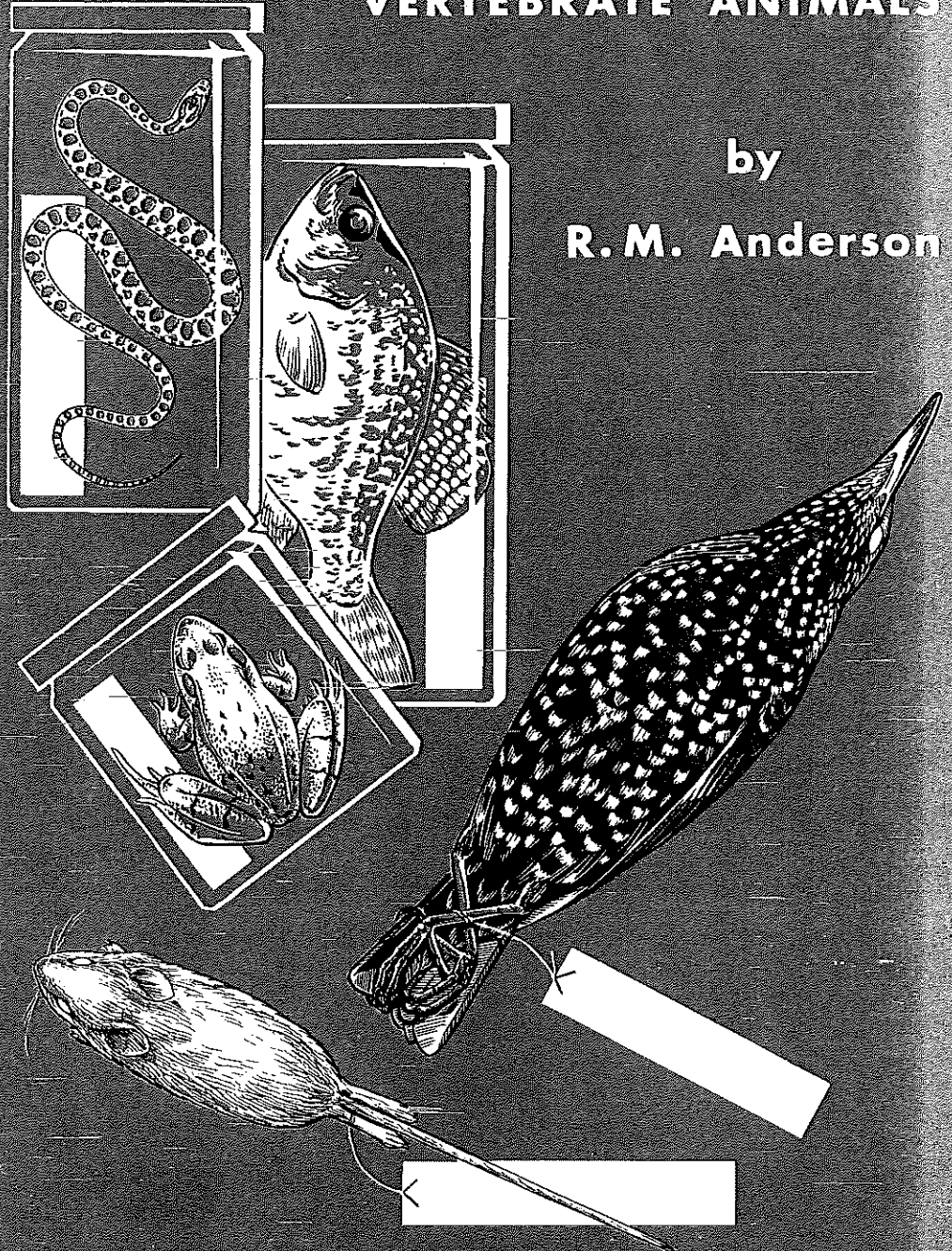


**METHODS OF COLLECTING  
AND PRESERVING  
VERTEBRATE ANIMALS**

by  
**R. M. Anderson**



NATIONAL MUSEUM OF CANADA

### CHAPTER III

## SKINNING MAMMALS

#### SMALL MAMMALS

##### *Labelling*

The first thing to do is to prepare a label or at least make notes of certain data which can only be obtained from the fresh specimen "in the flesh." Locality, date, and sex, should be put down first of all; then the three essential field measurements: length (L.), tail (T.), and hind foot (H.F.), taken in millimetres if possible. Take the measurements in inches and fractions if a millimetre rule or tape is not at hand. Colour of eyes, and of any soft or hairless parts that are apt to change colour on drying, should be noted on the back of the label.

##### *Cased Skins*

The simplest way to prepare small mammal skins is by "casing" them and this method may be used for any mammal from the size of a shrew up to the size of a wolf. The "cased skin" is easily and quickly prepared, without the use of preservatives, and with no other tool than a knife, and is quite suitable for scientific purposes. The student of seasonal moults and colour will often find skins "cased" with the flesh side out useful in showing the localized areas of new hair growth that form variegated patterns which are well known to fur-buyers as evidence of "unprimeness" of the skin, but which are often hardly visible on the surface of the fur (Figure 8). The "cased skin" is recommended for the casual collector or traveller who wishes to preserve an occasional specimen, or a collector who is pressed for time, or who is travelling light. In briefest terms:

*Skin the animal in the same way as a trapper would skin a fox or mink, leaving claws and feet attached to the skin, and dry and preserve the skull separately.*

One opening cut is made, beginning at one heel, cutting through skin at back and inner side of leg, across base of tail between the anus and the urethral opening, and down to opposite heel. Detach skin from legs, cut through each leg a little above heel, peel skin down on feet as far as the toes if possible and cut away any loose flesh, and loosen skin around base of tail. The skin of the base of tail is seized with the thumb and finger of one hand and the tail which is attached to the body is pulled with the other (Figure 9). By some twisting the tail will usually slip out of its skin or sheath. Some tails, as of certain shrews, may need a slight preliminary rolling-pin treatment with the handle of a knife on the table to soften them and loosen the skin a little. Stronger tails may be slipped through the points of a forceps, or gripped between two sticks held in the hand, or squeezed between the cleft of a split stick tied together at one end. Hairless tails

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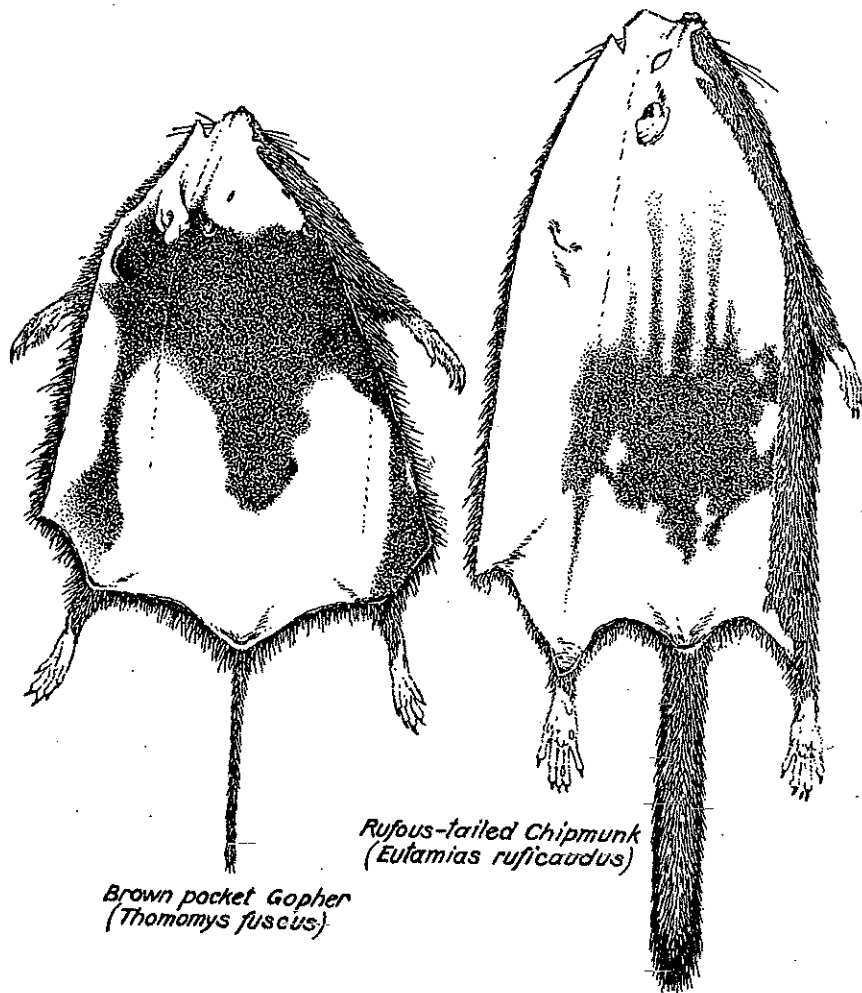


Figure 8. Flesh side of unprime mammal skins.

