

THE PREPARATION OF BIRDS FOR STUDY

INSTRUCTIONS FOR THE PROPER PREPARATION
OF BIRD SKINS AND SKELETONS FOR
STUDY AND FUTURE MOUNTING

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THE PRESERVATION OF BIRDS FOR STUDY

Travelers in foreign parts often fail to realize what valuable service they could render to the museums of America. They are apt to consider the birds of the world so well known as scarcely to need further collecting; whereas, in addition to the numerous species that remain to be discovered, many which have long been known are still unrepresented by a single specimen in any museum of the United States.

To aid in the improvement of our collections, the following instructions are offered for the use of our friends. The scientific value of a skin is greatly enhanced by correct preparation and labeling. To illustrate the successive steps a large number of figures are included, which have been drawn by Mrs. M. Frazee Belcher.

Collections of birds are composed chiefly of "skins," which resemble in general appearance a dead bird. They exhibit most of the external features of the living bird, the structure and colors of its plumage, as well as the general form of beak, wings, and feet. Bird skins may subsequently be mounted, if desired; but most of them are intended for study rather than for exhibition. Many a skin not fit for mounting is yet of distinct scientific value, provided its history is preserved on the label.

For study of the internal anatomy, skeletons and birds in the flesh preserved in alcohol or weak formalin are also necessary. It is customary to preserve but few examples of a species in this manner, whereas a series of skins is desirable, the external characters being more variable, and more commonly studied by systematic workers. Opportunities for preserving large birds in fluid seldom offer themselves, but their skeletons may be roughly prepared and dried, the final cleaning to be done at home. The skeletons of small birds are so fragile that it is usually better to bring the specimens back whole, preserved in fluid, which permits study of the muscles and viscera as well. The bones can also be cleaned—even though the birds have been kept in formalin—but alcohol is very much better for the purpose.

The preservation of birds as dried mummies, with the aid of carbolic acid or injections of formalin, is to be discouraged. They become very brittle, are difficult to examine, and are subject to the attacks of insects.

The Making of a Birdskin

Instruments

Do not accustom yourself to an unnecessary variety of tools. The fewer they are the more quickly you are sure to work. If nothing else were available, a penknife would suffice to prepare the skin of an ordinary bird. For small and medium-sized birds the following instruments are amply sufficient:

- 1 scalpel, with blade about $1\frac{1}{2}$ inches long;
- 1 pair of sharp-pointed scissors, blade 2 to $2\frac{1}{2}$ inches long—the stronger they are, the longer you can do without a second pair;¹
- 1 pair of forceps, about 5 inches in length, with long, slender tips;
- 1 thin metal knitting needle;
- 1 pair of cutting pliers, for the wire used in necks;
- Ordinary sewing needles (sizes 2 to 8) and cotton thread (Nos. 8, 36, 80) pins, of nicked brass, not of steel;
- 1 medium-sized carborundum stone, for sharpening knives and scalpel;
- 1 rather stiff artist's brush, for washing small spots of blood from plumage, and for moistening skin;
- 1 nail-brush, for drying and fluffing the plumage;
- Annealed, galvanized iron wire, of sizes 11, 16, 22;
- 1 folding metric rule;
- 1 pair of dividers, for taking measurements.

For larger and tougher birds, one may add to the kit:

- 1 thin-bladed kitchen knife;
- 1 pair of bone-cutters or short, heavy shears;
- 1 longer pair of forceps, about 10 inches over all, with tips not very slender; they will be used for stuffing skins.

¹Some workers find they cut fewer holes in skins by using scissors of which one blade has a rounded end.

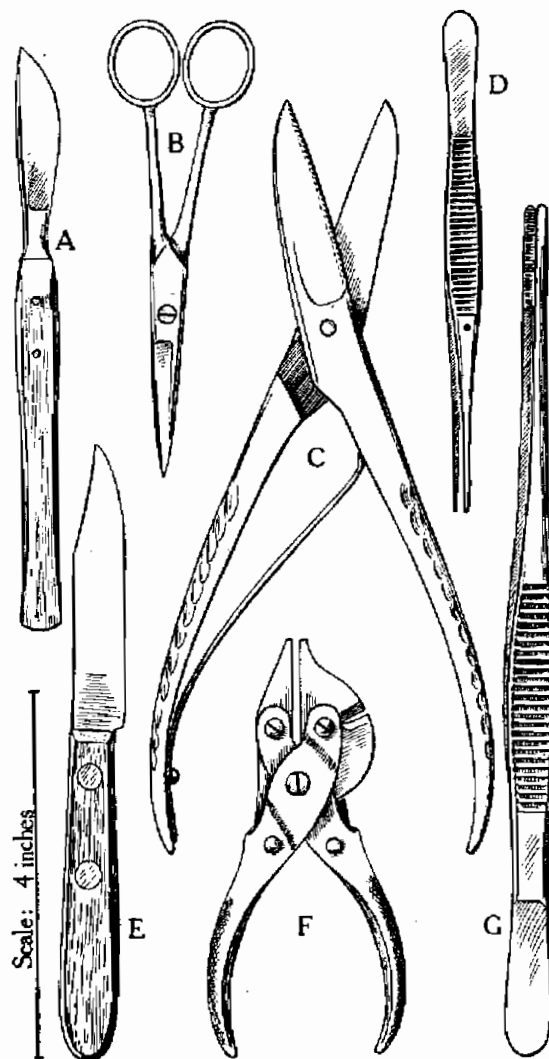


Fig. 1. Principal instruments used for skinning birds: A, scalpel; B, scissors; C, bone shears; D, small forceps; E, kitchen knife; F, cutting pliers; G, long forceps. Their dimensions may be figured from the accompanying scale.

Other Materials¹

Small birdskins are best stuffed with good, long-fibred cotton, not necessarily absorbent; larger ones with tow and "excelsior" wood-shavings, when available. In case of need, green moss may be used after thorough drying, or fine dry grass, or the dry husks of maize—in short, almost any soft, dry vegetable material.

The inside of the skins is to be dusted with powdered white arsenic (= arsenic trioxid), or powdered arsenic and borax (in equal parts by volume). The latter mixture is generally suitable for all bird skins, even in the tropics, although a similar mixture of arsenic and alum may be used for very large birds in hot, moist climates. Alum has the disadvantage of hardening the skin somewhat. The arsenic is used for its permanent effect in preventing insects from eating the skin, rather than for any immediate action as a preservative. It should never be omitted; and used with ordinary care, it offers no danger to the health of the collector. Arsenical soap is more tedious to manipulate, and not necessary.² Put no salt on a bird's skin save for temporary preservation, as described on page 33.

