarily be the canine and cheek teeth in carnivores and omnivores. Generally the upper teeth overlap the lower teeth. Therefore, glue lower canines and cheek teeth toward the inside of the lower jaw and the upper canines and cheek teeth toward the outside of the upper jaw. Closing the lower jaw against the upper jaw when glue is still pliable should facilitate alignment.

Teeth that appear to be fixed solidly in the jaw when processing is complete may loosen and eventually fall out with time and use. A method to prevent this is to run a "bead" of glue along the base of all the teeth where they enter the jaw bone. Spread the glue using a dry tissue or cloth. If clear drying glue is used and applied sparingly, it is almost invisible in the finished product. All gluing should be done on dry skulls before applying varnish or other final finish.

### CAUTION

**When handling any part of the carcass of an animal, there is the possibility of contracting certain zoonotic diseases. For example, the rabies virus can persist, in a viable state, in the brain tissue of an infected animal until the tissue is completely desiccated. Therefore, the use of latex, rubber or other gloves is highly recommended when handling any part of an animal carcass. Extra caution should be taken when handling brain tissue or the carcass of any animal for which the cause of death is uncertain. This is especially important when handling carcasses of species commonly associated with rabies such as, bats, skunks and raccoons. Prolonged boiling in water will kill most pathogens, such as rabies — freezing will not.**

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