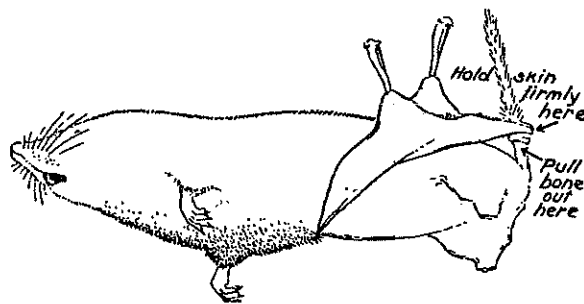


Figure 9. Skinning tail of small mammal.

like that of the muskrat, and heavy muscular or fat tails like those of the skunk, porcupine, or beaver, must be split on underside. In fact, any tail of an animal larger than a squirrel should be split open to remove fat, etc., and enable it to dry more readily. The tail being free, work the skin gradually free from the body. For the convenience of beginners, and, in the case of large skins, of anyone, the body may now be hung up by a slip knot around the hips or legs, so that the operator may have both hands to work with. Dust on plenty of sawdust from the time the opening cut is made, to absorb blood and grease, and to afford a better handhold on the skin. Avoid stretching the skin. Cut off the fore legs and continue peeling the skin down to the head. When the bases of the ears are reached, these may be cut off with the scalpel as close as possible to the skull. The eyes will soon be seen, and the membrane attached to eyelids should be cut through with the scalpel, but with great care not to cut the eyelid itself. This necessitates cutting deeply with the point of the knife. If the animal is large enough, thrust the finger into the eye from the outside and cut against the finger. This will ensure proper care. Cut around the lips close to the skull at the inner edge of the gums; and free the nose by cutting through the cartilage near the tip (Figure 10). The remainder of cartilage at tip of nose may usually be peeled out by the thumb or finger-nail, or by scraping with knife, and it should be carefully removed or the mammal's nose will shrink to a peak when drying.

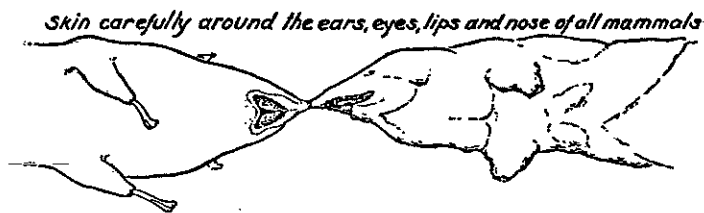


Figure 10. Skinning head of small mammal.

The skull then comes out and should have a label attached and be hung up to dry. Scrape or pull off any bits of fat or meat on the skin, using sawdust as an absorbent. The flesh and fat may be removed from the skin of body and legs with a knife or notched scraper, but around the eyes, ears, cheeks, and nose, the scissors come into play. Hold thumb or forefinger on fur side and stretch skin over it, then shear away flesh by holding the scissors flat on the skin. Avoid cutting any wrinkles or through roots of hair. Bring lips together with a stitch or two. Cut or scrape away any bits of meat from the stumps of the leg bones and skin these as far down as the skin will slip conveniently without tearing. Sponge off any blood or grease from the hair, and rub dry preservative into all parts of the damp flesh side of the skin.

Make a stretcher from a piece of thin board, cardboard, or corrugated pasteboard, or use a stretching frame (Figure 11) about the width of the cased skin as it lies flat, and pull the skin over the stretcher, fur side out, to dry (Figure 12). Animals larger than a squirrel should be put on the

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stretcher with the flesh side out for a day or two. When the skin is partly dry, but not brittle, turn it right side out and hang it up to complete the drying.

Sumner and Swarth (1924) described a method of stretching small skins uniformly for use in accurate determination of colour tones by instrumental means, the flat skin being laid out on a block and small pulley weights attached to the edges of the skin. However, they seem to have prepared many of their skins by first measuring the animal in the flesh, then stretching the skin slightly by hand while it was being pinned to the drying-board. The skin was pinned at eight points—tip of nose, extremity of each of the four feet, one at middle of each flank, and one at tip of tail. An important part of this technique consisted in thorough removal of grease from the skin by means of benzene.

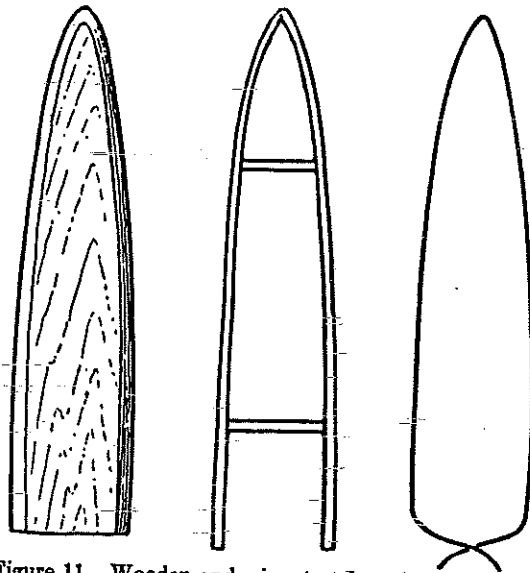


Figure-11. Wooden and wire stretchers for cased skins.

The writer as well as many other collectors have pinned or pegged out skins to dry in emergencies, but have not found the method well adapted for small skins as they break and tear easily when being examined.

Great care should be taken not to overstretch a skin, and to dry it as small as possible without allowing wrinkles to form. A skin which has shrunk in the natural process of drying can be moistened and stretched at any time, but when a skin is once over-stretched, it is almost impossible to reduce it to natural size again. If the skin is allowed to wrinkle, the sides of the wrinkles may come together, preventing rapid drying, and local decomposition may set in and the hair slip off in the cracks. *Where preservatives are not available, the skins of all animals should be dried flesh side out.* Small skins dry very quickly, and had best be left as they dry, until they can receive laboratory attention. If the skin is properly cleaned and stretched it will need no other attention, except to keep it out of the reach of mice, moths, and dermestres.

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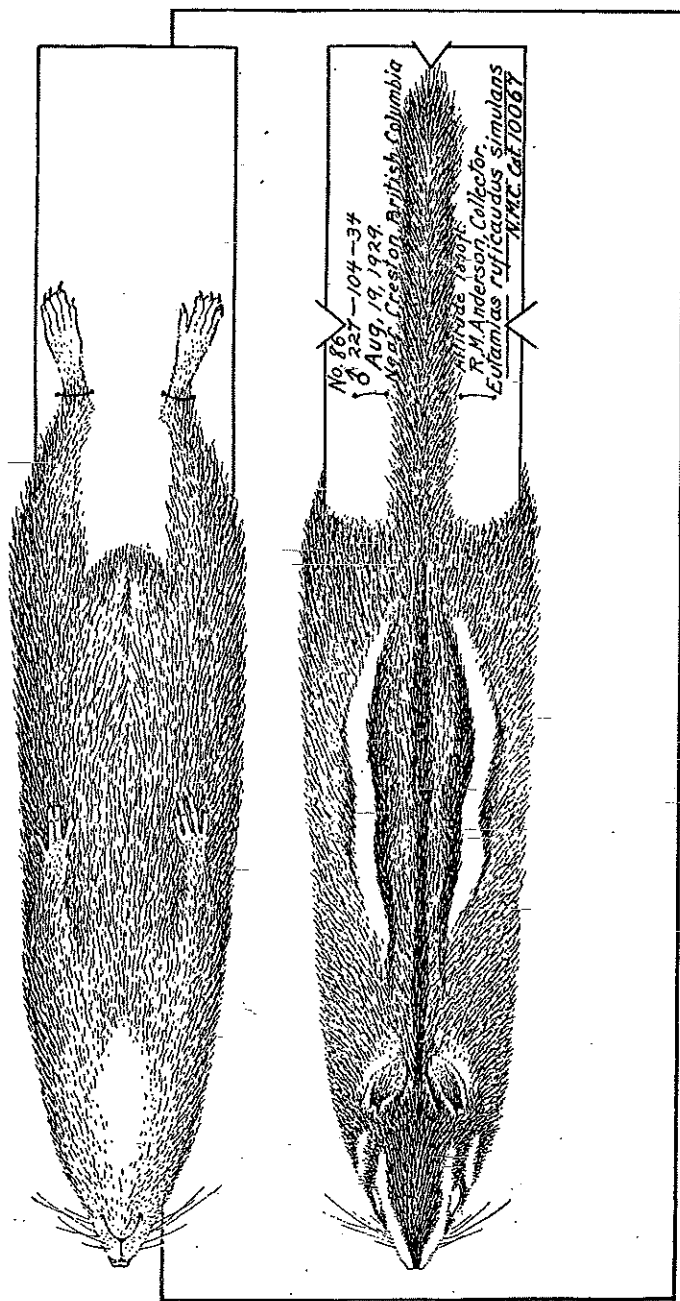


Figure 12. Cased skin of chipmunk (ventral and dorsal views).