For preventing the feathers from adhering to the flesh as it is exposed in skinning, for absorbing blood, and for drying parts of the plumage that may have to be washed, fine corn-meal is often used. Where this cannot be had, any other starchy meal which does not become sticky when wet will serve, and dry hardwood sawdust may also be used. Natives of the

¹It is not feasible to list all the equipment which a bird collector may find useful. For supplies used in drying and packing birdskins, see pp. 39-43; for preservation of birds in fluid, pp. 43, 44; and for simple soldering outfit, p. 44. Preparing rough skeletons requires no special tools, but arsenical soap solution is useful in safeguarding them, as explained on p. 47.

²Arsenical soap is sometimes very useful to paint on beak and feet externally, to prevent attacks by insects. See page 41.

tropics frequently prepare coarse flours from rice, millet, or manioc, which are suited to the purpose. Failing these, dry powdered clay or wood ashes may often be employed. Plaster of Paris has been much used by taxidermists, its only fault being that it is almost sure to leave a light powdery bloom on the feathers, particularly if they are of dark color. The very best material I have ever found for cleaning feathers is a mixture of plaster of Paris and potato starch or potato flour (equal volumes). It may safely be used in place of corn-meal throughout, and acts far more rapidly.

When birds are very fat, benzine or carbon tetrachlorid may be used to wash the grease from skin or plumage. Sheets of paper, thin cheesecloth, or mosquito netting are used to wrap large birdskins while drying, instead of the thin layer of cotton which is recommended for small specimens. Collector's tags of convenient size are shown on page 37. Never neglect to take a generous supply of naphthaline, it is the cheapest form of insurance against destruction of skins by insects, and in the tropics is absolutely essential to success.

Care of the Bird before Skinning

By proper handling of the freshly killed bird, a great deal of trouble can be avoided. Pick it up by the bill or feet, and scrape off with a knife-blade any drops of blood which may adhere to the feathers. A small wad of dampened cotton will be useful to wipe off blood-stains, before they have time to dry. Any large shot-hole may be stopped with a bit of cotton, after which corn-meal should be sprinkled among the bases of the neighboring feathers. Open the mouth, and insert a large plug of cotton, pushing it down the throat to prevent the oozing out of blood or other fluids.

In very warm climates, where small insectivorous birds have a way of putrifying and losing feathers on throat and abdomen within a few hours, it is often worth while to carry a hypodermic syringe, with which to inject a preservative into

the abdomen. Insert the needle through the vent, pushing it into the body-cavity about the intestines. Very weak formalin (1 part to 25 of water) may be used, if there is no objection to the hardening of the belly skin; but a saturated solution of alum (*i.e.*, so strong it can dissolve no more alum) does not have this fault, though it retards decay appreciably. Carbolic acid may likewise be employed. Such preservatives aid greatly in the subsequent determination of the bird's sex, by keeping its organs in far better condition, especially when they are undeveloped. For the throat, a little of the preserving solution (preferably alum) is squirted into the gullet before it is plugged. Alcohol is not to be recommended, for it runs out again too easily on to the plumage.

Next make a cornucopia of stiff paper, drop the bird into it head foremost, seeing that the bill is not turned forward on to the throat; and if the bird is not too large, fold in the edges of the cornucopia and place it in a basket or other receptacle where it will not be pressed upon, have its tail damaged, or be shaken about. In a warm climate, avoid the use of a metal box for carrying birds, as they will become overheated. Decomposition of the skin results in a blistering or sloughing of the epidermis, loosening the feathers so that they fall out when the bird is handled.

Measuring Fresh Birds

The dimensions of bill, wing, and tail are usually measured from the dried skin, and there is no advantage in taking them from the fresh bird. In certain cases, particularly with large species, it is of interest to record the spread of wings, from tip to tip, and the total length, from tip of beak to end of tail. The "length of body" would be a useful measurement to take from every species; this would be the distance in a straight line from the anterior surface of the shoulder to the vent, or, if the birds is already skinned, to the tip of the small bone (pubis) which extends down in the belly wall close

to the vent. In birds of ordinary size it may be measured with a pair of dividers. Always use the metric system in preference to inches.

Skinning the Bird

(1) See that the throat is tightly plugged with dry, non-absorbent cotton. Do not plug the nostrils, for the pressure may change their form, which it is desirable to preserve. If blood oozes from the nostrils, place a strip of cotton over them and across the forehead, stuffing the ends down on each side into the throat, and then add another wad in the throat to hold them fast. This will keep most of the blood away from the plumage of the head during the operation of skinning. If the eyeball has been ruptured by the shot, pull it out with the forceps, and fill the cavity with meal.

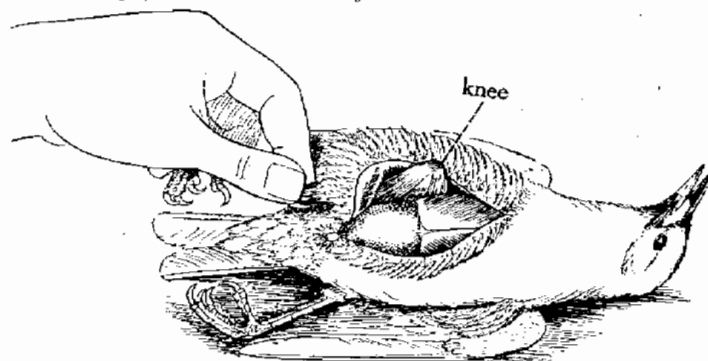


Fig. 2. The first knee has been exposed. Cut through joint and flesh, down to the skin.

(2) Lay the bird on its back. Separate the feathers down the mid-line of the breast, where the skin will be found more or less bare. With scalpel or scissors make a longitudinal incision through the skin, from about midway down the breast bone, backward to the vent, into which the cut may be continued. Try not to cut into the wall of the abdomen, although a small hole will not matter.

(3) Taking the very edges of the skin by the finger nails, and pushing with the handle of the scalpel between the skin and flesh, separate the skin from the body, farther and farther back on both sides, until you lay bare the bird's knees. Sprinkle corn-meal or other drying powder (p. 7) upon the flesh as it is exposed, to dry it, and to prevent the feathers from adhering.

(4) Take hold of one of the feet from the outside, push the knee farther up into view inside the skin, as in Fig. 2. With the scissors, clip the leg entirely in two at the knee-joint, inside the skin. Do the same with the other leg.

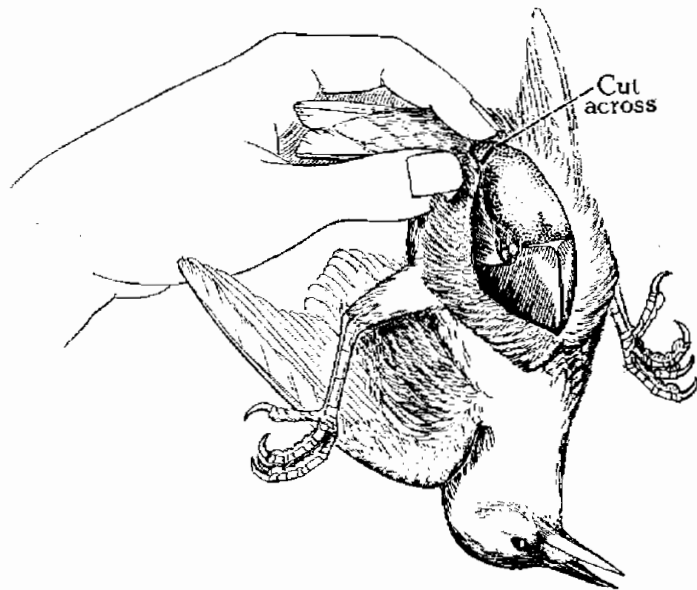


Fig. 3. While holding the base of the tail, press it upward with the second finger, and cut through with scissors to the skin of the back, on the line indicated.

(5) On both sides of the abdomen separate the skin as far as possible, and sprinkle meal. With the scissors, first cut

through the lower end of the intestine, close to the vent, and then through the base of the tail, far enough forward to avoid the bases of the tail-quills. (See Fig. 3.) Continue until you see the skin all across, and the tail is completely severed from the body, inside the skin. A small hole may perhaps be cut

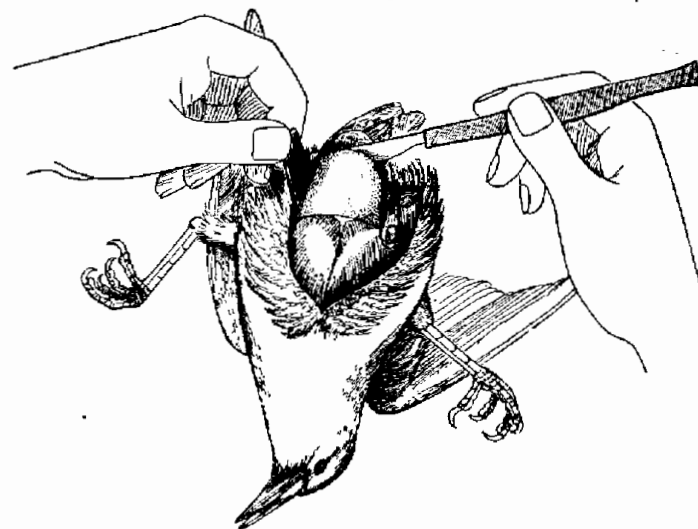


Fig. 4. Supporting the body by one of the thighs, skin forward over flanks and rump.

accidentally, but remember that a small hole entirely under the plumage matters little, and a larger one can usually be sewed together without detracting from the value of the specimen.

(6) With the left hand grasp firmly one of the thighs, to support the body of the bird. With the thumb of the right hand, aided occasionally by the scalpel, separate the skin of the rump from the body, as in Fig. 4. Continue forward, turning the skin of the specimen partly inside out, and remov-

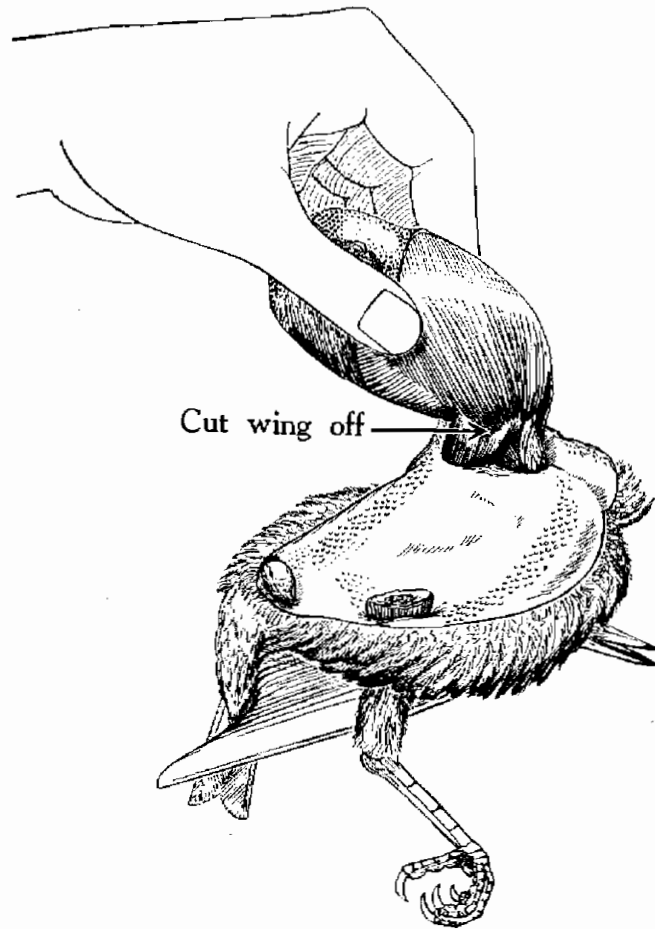


Fig. 5. The body has been almost entirely skinned, so that the bases of the wings are exposed, ready to be cut through at shoulder joint.

ing the body gradually from the skin.¹ Use an abundance of meal to keep the feathers from being soiled, and try to keep the fingers interposed between the feathers and the flesh, as the work proceeds.

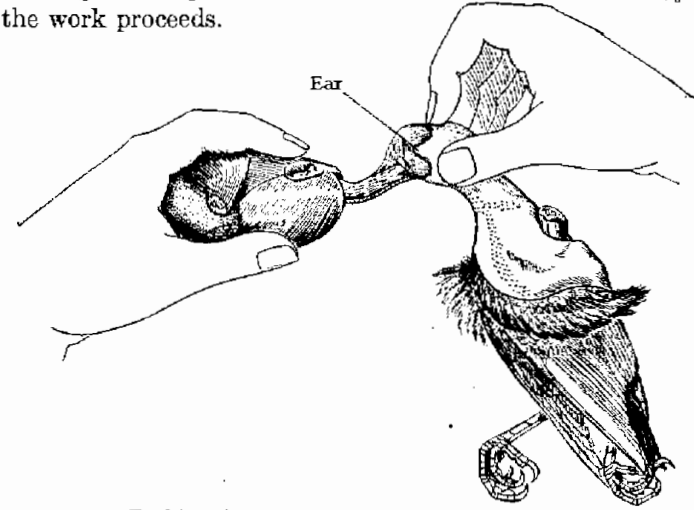


Fig. 6. Pushing the skin forward over the head. The ear has been reached, and its skin may be pulled out with the finger nails, or in a larger bird cut through close to the skull.