Where many skins are handled, professional trappers usually keep drying-boards or frames on hand. Wire stretching-frames are inexpensive, may be easily made or purchased, and may quickly be adjusted to any size of pelt and allow space for a circulation of air between the sides of the pelt, thus hastening the curing process. Another great advantage of the wire stretcher is that the springy sides need only to be compressed and the dried skin slips off without sticking or tearing the hide or the fur. The average collector, who only puts up an occasional cased skin, will usually find it less trouble to improve a stretcher from a piece of packing box, shingle, split cedar shake, or bent willow saplings, than to keep on hand elaborate equipment that is seldom used.

An adaptation of the method of "casing" skins used by commercial trappers as described by the writer in the first edition of this work (1932, pages 45-48), was described as a practical means of getting mammal skins from persons who had neither the time nor the inclination to "make" the conventional type of "scientific or study skin." Such skins are as useful as any other "make" for the purposes of mounting, and to all intents and purposes known to the writer are perfectly suitable for study purposes. If the owner insists on having his skins uniformly made it is quite feasible to relax the cased skin and make it up in the orthodox style, an operation which has been commonly done in the past. If pasteboard is used for a stretcher it may be left inside the skin and the necessary data written on the bottom (Figure 12). If badly soiled, the stretcher may be replaced by a clean one. It has also been suggested that if a permanent mounting card be cut from transparent sheet celluloid to replace the original cardboard stretcher the hind feet and tail may have the under surfaces examined without removing the stitches binding them down.

Mr. Charles Elton, Director, Bureau of Animal Population, University Museum, Oxford, England, has been carrying on extensive experiments in preparation and storage of flat or cased skins, and referring to the method described by the writer in first edition of this bulletin (1932), writes as follows (1938, pages 244-245):

"The following extensions of this technique have been made. Suppose one has cased a mouse skin: instead of tying a label onto the animal, one leaves sufficient of the stretcher card behind the hind legs to allow the data to be written upon it, and the hind legs and tail to be secured to the card with thread. The base of the card is cut to a standard width that is considerably wider than the mouse, the width used for small mammals, such as mice, is 4 inches. The whole mounted specimen with its card is put inside a cellophane envelope, 4.25 x 11 inches, open at both ends so that the mouse can always be slid in and out with the grain of the fur. The resulting product is a flat specimen of which both sides can be examined without removal from its envelope. It can be removed in an instant if desired, the hind legs and tail are safe from injury, and the records are securely attached to the skin and are visible at a glance. The mounted specimens can then be stored in cabinet drawers or boxes, and classified with guide cards or individually distinguished. This system has especial value where large numbers of skins are being collected for ecological or genetic study, but it may prove also to be of use to the museum expert, provided he does not insist on having round skins for comparative work. The cased skin is inevitably wider than the animal, but this point appears less serious when it is realized that reliable measurements can in any case only be made on the body itself. . . . Casing skins is at least as speedy as any other method, but there is a potential waste of time in cutting cards to the exact size required in each instance. This difficulty is overcome by having a set of flat metal gauges by whose aid the right size of card can quickly be found. Each gauge has a line drawn down the centre marked at

Figure 12. Cased skin of chipmunk (ventral and dorsal views).

centimeter intervals, that facilitates cutting the base of the cards to the right depth to clear the end of the body. The gauges are held together at their bases by a central rivet, and they pack into a small space . . . The cost of cards and cellophane envelopes is quite small, and is balanced by the great saving in overhead costs of storage and the convenience of reference."

Arthur and Ruth D. Svihla of the Department of Zoology, University of Washington (1939, page 111), have recently tried out the above method in the field with a few modifications and found it time-saving, convenient, and satisfactory for such small mammals as mice, voles, shrews, and weasels. It was found that by making the slit from leg to leg along a line midway between the anus and the urethral opening, more skin support is given the base of the tail and a smoother ventral line is obtained. They use corrugated pasteboard from ordinary packing cartons for the bodies, it being stiff enough for ample support and porous enough for quick drying, and one quickly becomes adept in approximating the correct width and trimming the cardboard to shape. Two leg wires only are necessary, one for each side of the body. These can be bent slightly at the feet so that they turn in, holding the feet to the ventral side of the skin. This ensures their protection and prevents them from being broken off. A single tail and body wire was cut a few millimetres longer than the total length of the animal, inserted through the base of the nose and passed along the mid-line of the body to the tip of the tail. The wire projecting from the nose was then clamped down ventrally holding the cardboard and skin firmly together.

The label can be sewn to the cardboard so that the free end just tucks under the skin, and the data can also be printed by hand very easily on the cardboard body after the specimen is made up.

Whether the collector uses the wide based stretcher described by Elton, or the ordinary shape used by trappers is a matter of individual preference. In either case the data can be written on the base of the card, and a more formal label also attached if desirable. If a wide-based card is found necessary to hold the specimen in place inside of the cellophane envelope, it may be slipped on top of the original stretcher at any time, or the old stretcher slipped out and a new one substituted. The writer recommends degreasing the skin with carbon tetrachloride before attaching a clean museum label. If a clean, degreased space is visible on the flesh side of the skin, large or small, it is well to print the catalogue number with a pen and India ink, to avoid mixing specimens if the label is removed.

#### *Standard Study Skins*

In most museums and large private collections the skins of mammals smaller than a raccoon are made up as study skins or so-called "scientific skins." Medium-sized and large skins are usually cut open and spread out. The extra trouble involved in making up "study" that is "stuffed" or "round" skins instead of the simpler "cased" or "flat" skins is counter-balanced by the convenience of comparing uniformly made skins, as most museums use the conventional make of study skins for scientific reserve series. Flat skins are more apt to have the tails and legs torn off in handling.

For purpose of explanation the writer has selected a short-tailed shrew (*Blarina brevicauda*). After taking measurements, writing labels, and

recording data in field catalogue, the collector should plug with cotton the mouth, nostrils, and shot holes of the specimen if blood is apt to flow. If the animal has been dead for some time so that the blood is congealed, it is usually not necessary to plug holes. Lay the specimen on its back, part the fur along the mid line of abdomen, and make the opening cut from about the breast bone to the base of tail, making the cut run to one side of genital organs and perineal regions (Figure 13). After starting the



Figure 13. Making opening cut for study skin.

incision, if the skin is loosened with the handle of the scalpel, and the cut is made with edge of blade up, there is less likelihood of cutting off the ends of hairs, and of penetrating the abdominal cavity. If the abdomen is perforated, and juices run out, smother them with sawdust, and keep any exposed flesh coated with sawdust from beginning to end of the operations. The free use of sawdust will keep the fur clean and prevent hair sticking to the body, as well as giving a grip on the slippery surface of the skin.

Use the fingers or flat end of scalpel handle to loosen the skin from the flesh, and work the skin loose from the knee and upper leg. Grasping the foot, thrust the knee-joint upward, disjunct it with knife, scalpel, or scissors (Figure 14), and work the skin as far back as it will go—usually to the heel in small mammals. Some collectors save time here by cutting

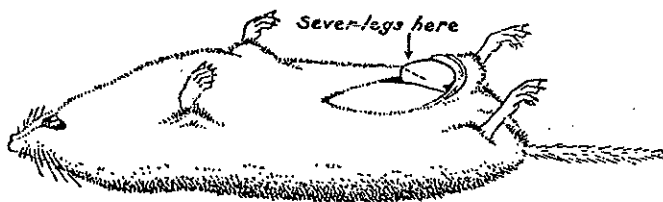


Figure 14. Skinning legs of a small mammal.

the leg off at the heel joint, but pay for it later by not having the bone to wrap the leg filling around. Clean the flesh from the lower part of the leg. The muscles usually peel off easily by slipping the blade along the bone and severing the tendons near the joints. Skin the other leg in the same manner.

Work the skin loose around the base of the tail and slip the tail vertebra out from the skin or sheath as described on page 48 (Figure 9). Sometimes a tail is broken in a trap, or is severed by a shot, and sometimes

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should be taken that the skins are marked or labelled so that in mammal specimens the skull goes with the right skin, and that the birds are properly sexed. If several bodies are on hand at once, there is a very great danger of mixing them up. A certain amount of bookkeeping is necessary if the specimens are to be of scientific value, and too much should not be left to memory.

Dry powder (arsenic, alum, borax, saltpetre) may be dusted on and will stick to a moist skin, but if the skin has become dry it should be moistened by sponging with a wet rag or bunch of cotton. A small dry spot may be softened by dabbling on a little water with the finger and rubbing it in. The powder may be dusted on with the point of scalpel, with a small brush, a rabbit's foot, or a bit of cotton on a stick. Rub an extra amount into scalp, feet, and base of tail, and shake the surplus back into the poison can. If the animal is fairly large and the skin does not dry quickly, the soles of the feet should be slit, the flesh removed, and a little preservative put in. The slit may be closed by a stitch or two.

After finishing the work, if poison is used, the hands should be thoroughly washed and the nails cleaned with a soft stick. Medical students often rub the finger-nails full of vaseline or cosmoline before beginning a poison-pickled or malodorous dissection, and subsequently wash the hands with hot water and green soap.

#### *Filling the Skin*

Before turning the skin right side out, the leg bones should be wrapped with cotton, both to shape the skin and to prevent the bones from adhering when drying. A small, flat sheet of cotton is peeled off the roll, and one end wrapped tightly around the stump of bones, the thicker end forming the upper part of the legs and later lying alongside the body filler (Figure 18*d*). If the upper bones of the leg have been cut away, a leg

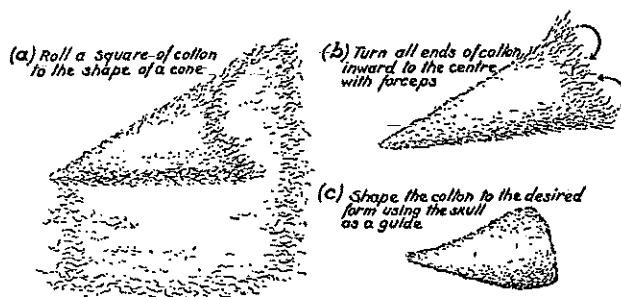


Figure 16. Making artificial head for a small mammal skin.

wire should be wrapped with cotton batting. The wrapping should not reach to the tip, but begin at the position of heel or wrist. The end of the wire is pushed into the foot, preferably on the top of the foot or along its side.

Turn the skin right side out. The first step is to fill the skin of the head. Peel off a small square of fine-fibred cotton and roll it into the shape of a cone (Figure 16). Twist and squeeze it hard by pushing it

with fine pointed forceps, a piece of stiff wire, or knitting needle into a loop made by the forefinger and thumb. Turn all ends of cotton inward to the centre with forceps and shape the cotton to the desired form, using the skull as a guide. Skulls that are angular or odd-shaped like a rabbit's should be imitated as closely as possible to make a good looking "skin." Some collectors think that equally good results may be obtained with shrews by making head and body filler in one piece, but the writer's experience is that the pointed head of the shrew cannot be made firm enough in that way. The tail must now be wired. Splinters of tough wood or bamboo are often convenient substitutes for wire. A wire may be straightened by putting one end in a vise or around a nail and pulling strongly, or by stretching the two ends apart while holding each with a pair of forceps. The wire must be small enough to go to the tip of the tail skin, rigid enough not to bend easily, and proportionate to the size and durability of the skin. Cut a wire the length of the tail plus a little more than the length of the opening cut in the body skin. Wire for tails that run to a very fine point should be tapered with a file for an inch or two. The terminal part of the wire should be slightly roughened with a file so that the cotton wrapping will not slip. Wrapping the tail wire for a long haired tail is not very difficult, as the only important thing is to cover the wire with cotton at all points. Wiring a smooth, short-haired tail takes some practice, as the artificial tail must be smooth and tapering; its imperfections will be glaring when the skin dries down upon them. The tail of the jumping mouse may be taken as a good example. Flake off the thinnest possible wisp of fine-fibred cotton, wet the wire so that the cotton will stick, and beginning at the tip wrap the cotton firmly around the wire, twirling the wire with one hand, and gradually thickening the wrapping with the other, following the natural tail as a model (Figure 18c). If the wrapping tapers too much at any point it may be built up by wrapping on flat, slender wisps of cotton, but care should be used to wrap tightly or the cotton may slide into a bunch on the wire when insertion is attempted. If this happens, the best thing to do is to wrap a new tail, as forcing in a lumpy tail is apt to pull off the end of the tail skin. If the tail is spindle-shaped, as in the star-nosed mole or some shrews, wrap the wire with cotton to imitate the natural shape of the tail, and cut a slit underneath the basal part of the tail in order to allow the wired tail to enter. The slit may be sewn up with a few stitches. Painting the wire tail with arsenical soap makes it slip in easily, but if dry preservative is used, the tail may be wet and rubbed in the powder before insertion in the sheath. After working the wire into the tail properly and seeing that the skin is not twisted, the body filler may be prepared.

It is important that all the body filler should go in one smooth, firm roll, because if separate bunches are put in the skin, it will be sure to have a lumpy appearance when it dries and shrinks. Irregularity is much more noticeable in a mammal skin than in a bird skin, as the imperfections of the latter are disguised by an overlapping sheath of feathers. Roll an oblong piece of cotton until the circumference is roughly that of the body. The cotton body will be a little larger than the skinned carcass, as the body becomes more or less deflated after death. The skin will also shrink down on the body filler to some extent while drying. The intention is to make the stuffed skin look like the animal in life. Turn both ends of the

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cotton inward to the centre with forceps, push the ends inward until the exact body length is secured, using the skinned body as a guide (Figure 17). The anterior end of the tail wire may be bent up a little and slipped inside the cut along the abdomen.

Grasping the cotton head-filler firmly at each side with the forceps (Figure 18), insert it through the opening cut and make it go to the extreme tip of nose. Follow this with the cotton body, shoving one end firmly into the hollow at the base of the cotton head and tucking the rear end of body neatly around the hips. Arrange the legs in natural position, the loosely wrapped ends lying flat against the body filler (Figure 18).

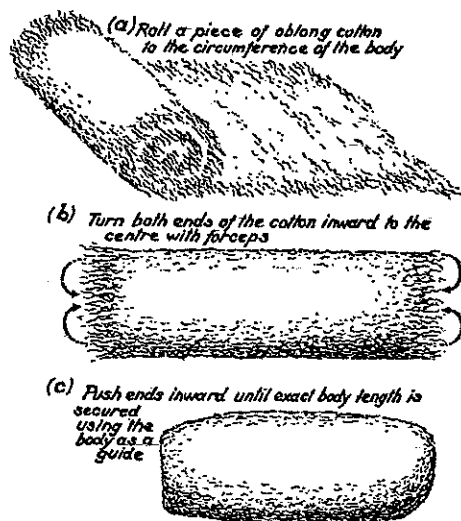


Figure 17. Making artificial body for a small mammal-skin.

Before sewing-up the skin, see that the ends of leg cotton lie parallel along the body, adjust a thin layer of cotton over the end of the tail wire, and put a little extra padding where necessary around the base of the tail, sides of the shoulders, etc. A common fault is to have the hips break off abruptly and leave a shrunken space around the base of the tail. Tie the end of the thread into the skin at the first stitch, as a knot often pulls through. A common practice is to catch a little lump of loose cotton in a slip knot at the end of the thread to make a stop knot, but care should be taken that this does not form a lump under the skin. Sew up the opening, beginning at either end of the slit, using the baseball stitch (Figure 19) from one side to the other, putting the needle from inside of skin to outside, and taking care not to catch any tufts of hair in the stitches. When all the stitches are in place, gradually draw the edges of the opening together, carefully take up the slack in the thread, and make the end fast by an extra stitch and knot. It is generally more unhandy to draw each stitch tight as it is made, as the overlapping feathers or hairs get in the way of the next stitch.