(7) The bases of the wings will soon appear. (Fig. 5.) Cut them off at or near the shoulder joint. Continue turning the skin forward. The neck is soon reached; and the skin will turn back easily over it, till the base of the head is reached.

(8) Work the skin carefully over the head, *pushing* with the finger nails close to the skull, rather than pulling on the skin of the neck.² As the back of the head emerges, the ears

¹In the case of large birds, a cord may be tied about the body just in front of the thighs, as soon as the skin has been peeled off to that point, and the bird may then be hung at a convenient height. This saves the effort of supporting its whole weight with the left hand.

²In many woodpeckers and ducks the head is too large to come through the skin of the neck. If after patient trial it cannot be persuaded, cut off the neck close to the base of the skull, and proceed as indicated on page 26.

appear (Fig. 6), and by seizing them firmly with the forceps or between the nails of thumb and index finger, they can be pulled from their hollows. Only in large birds is it necessary to cut the skin of the ears, as close to the skull as possible.

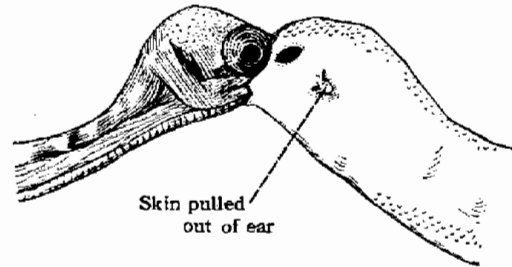


Fig. 7. The head is skinned to the base of the bill.

(9) Next the dark-colored eyeballs appear, and the thin transparent membrane is cut which attaches the eyelids to the eyeball. Continue cutting forward until the lids are completely free from the eyes, and above all avoid cutting the edges of the lids, which so often bear a circlet of small feathers.

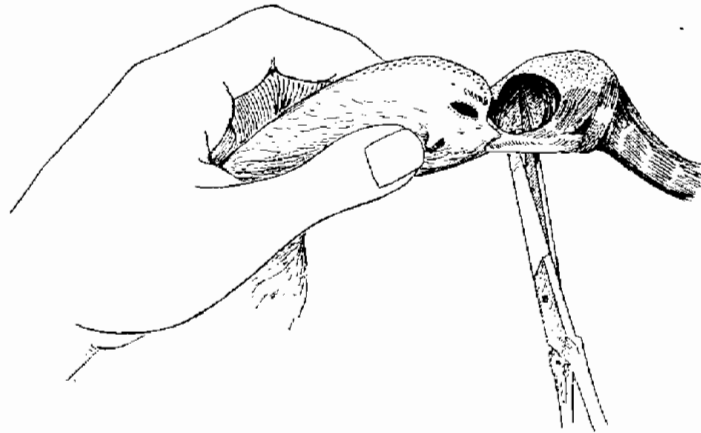


Fig. 8. The first cut for the removal of the brain is through the thin wall between the orbits, without injuring roof of skull.

(10) Continue skinning forward to the very base of the bill, above and below, as in Fig. 7. This is especially important in large birds, for it enables this part of the skin to dry and retain its feathers. The skin must remain attached at the base of the bill.

(11) Pry the eyeballs from their sockets with the handle of the scalpel, but avoid breaking them. Cut away the tongue and floor of the throat.

(12) With the scissors make a cut directly across the roof of the mouth, below the orbits, but without cutting the lateral supports of either the upper or the lower jaws (Fig. 8).

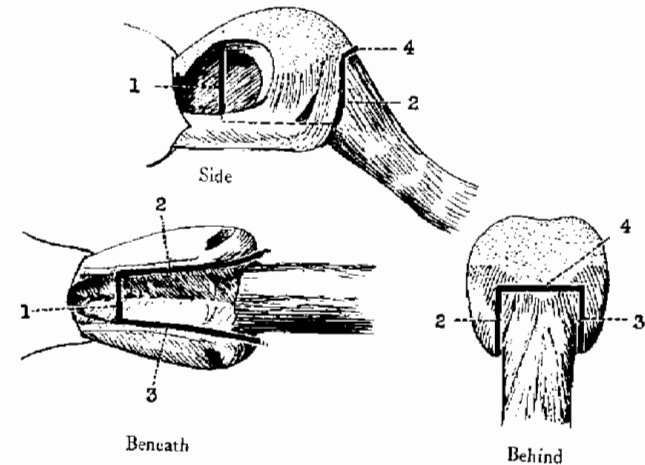



Fig. 9. Four cuts with the scissors suffice for the removal of the base of skull, and of the brain. These are numbered in the order in which they are made.

Again with the scissors, make incisions from each end of the preceding cut backward along the base of the skull, within the branches of the mandibles, as far as the rear of the skull, at the sides of the attachment of the neck. Connect the posterior ends of these cuts by a fourth, across the back of the

skull, just above the juncture of the neck.¹ These cuts are shown in Fig. 9.

(13) Pulling the neck from the head will now remove the base of the skull and part of the brain, the remainder of which is to be scooped out with scissors or scalpel. Large openings should connect the brain-cavity with the orbits. 

(14) Cut away any loose flesh from the skull, and powder it generously, as well as the skin of head and neck, with

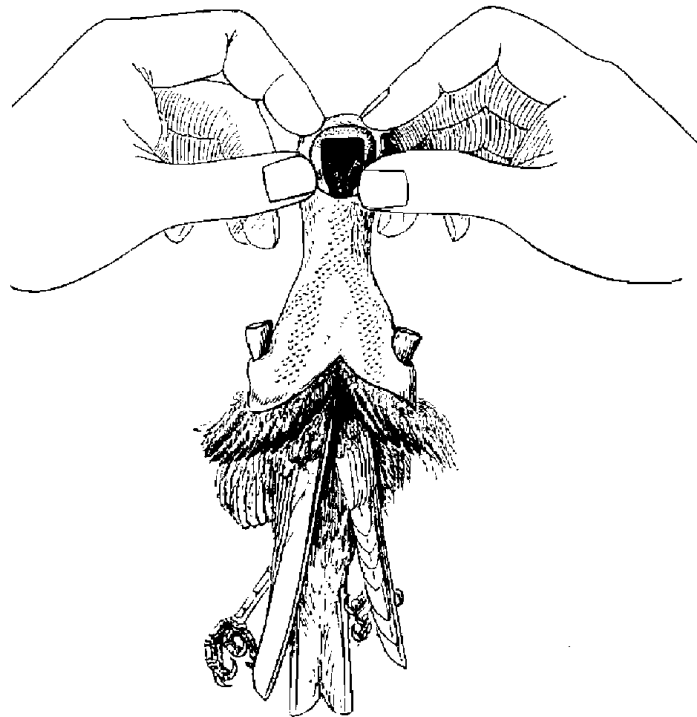


Fig. 10. Turning the skin of the head back over the empty skull, which has been cleaned and poisoned.