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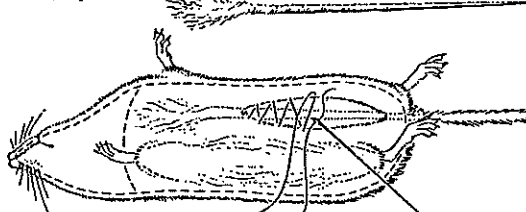
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(a) Insert cotton head first through opening cut—

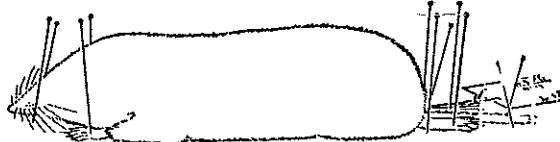
(b) follow with cotton body pushing it snugly against the cotton head—



(c) Then twist a thin strand of cotton over a stiff wire and insert carefully into the skin of the tail



(d) Before sewing see that ends of leg cotton lie parallel along body also adjust a pad of cotton over tail wire and any extra padding wired



(e) Attach tag to right hind foot, pin feet and tail as indicated and let the skin dry

Figure 18. Filling a study skin of a small mammal.

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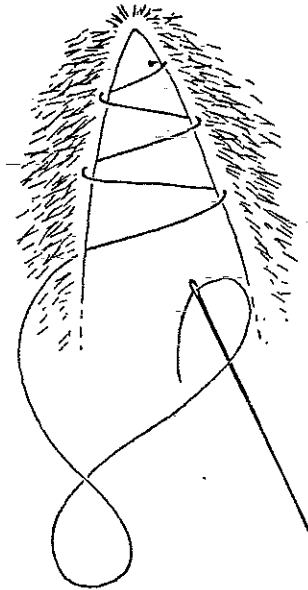


Figure 19. The "baseball stitch" used for sewing mammal and bird skins.

*Laying out Specimens for Drying*

In order to dry properly, the skin should be pinned out on a board. If obtainable, sheets of pressed cork, such as are used by entomologists for pinning out insects, are superior to anything else for small mammals, but any soft board that pins can penetrate will do.

The stuffed skin will probably be somewhat rough and distorted, and should be laid out as nearly as possible in the shape and size of the dead animal. It is convenient to keep the skinned body at hand until after the laying out of the skin, but the length of body and tail can be taken from the measurements made at the start. Lay the skin beside the skinned body and gently compress or elongate the skin with the fingers so that the lengths of tail and body correspond with those of the carcass. The writer's method is to anchor the skin in place by a pin through the base of the tail, then to place a pair of pins crossing over the middle of the tail to hold it in line with the body. Bring the tip of the nose to its proper place, and draw the front paws into line, parallel with the sides of body, pinning them in place by one pin through each paw. The hind legs should then be drawn back into place, parallel with body, and pinned with back of foot up. One other pair of pins should be put in the board at the outer side of each

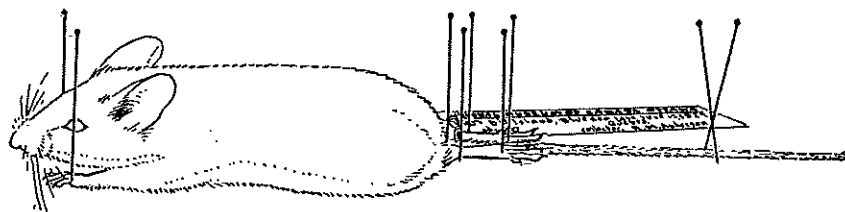


Figure 20. Pinning out a small mammal skin for drying.

foot near the heel to keep it parallel with the body (Figure 20). If necessary, pins may be put between the toes to spread them. This is more desirable with webbed toes or toes with fringed edges, such as those of the water shrew. If the head is properly stuffed it need not be pinned, but if the nose has a tendency to spring up, it may be held in place by a pin set at an angle along each side of face. Be careful that these pins do not leave a groove in the damp skin.

Tie the labels with the complete data to the right hind foot, making a secure double knot just above the heel, so that the thread cannot slip off (Figure 20). Never put on a label with a slip knot or half hitch as the label is apt to get lost. It is best to put a label on the skull at once and hang the skull up, but it may be pinned for drying on the board with the skin. A pin should be run through the space inside of the cheek bone, but holes should never be made in a mammal skull. Some well-made skins of different species are shown in Figure 21.

Burt (*Mammals of Michigan*, 1946) gives suggestions on collecting specimens of the groups found in Michigan, a list of representative habitats, and (pages 32-44) on preparation of specimens. His method of preparing small mammal skins differs from the preceding methods little more than

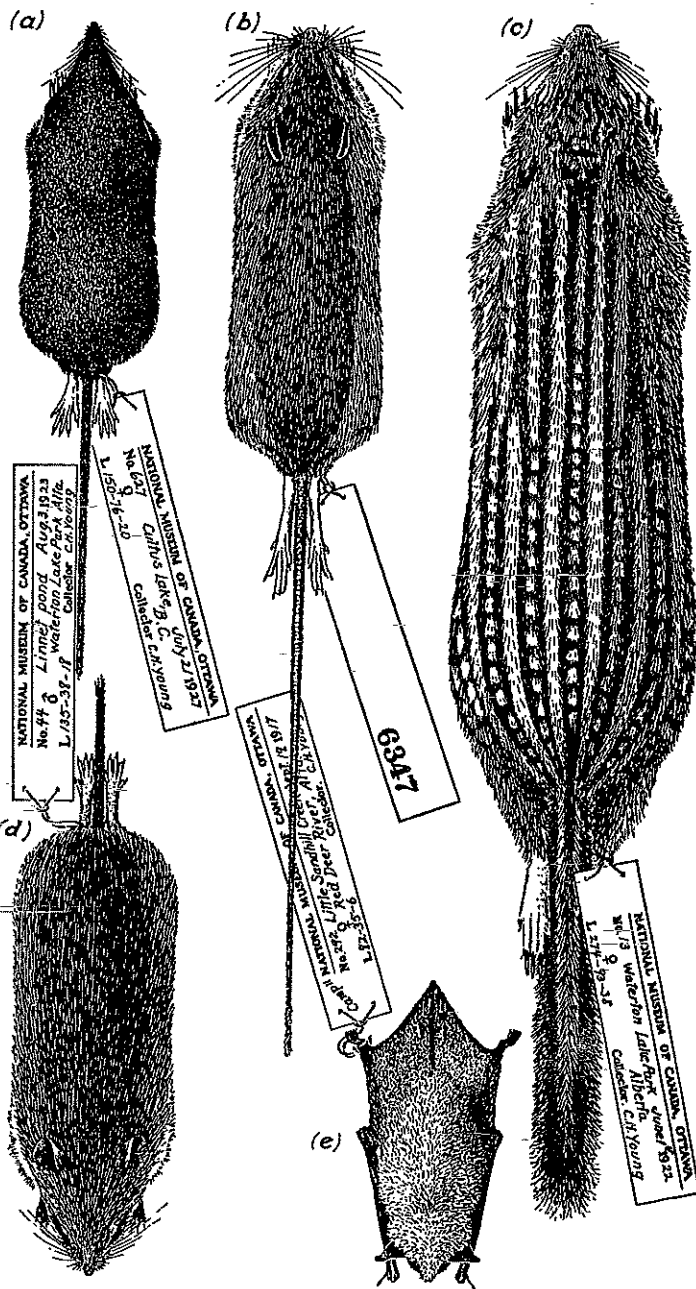
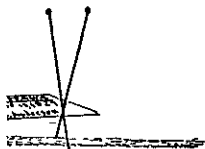


Figure 21. Examples of well-made small mammal skins: (a) water shrew, *Sorex palustris*; (b) jumping mouse, *Zapus princeps*; (c) striped ground squirrel, *Citellus tridecemlineatus*; (d) red-backed mouse, *Clethrionomys gapperi*; (e) Say bat, *Myotis subulatus*.

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in cutting off the bones of hind leg just above the ankle and the bones of fore leg just above the wrist; cutting four straight leg wires about two-thirds the length of the body, to be wrapped in cotton and the uncovered tips forced into the feet just under the skin of the sole. This may stiffen the skin a bit more than by leaving in the wrapped leg bones, prevent a leg from being pulled off by a dangling label, and make the skin more durable for class use. This method involves the use of four additional wires in the legs. If the wires are not available a narrow strip of bamboo or hardwood slivers might be substituted, but the collector should be familiar with the method of leaving the leg bones in place.

If the skin has been torn before beginning operations, it may be better to remove the body through the original gap instead of making a new cut. Keith Reynolds, of London, Ontario, recently sent the writer skins of short-tailed shrew (*Blarina brevicauda*) and star-nosed mole (*Condylura cristata*), showing a method used by A. A. Wood, of Strathroy, Ontario, on shrews and moles, species which are prone to decompose rapidly in hot weather. When the hair on the abdomen has started to slip or become loose, he finds it better to make the opening cut from middle of throat along the breast to tip of sternum. With careful handling this will to some extent prevent the loose hair from rubbing off while the animal is being skinned and the opening cut sewn up. The same condition is less frequently found in trapped meadow mice (*Microtus* group) when the stomach contains a large amount of partly digested, soft, green vegetation. (See also, use of alum on skin in such cases, p. 11).

#### *Preparation of Skulls in the Field*

The skull is removed from the carcass by disjuncting carefully at the neck. Cut off only the largest muscles in medium-sized species, and remove nothing but eyes, tongue, and brain from the skulls of small species. Small bony processes are apt to be cut or broken off in the field and a certain amount of dried tissue protects the skull from such breakage. In small skulls poke out part of the brain with a wire or tooth-pick, because if the whole brain dries in place, it may swell later when the skull is being cleaned and separate the sutures, particularly in young skulls. Large skulls should have all the brains removed. A rough wooden spoon may be whittled out of a stick, or a soft green twig may have the end hammered into a rough brush, and with these the brains may be poked out. After part of the brains have been removed, water may be poured in through the foramen magnum (entering point of the spinal cord) and the skull well shaken and rinsed out before hanging up to dry. The skull should be preserved in as perfect a state as possible, and the foramen magnum should never be enlarged by cutting nor should any bony processes be cut or scraped away.

Skulls may be dipped in cornmeal or sawdust to hasten drying and to keep labels from sticking to the flesh. Do not allow skulls to remain wet, as they macerate and decay when damp, and the jaws and teeth may drop away, so that the numbers cannot be associated with all parts of the skulls. Fractured skulls will usually have the parts kept together by the periosteum and ligaments, but if any pieces become detached they should be tied up in a bit of rag and fastened to the larger parts.

Small skulls dry quickly when hung up. When several skulls are being cared for at once they may be strung on a cord or wire passed through the loops by which the labels are attached, preferably through a special loop made by tying together the loose ends of the thread after the label is fastened. By keeping the loops short the dangling skulls will not get tangled, and any particular skull may be removed without loosening its label. The "strings" of skulls will dry rapidly in the sunshine or near a fire. Care must be taken that they are not stolen by cats, dogs, rats, or birds.

If there is no time to dry skulls, they may be preserved in alcohol, but no alum or formalin should be used, as these retard the cleaning processes. Formalin also decalcifies bones, if they are left in the solution for any length of time. When only a few skulls are to be handled, alcoholic preservation has some advantages, particularly in preventing loss or breakage of small loose skulls. (See also Borell, 1938, cleaning by dermestid beetles.)

#### LARGE MAMMALS

Mammals larger than the woodchuck (*Marmota*) or raccoon (*Procyon*) are too bulky to be stuffed in the field. The skin is removed in a somewhat different manner from that described for smaller mammals, dried flat, with or without the use of chemical preservatives, and tanned later.

It is sometimes difficult to get accurate and consistent measurements. Large mammals should if possible be measured on level ground, in a straight line from tip of nose to end of last vertebra of tail. Never measure around the curves of the back. A tape (preferably a steel one) should be used for all measurements. Measurements taken with a knotted string are uncertain on account of elasticity of the string, even if the collector can remember what the knots mean. Notches on a stick are a bit better, but after all, if a man is going to do scientific collecting he would do well to bring along tape and notebook as well as rifle, cartridges, and skinning knife.

The three essential measurements used in scientific comparison should always be taken:

- (i) Length, from tip of nose to tip of last vertebra of tail, measured in straight line, with body stretched out.
- (ii) Tail, length from base bent at right-angles to body to tip of last vertebra, not including hairs at end of tail.
- (iii) Hind foot, from tip of hock to tip of hoof, or from back of heel to end of longest claw, the foot being pulled out straight in any case.

Additional measurements (Figure 22) may be taken for the benefit of the taxidermist who may mount the specimen.

- (iv) *Height at shoulders*, distance in a vertical line from top of withers to sole of foot or bottom of hoof as the animal would stand in a natural position.
- (v) *Chest: circumference* just back of the elbow, measured with a string or tape; *depth* at same point, measured in a straight line between two sticks stuck in ground at withers and brisket; *thickness* in widest part, the distance between spines of shoulder blades.
- (vi) *Neck: circumference, depth, and thickness* at three places: (A) just back of head; (B) middle of throat; and (C) just in front of shoulders.
- (vii) *Abdomen: circumference, depth, and thickness* at largest part.
- (viii) *Fore leg: circumference, depth, and thickness* at three points: (A) elbow joint, near the body; (B) at middle of forearm; (C) at knee joint.

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skin and the warm flesh as he works. The writer spent 2 or 3 hours skinning his first sheep on a mountain side at 25 degrees below zero, frosting several knuckle joints in the operation, but after some experience shot, skinned, and cut up the meat of a caribou ready for loading on a sled in 25 minutes, at 30 degrees below zero. The difference was entirely due to knowing what to do, and making it snappy.

#### MAMMALS REQUIRING SPECIAL TREATMENT

##### *Bears*

Bears necessitate more hard manual labour than most species, as they are generally fat and in any case the skin adheres tightly to the flesh and must be cut away. Scraping the grease from the skin is a long and tedious operation which should be done as soon as possible, as the skin will dry rapidly in spots where the knife cuts have removed the fat, and it is very easy to gash the skin at these points, or to shave-off a patch of the hair roots so that the hair will drop out. The skin of a polar bear is most readily cleaned of fat after it has been spread out on the ice or snow and frozen flat and smooth. By a fortunate provision of Providence, polar bears and Eskimo are frequently found on the same range, and an Eskimo woman with a curved-edged *ulun* or woman's knife will shave the blubber from a bear skin with high professional skill and startling rapidity. It will pay any collector to watch this operation once for his own education. The same results may be obtained by using a strongly curved skinning-knife with bevel-edge and stretching the skin across the thigh or over a rounded beam. With a little practice, cultivating a sweeping, outward, shaving-stroke, with the back of the hand up, regulating the pressure by the "feel" of the blade on the inside of the skin, the blubber may be loosened and rolled up very rapidly. The removal of the blubber is an absolute necessity, whether the skin is to be salted or dried.

The bear's feet should be skinned to the base of the claws, and the thick, hairless pads on the soles should be left intact and attached to the skin. The foot is most readily skinned by continuing the leg incision around the inner side of the foot at the edge of the hair. The ordinary hunter or trapper, white man or native, usually cuts off these pads, leaving them attached to the carcass, and most "hunter's skins" come into the market in this shape. Though this mutilation does not deduct from the value of the skin for a rug, it does deduct from the scientific value. Bears, or any other mammals with thinly haired under parts, should have the opening cut made along the middle of the back, if the specimen is to be mounted standing erect on the hind feet.

If Indian or Eskimo assistants are employed, they must be watched very carefully, as many of them have traditional methods of their own for cutting and removing skins of most animals, to say nothing of superstitious taboos, one of the most annoying being the common practice of leaving some part or tuft of the skin attached to the skinned carcass. The feet, and the perineal and genital regions are most subject to such mutilations, and the collector who would bring out a perfect, complete skin must be continually on the job.

*Seals and Walruses*

Seals have the skin lined with a coat of soft, greasy blubber, and are most readily skinned by cutting a deep gash along the under surface, clear through skin and blubber, and dissecting and rolling the carcass out of the skin. If the skin is to be mounted, it is well not to bring the opening cut farther forward than the breast and to make lateral cuts to each flipper. The blubber may be cut away in a mass with a curved knife as in the case of a bear skin. By holding the skin taut with one hand, one may usually avoid cutting the skin—with practice. If any seal-hunting natives are around, it will usually be cheaper and easier to have this rough cleaning done by a professional, although the finer points of the head and flippers had better be done by the collector himself. Bearded seals and sea-lions should have the lips carefully skinned and thinned down around the roots of the "whiskers" so that the salt can strike in; otherwise the bristles are apt to slip out.

The ordinary method of preserving seal skins has been by salting, but as it has been found that brine changes the colour of hair seals very much, the skins should be dry-cured if possible, or at any rate, partly-dried, and the salt kept on the flesh side away from the hair (*See page 74*).