¹In large birds the same cuts are made in the skull, but with stronger bone shears, instead of the scissors.

arsenic and borax, which is shaken from a piece of cotton held in the forceps.¹

(15) If the skin has dried so as not to turn back easily, moisten it slightly. The head is now turned right side out, by gradual coaxing with the fingers, rather than by pulling. (Fig. 10.) No stuffing is as yet placed in the head. Straighten out the feathers with small forceps and a needle, especially about the cheeks and eyes.

(16) Pull the wing-bones inward, and clean the wings, one after the other. Push the skin away as far as the elbow. Then push forward the skin along the *upper* or *anterior* side of the forearm, leaving the quills (secondaries) attached to the lower of its two bones. The muscles of the forearm, in all small birds, can be removed from the upper side, almost as far out as the wrist. There is no objection to the removal of the upper of the two forearm bones (radius) when snipping out the flesh. The upper-arm bone (humerus) should, however, be cleaned of flesh and left attached to the bone (ulna) remaining in the skin of the forearm. These bones are illustrated in Fig. 11.

(17) Another method of skinning the wing, which makes for more speed in preparing birds of medium size, such as pigeons, consists in separating the quills from the lower bone of the forearm with the scalpel. This allows greater freedom in removing the muscles of the forearm, but the bone of the upper arm should not be removed, and later the skin should always be pulled so that the wing-quills extend back again to the elbow. Otherwise the form of the wing becomes unnaturally distorted. In really large birds, the wing is opened from the outside, on its lower surface; and the quills must always be left attached to the bone.

(18) Before turning the wings right side out again, proceed to skin the legs, pushing the skin down as far as there are

¹A dried rabbit foot or a large artist's brush is even better for the purpose.

any feathers, and then removing all flesh from the bones.¹ In large birds see carefully to the farthest (outermost) parts that are feathered, as they are very apt to decay, and give them an extra share of arsenic and borax. Do not attempt to turn over the scaly skin of the feet, as it will injure the scutes.

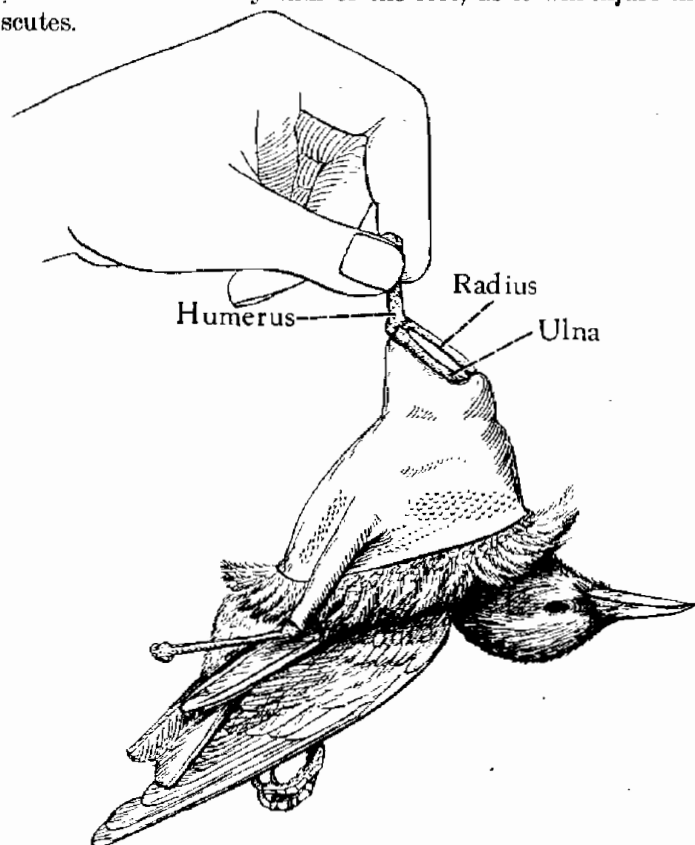


Fig. 11. The flesh has been cleaned from wing and leg; this treatment suffices for all small birds.

¹The head of the tibia may be broken off, and the muscles stripped down in one movement.

(19) Remove as much flesh and fat as possible from the base of the tail. The oil-gland of small birds need not be removed. Avoid injury to the bases of the quills, or they will fall out. Most of the bone may be removed, except the very tip, between the middle feathers.

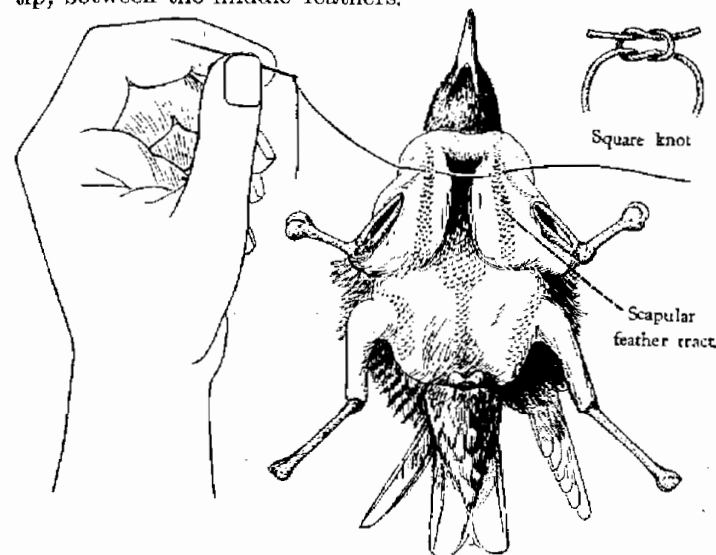


Fig. 12. Where to take the stitches to hold the scapular feather-tracts together.

(20) Remove all fat and any bits of flesh from the inside of the whole body-skin. (See page 26 for the treatment of fat.)

(21) Through the forward end of each scapular feather-tract a stitch is to be taken. (Fig. 12.) Draw them together with the thread, and tie firmly (with a "square" knot) at a distance approximating that which would separate them on the back of the live bird. This will make the arrangement of the wings and adjoining feathers vastly easier. Tying the wing-bones together is another means to the same end, but less effective.

(22) Powder the whole inner surface of the skin, especially that of wings, feet, and base of tail with arsenic and borax.

Wind a little cotton about the leg-bones, and turn the whole skin right side out.

Cleaning the Plumage

(23) Look for any blood spots on the plumage, and wash them clean, using a small brush, rather stiff, dipped in clean water. Peroxide of hydrogen will remove obstinate blood-stains, and does not affect the color of the feathers if dried at once. When the blood has been entirely removed, the feathers are dried by rubbing them with absorbent powder or meal, raising the feathers and brushing them lightly forward and back with the nail-brush. Add more powder, rub into the bases of the feathers, and repeat until the feathers are entirely dry. Then remove all powder by shaking and a vigorous use of the nail-brush. When the meal becomes damp it should be dried in the sun or over a fire.

Filling out the Skin

(24) Birdskins are not left flat, but are filled out to the size of the body removed, so as to show the relation of the plumage to the different parts of the body. First roll a fluff of cotton on the end of the fine-pointed forceps into a small hard ball exactly the size of the eye. Taking the ball firmly in the forceps, pass it up through the skin of the neck, through the back of the skull, and lodge it in the orbit. Another ball fills the other orbit, and a little cotton in the brain-space holds them firm. The eyelids are arranged from the outside with a needle, as though the eyes were wide open, so that a smooth cotton surface shows.

(25) The stuffing for body and neck is put in together. On a soft iron wire,¹ somewhat longer than the stuffing is to be, roll cotton first in the form of the neck, tapering to a point

¹A slender, pointed stick may be used instead, though less convenient. In making up the skins of very small birds it is scarcely necessary to use either stick or wire. The cotton may be wound on a thin knitting needle, or a long quill of an Old World porcupine, which is loosened by a reverse twist and withdrawn, after the stuffing has been arranged inside the skin.

anteriorly.¹ Farther back more cotton is tightly rolled, until it approximates the size of the body you have removed. (Fig. 13.) It must never be larger. The cotton neck protruding from the

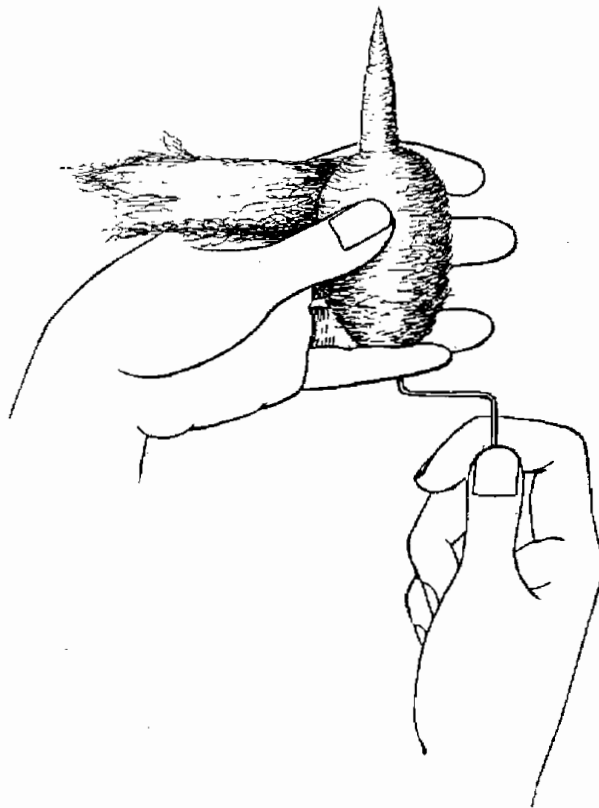


Fig. 13. Rolling the artificial body of cotton or tow on a wire.

cotton "body" should not exceed the length of the bird's neck as it lies before you, for though it will run up into the throat, it cannot bend into the natural curve of the neck of the bird.

¹Dip the wire in water first, if necessary, to make the cotton adhere tightly.

(26) Open the skin and insert the pointed anterior end of the stuffing (at tip of wire or stick), running it up the neck and into the throat, until its tip appears in the mouth. Pull back the skin of the bird until it encloses the cotton body. (Fig. 14.)

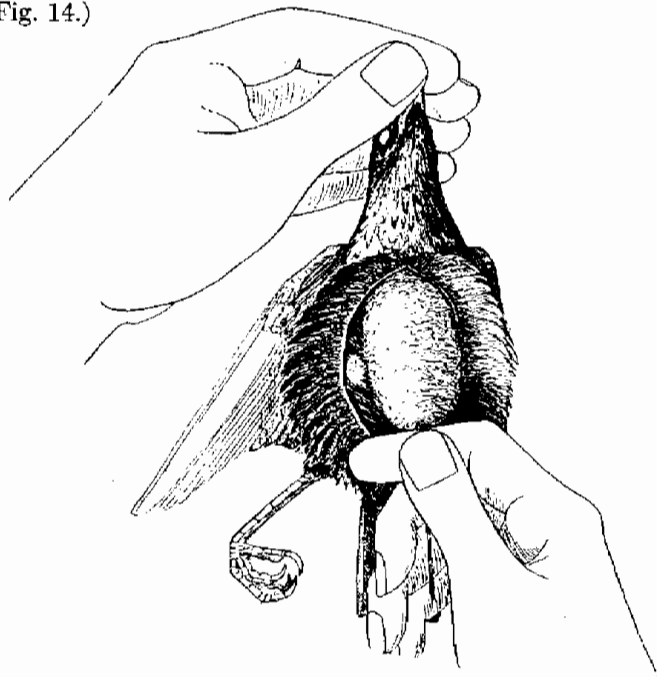


Fig. 14. Inserting the stuffing in the skin; the pointed artificial neck runs up between the bases of the lower mandible.

(27) You are now ready to arrange the skin properly with the forceps, folding the wings close to the body and on the back rather than down on the breast, and pushing the skin of chest and hind-neck forward or backward, as the smoothing of the plumage may require. The skin of the ear-region or crown may be raised with the point of a fine needle and moved about slightly until the feathers all lie naturally.