Walrus skins are preferably thinned down at once with the curved skinning-knife, to not more than one-fourth of the original thickness, and the skins salted in bulk. Dead seals and walruses designed for scientific specimens should not be exposed to sunshine for any length of time before skinning, as the cuticle will blister in a remarkably short time.

*Beaver*

The beaver is handled as an open skin, with opening cut along the median line extending to near the tip of the tail on the lower side. The broad, flat, scaly tail presents no particular difficulties, but care should be taken not to cut gashes through the skin as there is no hairy covering to conceal stitches. The feet are skinned down to the toe-nails and the webs between the toes split or separated in the process. To do this, it is necessary to split the sole of the foot from a point near the junction of the middle toe to the centre of the heel in the hind foot, and to a short distance beyond the wrist in the fore limbs. As the skin is rather heavy and fatty, it is rather hard to dry properly without undue stretching, and is best dry-salted and later tanned in the laboratory.

*Muskrat*

The muskrat is skinned and made up like an ordinary small mammal. The only abnormal feature is the tail, which is long, scaly, sparsely haired, and laterally constricted, so that its height is much greater than its width. The tail must be split on the under side nearly or quite to the end in skinning. To get a thin tail filler the best method is to whittle a tail of soft wood (preferably white cedar) to the same size and shape as the skinned tail, and long enough to extend about halfway through the body. The same high, narrow effect may be obtained by wrapping two wires tightly with cotton and then wrapping the two together with fine fibre cotton. The latter method is used in mounting a muskrat if the tail has to be bent.

*Porcupine*

The Canada porcupine is a formidable-appearing animal and may be embarrassing to a novice, as the quills are rather loose and the barbed points are painful weapons. A porcupine killed with a club is apt to have the skull broken into fragments or to have many of the dorsal quills flattened or knocked off. The best method of killing is by a small rifle bullet through the body, or by shotgun through the thin-skinned, unprotected under parts, which avoids riddling and tearing the quills. The selection of a shot is a simple matter, as the porcupine will generally climb a few yards up a tree and stay there. The porcupine has no quills on the under part of the body and throat and the skin may be rapidly removed without injury from a single quill.

Make a cut along the median line from the throat to the tip of tail, and cut the skin from the body with long, sweeping strokes, turning the edges of the skin outwards and rolling the skin back with the quills inside. As the roots of the quills are deeply embedded in the skin, be careful not to cut off their bases. The tail is very thick and muscular, with the skin grown tightly to the flesh, so it must literally be carved out of the skin, avoiding if possible cutting any gashes in the tail skin, particularly on the dorsal side. As the skin is usually fat, it needs considerable subsequent cleaning with knife, shears, and scraper. It is generally best to salt a porcupine's skin in the field, and defer cleaning until the skin reaches the laboratory, and has hardened a bit. Although the porcupine is rather large it is usually easier to handle in the museum as a made up "study skin." In making up the skin, stuff it rather smaller than natural size and flatten the body considerably, not more than 3 or 4 inches deep, otherwise the specimen will take up too much case room and be a problem generally. A porcupine skin can be handled with less danger from quills if a narrow piece of wood is used to stiffen the body, as in the "California style" of rabbit skin (page 80), letting the stick project far enough behind the body for the legs to be tied to the stick. The projecting stick may be used as a handle in lifting the specimen.

*Hares and Rabbits*

Although these animals are rather large and bulky, they are best made up as study skins. The skin is thin and tender and brittle when dry, so that when flat or cased the heavy legs and feet are apt to be torn off. The skin is removed in the manner usual for small mammals.

As the head is angular and irregular in shape, with broad cheeks, narrow nose, and depressed muzzle, care should be taken to make the head filling as near the natural size and shape as possible. Crumple up a hard wad of paper for a core and wind cotton, tow, or oakum around it as tightly as possible, to make a firm artificial head. Leave the leg bones attached to the feet and wrap them loosely with cotton or tow. If the leg bone is broken make a rough splice by thrusting a bit of stick or wire into each of the broken ends. Cut two pieces of fairly stiff wire (iron or brass, annealed, No. 16 or 17), sharpen one end of each, and thrust them into the heels from the outside, along the hind leg bones and into the fore leg on each side, and out at the wrist. Arrange the skin in proper length and tie the leg bones fast to the wires, which run parallel to each other

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through the body (Figure 25). Make an artificial body of soft filler, thrust the anterior end into the back of the head filler and spread the posterior part around the dorsal side of the connecting leg wires. Put in flat bunches of cotton where needed to fill out around shoulders, hips, and base of tail. Also place a layer of cotton along abdomen to cover the wires where exposed. The tail should be supported by a small wrapped wire. If wires of the proper size are not available, the fore and hind legs may be connected by slender strips of wood lashed to the leg bones, or the legs may be fastened to a stiff stick running the full length of the body. The essential point is that the legs must be fastened in place and the body connected rigidly fore-and-aft or the dried skin will become easily broken in handling.

Arrange the body on a board for drying, pinning it down with heavy pins or slender wire nails. The cartilage should have been skinned out of the ears as far as possible, at least loosened from the skin on the outer side of the ear. The base of the ear may be stiffened with a curved piece of cardboard or stiff paper. After the body is pinned down the ears

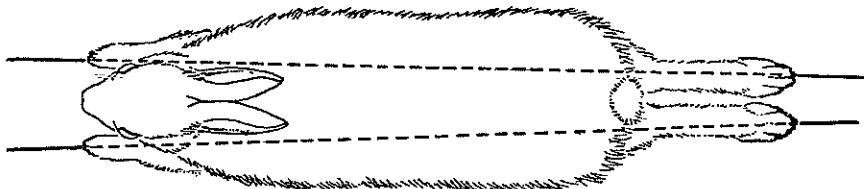


Figure 25. Method of wiring a rabbit skin.

should be laid back on the head and neck, parallel with each other, and a firm, pointed roll of cotton thrust down into the external auricular opening of each to keep them in shape until the skin has dried. The cotton roll may be pulled out after the skin has dried. If the specimen has to be moved before it is thoroughly dry, it is well to pin down each ear and to fasten the ears together by a stitch through their inner edges.

"*The California Style of rabbit skin.*" Although the method described above makes a good exhibition specimen skin, the technique involves rather too much taxidermic skill, and in a large series the specimens take up too much room. The National Museum of Canada has lately adopted the "California style" as developed by Mr. Adrey A. Borell. Some of the advantages are: flatness, giving economy in storage space; firmness of the fore and hind limbs, thus preventing breakage in transportation and later handling; and simplicity of technique in the field, doing away with the necessity for pinning while drying. As described by Dr. E. Raymond Hall, the "stuffing" of the body is prepared by cutting out a piece of corrugated cardboard outlining the body and attaching a stiff wooden stick to the cardboard by means of thread or wire at two places. The stick projects forward to the head and far enough posteriorly to allow of securing the hind feet to this central support. A thin layer of cotton is laid over this "paddle", which is inserted in the skin or the skin turned back over it. The posterior square end of the cardboard is then cut to fit the skin, and wire or, preferably, slivers of wood or sticks are inserted, one in each leg. The skin is sewed up, and the hind legs are secured to the median stick by a stitch of strong thread or preferably a bit of thin wire passing

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through inner side of each foot and fastened to stick by twisting ends of wire together with pliers. The fore legs are laid out flat along each side of throat and secured to the body by a hidden stitch between the toes. The ears are spread out with dorsal side down, and held together by a stitch through inner edge of both ears.

#### *Flying Squirrels*

Flying squirrels have broad, lateral folds of skin extending from the wrists to the ankles and covered with fur on both upper and lower surfaces. These double folds of skin should be separated and the inner side of the skin treated with preservative. In filling the skin do not let the body stuffing spread out into these lateral folds and make a sofa pillow effect. The body filling should be firmly wrapped and the legs should be held in to the body by thread tied around the front of hips and back of shoulders. Lay out the skin as in the case of an ordinary small mammal. Spread the lateral folds out smoothly and if they show a tendency to spring up, cut a curved piece of pasteboard to cover each side and pin these down close to the body until the skin is dry.