(28) Once you are satisfied with the general appearance, which should resemble that of a dead bird lying on its back, cut or break off the posterior, projecting part of the wire or stick, and sew up the incision of the belly with a few stitches.¹ Do not draw the sides too closely together, as the edges of the skin will always have shrunk somewhat. The feathers will readily hide the slit. If the borders of the skin have dried too much, moisten them inside before sewing; the feathers may then be more easily arranged.

To permit of a flattening of the back, so the skin will lie more solidly, the wire in the neck may be bent slightly, or the stick may be broken in the middle of the body.

(29) Tie the mandibles together, so that the bill remains closed as it would in life. The tip of the upper one should often project very slightly beyond the lower. A well-closed bill is essential to a good skin. The thread may be passed through the nostrils with a fine needle, provided it does not injure them, and tied around the lower mandible. In very thick-billed birds the thread may not hold; in such cases a very fine pin inserted between the rami of the lower mandible will serve to shut the bill. Here, too, beware of injury to the nostrils. When the nostrils are soft, as in goatsuckers and cuckoos, it is better to pass the needle and thread through some other part of the soft base of the bill, the hole will be imperceptible. The thread that ties the bill may also be attached to the anterior end of the neck-stuffing in cases where the head is apt to fall loose (e.g., goatsuckers and swifts). Ducks' bills may be shut without undue pressure if the thread passes over a small wad of cotton placed beneath the lower mandible.

(30) Cross the legs and extend the toes moderately. Attach a label (see page 37), tying the string preferably with square knots, so firmly as to leave no chance of its falling off subsequently. The string of the label should be long

¹In very small birds one stitch is enough.

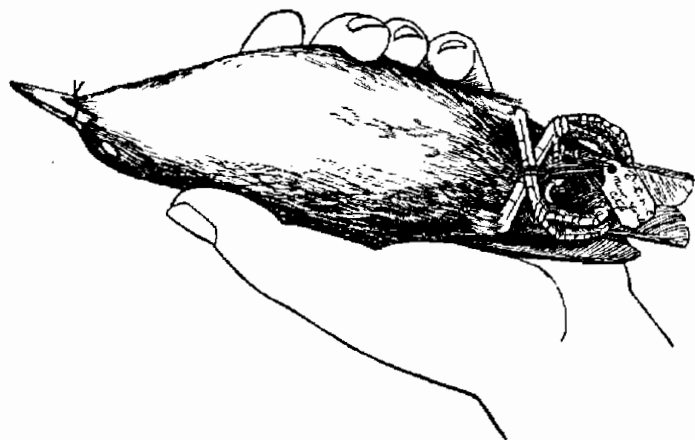


Fig. 15. The finished birdskin is molded in the palm of the hand, the wings being pressed in against the back, so they do not hide the sides of the breast.

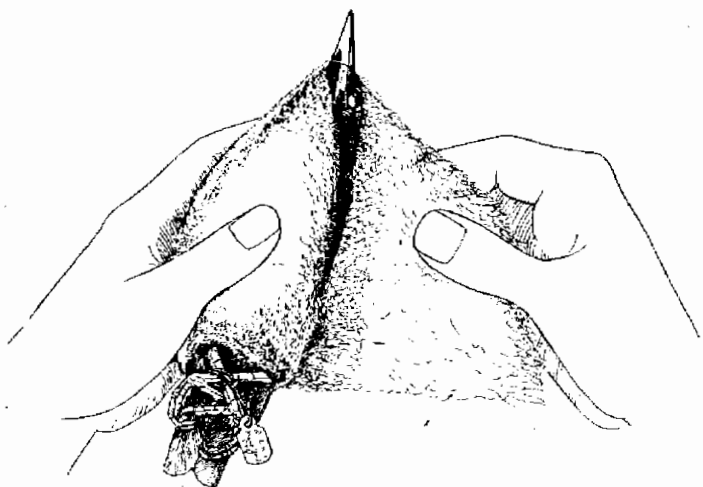


Fig. 16. Wrapping the finished skin in a thin sheet of cotton, before it is laid away to dry.

enough to permit of its being rotated freely for reading on both sides. The label must bear at least the sex of the specimen, the locality, and the date.

(31) Let the skin slip through the palm of the your half-opened hand (Fig. 15), pressing the wings into place, and arranging the tail and legs. Lay the skin, back down, upon a thin sheet of cotton broad enough to enclose it. Draw the lateral edges of the cotton up around the sides, as in Fig. 16, so that they hold in the wings and enfold the whole skin, overlapping on the throat and breast, preserving the desired form and the smoothness of the plumage.¹

(32) Put the skin in a cool airy place to dry, where it will be safe from insects or any other small animals that might destroy it. (See page 40 for drying racks).

Large-headed Birds

When the skinning of the head cannot be done through the neck, as in the case described on page 13, the neck alone is removed, the skin turned right side out, and a slit is cut between the feathers from the middle or rear of the crown as far back on the nape as may be necessary to allow turning out the skull and the removal of eyes, brain, and all flesh about the head. (Fig. 17, A.) The same cuts are made in the base of the skull as in the usual procedure. Through the slit in the skin of the nape the necessary stuffing is afterward introduced into the orbits and brain-case. Then the slit is sewed together again, and will usually be hidden by the feathers. When a considerable amount of flesh has to be removed from the skull of a large bird, it is well to replace it by inserting pads of cotton with the forceps just before the skin is closed.

In a few cases the slit is better made on the lower side

¹Instead of wrapping with cotton, some collectors prefer to push the finished skin, bill foremost, into a cornucopia or a cylinder of paper. But the results cannot be so well controlled.

along the mid-line of the throat. Birds like the horned guinea-fowl are best treated this way (Fig. 17, B), for the excrescence on the crown must not be separated from the skull. The head cannot be completely skinned; but the soft parts of

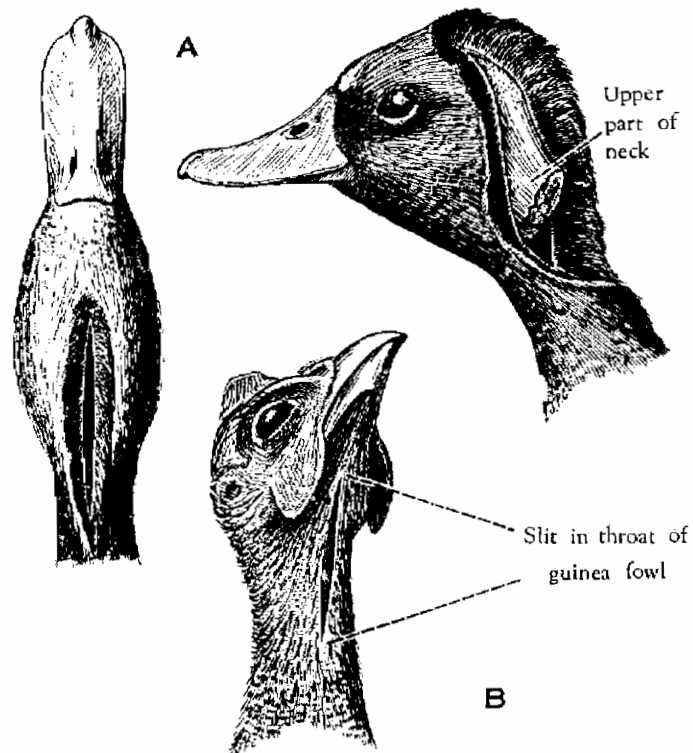


Fig. 17. Opening the heads of thin-necked birds: (A) a duck, (B) a guinea fowl.