#### *Bats*

It may be well to spread fully the wings of one or two specimens of each species and pin them out on the drying board. Spread bats' wings are easily broken and for that reason most collectors make up the bulk of their bat skins with the wings neatly folded at the sides (Figure 21). However, in many species of bats important specific characters are derived from comparative measurements of length of each finger, and length of metacarpal bones, and it is often difficult to measure these parts in a closely folded, dry skin. The writer has frequently found it necessary to relax such a skin before the desired measurements could be made. For this reason, he has recently been advocating that bat skins (particularly of the genus *Myotis*, the little brown bat and its near relatives) should be made up with the wings partly spread, with each finger pinned out far enough that the different joints may be examined and measured separately (Figure 26). In addition to the three usual measurements (length, tail, and hind foot), bats should have additional measurements of the ear: height of ear and height of tragus (See Measurements, page 44). The size and shape of the ear form important specific characters in some species, and the collector should try to have the ears dry in approximately natural state, keeping them in shape by occasional pinching into shape while the ears are still partly flexible. Major Allan Brooks stiffens the ears of the longer-eared species by painting the *inside only* with shellac; if care is used the tragus will stand up. It is also advisable to make an outline sketch of the ear, including tragus, on the back of the label.

#### *Skunks*

Most collectors are shy of handling skunks, but when killed properly and cleanly, a skunk is no more difficult to skin than a weasel, mink, badger, wolverine, or any of the other Mustelidae, all of which have scent-glands secreting a more or less disagreeable musky odour. The skunk is

much less dangerous than is generally supposed. It never throws its scent except in self defence, and then not more than 8 or 10 feet, although the spray may be carried somewhat farther in a strong wind. Various experts state that the surest way to kill a skunk without smell is to drown it, but the writer can guarantee no safe way to get the skunk

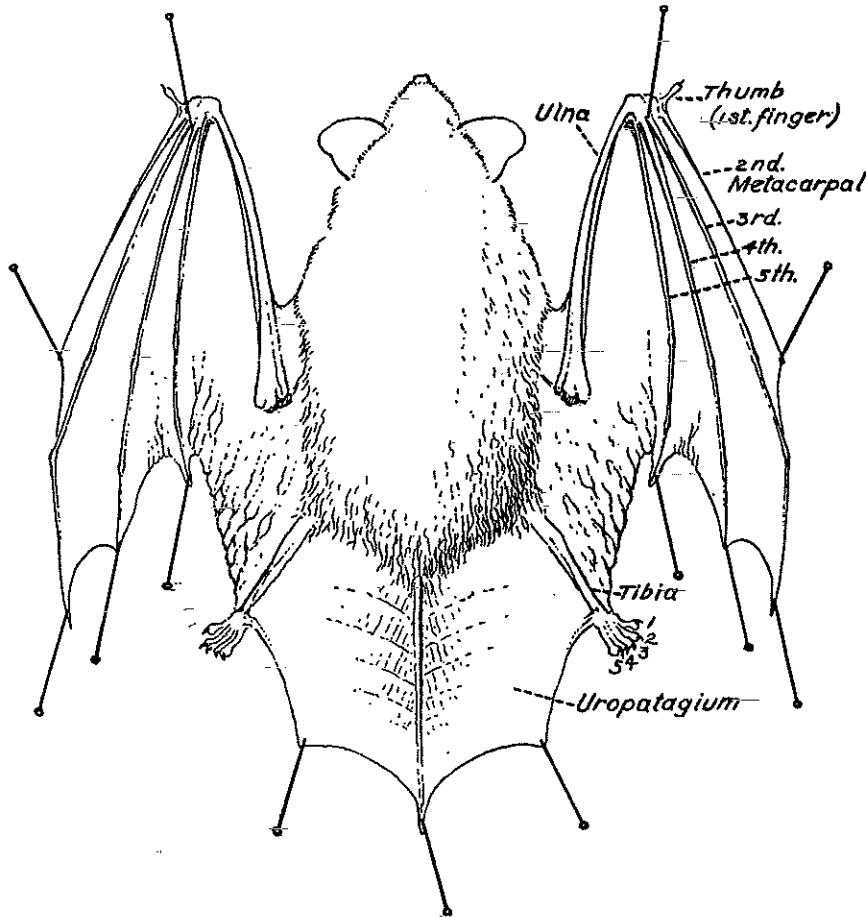


Figure 26. Drying bat skin with wings partly spread.

to water. Seton (1929) and other authorities assert that the skunk is harmless if held up by the tail, but like other methods of "belling the cat" it is not always safe for the amateur. The skunk, however, is a careful and cleanly animal and does not willingly soil its own fur, even if caught in a trap. It may be easily and painlessly killed by approaching cautiously from one side and dealing a heavy blow with a club across the small of the back, over the kidneys. Shooting spoils the skin for the fur market, and if the animal is not instantly killed some fluid may be ejected. However, a charge of small shot at medium range in the lower part of the back

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will not spoil the skin for a specimen, and will usually cut the spinal cord or paralyze the hind quarters so that no scent will be ejected. Any faint skunk odour will disappear from the skin in a few days, but if badly saturated the skin should be scraped and washed in gasoline, which removes the grease from the skin at the same time. A mild solution of vinegar ( $\frac{1}{2}$  cup to 1 quart of water) is helpful in removing skunk odour from skins, clothing, and dogs.

#### PELTING SKINS (FOR THE FUR TRADE)

##### *Cased Skins*

All skins of weasel, ermine, mink, marten, otter, muskrat, opossum, and skunk should be cased and dried on stretchers with the *pelt side out* and the *fur inside*. Fur buyers and game officials usually judge whether a skin is "prime," that is, taken in open season, by looking at the flesh side of the skin. If "prime" and the hair fully grown, the flesh side of the skin is a light creamy, whitish, or parchment colour, while "unprime" skins, taken out of season, show dark reddish, brownish, or blackish areas over the whole or part of the skin, due to blood and pigment cells at the roots of the new-growing hair. The details of removing the skin for casing have been described on page 67.

Skins of the fox, wild cat, lynx, and wolf are also cased and dried on stretchers (Figure 11), but before the skin has become too hard and stiff it should be turned so that the fur is on the outside. Sometimes part of the skin will need to be softened slightly with wet fingers or a damp cloth and worked and twisted a bit before it can be turned right side out. The skin should be hung up for a while to dry this superficial dampness before packing it away. Many northern trappers improve the appearance of their fox furs by suspending them by the head from a strong line at a safe height from the ground for a month or so during March, April, and May. The strong winds drive snow and sleet particles into the fur and remove particles of blood and dirt, and the frequent periods of bright sunshine and snow glare have a cleansing and bleaching effect. The trapper should be careful to split the tail sheath of all skins that are hung up exposed to snow, as the snow in melting may run down into the sheath and cause the hair to fall out. Any furs that have become mussed by baling, packing in bags, or otherwise, may usually be freshened and fluffed out by hanging in the wind for a few hours.

Some fur trappers mistakenly overstretch the skin of a fur animal trying to make a large skin out of a medium or small one. This trick does more damage than good as an overstretched skin becomes thin and the fur less dense, causing reduction in sale price. On the other hand, if the skin is allowed to wrinkle, it will not dry properly and the hair is apt to slip off in the creases.

##### *Open Skins, or Flat Skins*

Bear, beaver, raccoon, wolverine, and seal should have the skins removed by opening so that the entire skin may be stretched flat on a board or on the ground.

To prepare an open pelt, cut the skin down the abdomen, from the lower lip to the tip of the tail, and from the feet cut up the back of the hind legs, and on the inside of the fore legs to join the median cut. In cold

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winter climates the skin may be spread out on the snow and frozen flat and smooth, after which it may be hung up outdoors. In the dry, cold atmosphere of northern Canada, the moisture will evaporate rapidly from a frozen skin hung up exposed to the wind. In warmer regions the skin may be tacked or pegged out, or the corners held down by weights to dry.

Beaver skins for the fur trade have the tail and feet trimmed off and the skin stretched in circular shape on a wooden hoop, the skin laced to the hoop by a thong passed through holes cut in the margin of the skin. The tail and feet of muskrats, and the flippers of seals, are also cut off before stretching. Such skins, however, are worthless for scientific purposes, except for showing condition of the pelt at the time of taking.

Most natural history museums do not have adequate collections of the valuable fur-bearing mammals. Competent trappers are not often available, winter field work is difficult and expensive in the haunts of the rarer mammals, and high prices for fur prevent extensive purchases. The skulls of such mammals from different regions are of great interest to the zoologist for study of geographical races, and to the palæontologist for comparison with fossil forms. Skulls of skinned mammals are a mere by-product of the trapping business, and are generally thrown away, but the National Museum will be grateful to any trapper who will take the trouble to donate skulls with data.