the throat, the eyes, and the brain can be removed from below. The fact that the slit remains visible is of no moment. With sufficient pains the head of a guinea-fowl can be cleaned through the neck without cutting a slit. A liberal quantity of preservative must be inserted. Hawks and other diurnal

birds of prey have a bony shield over the eye, projecting from the region of the forehead. It is best kept attached to the skull.

Fatty Birds

Small patches of fat may be removed from the inside of the skin by scraping with the scalpel, enough corn-meal being used to prevent the oil from reaching the plumage. Waterfowl are often so greasy that the removal of the fat is almost certain to soil the feathers. It must never be left on the skin. Scrape away from the tail and in the direction of the head; far fewer holes in the skin will result. A metal comb, a spoon with serrated edge, or a wire brush (such as used for cleaning automobile tires) may be employed for removing fat. The corn-meal or other absorbent powder (See page 6) may be heated in a pan over a fire (though never hot enough to scorch the feathers) and it will absorb oil much more effectively. Where gasoline, benzine, or naphtha is available, the skin after careful scraping may be dipped and washed in any of these fluids, and then dried by shaking meal or powder, or sawdust, into the feathers and beating and brushing. For small birds, carbon tetrachlorid (often sold under trade names such as "Carbona") may be used to the same purpose and without danger from fire. These degreasing fluids must not be expected to remove dried blood at the same time; that should previously have been sponged off with water. Many taxidermists, in preparing fatty water birds like ducks, prefer to make the initial slit in the body-skin down one side, beneath the wing, instead of on the middle of the belly. The short dense feathering of the underside is more easily arranged afterward; and the plumage along the mid-ventral line is preserved from soiling by grease. Such a procedure is by no means objectionable.

Some workers find it easier to make the first incision from the base of the neck to the posterior border of the sternum

only. Cutting first the bases of the neck and wings, they remove the body by its anterior end.

Wings and Feet of Large Birds

Special attention is required by the wings and feet of large birds, for with only the treatment described above, they would be certain to decay and lose feathers or scales before

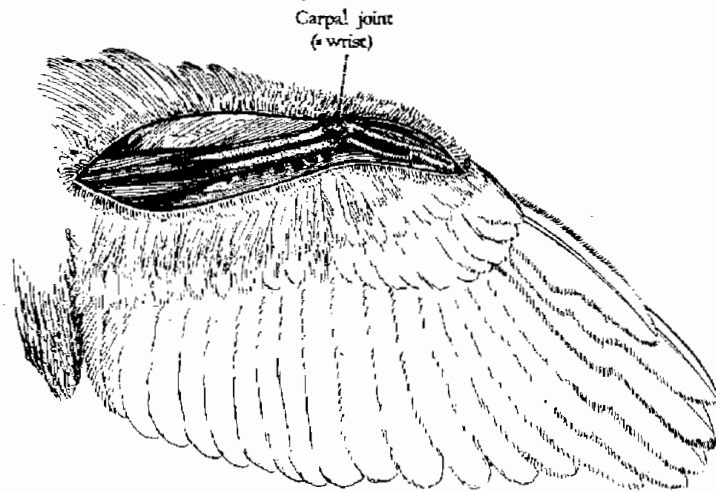


Fig. 18. The opening made along the under side of a large bird's wing, for the removal of flesh. Be sure to skin around over the upper side of the wrist joint, and poison well with arsenic.

they could be dried. In warm climates especially, every bird as large as a partridge must have a slit made along the underside of the wing, out to the tip, in the line where fewest feathers grow. (See Fig. 18.) Then all fleshy parts and large tendons are removed. The bases of the large quills (secondaries) are not to be separated from the bone (ulna), for this would make their subsequent arrangement difficult—particularly in a large bird which is to be mounted. It is especially important to separate the skin of the wrist joint, around to the upper surface of the wing, from the bones at that spot,

and to insert a generous dose of arsenic and borax. Failing this, in large birds, the feathers of the "bend of the wing" are more than apt to become loosened through "sweating" of the skin.

The slit of the lower surface of the wing may be closed with a few stitches, but drying will be more rapid if it is not too carefully sewn up. Try to keep the feathers near it clean.

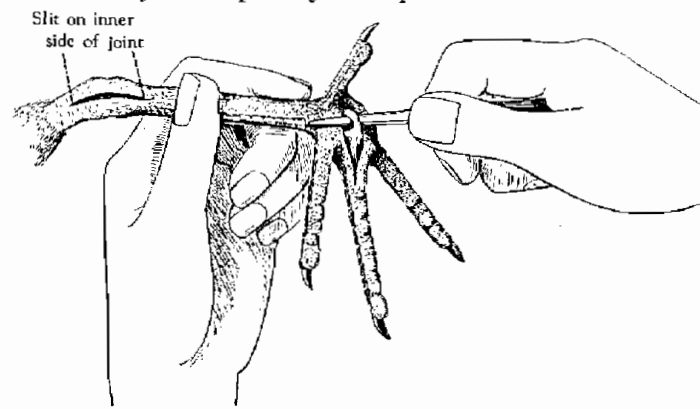


Fig. 19. Pulling the tendons from the leg of a large wading bird. Note also the incision on the inner side of the shank, near its upper joint. It need not be made till after the tendons have been drawn; through it the skin is loosened and poisoned all around the joint.

In large birds that require such treatment, it will be necessary also to wrap the bone of the upper arm with cotton or tow, to keep it from contact with the skin, for drying will be slower than in small birds.

The feet in large birds dry so slowly that the skin often decomposes, and the scutes become loosened. To obviate this the tendons of the tarsus are removed, together with any small muscles present. After all the other skinning operations have been completed, cut a longitudinal slit in the median pad of the sole. The tendons of the toes all converge here, and by pushing the tip of the heavy forceps beneath

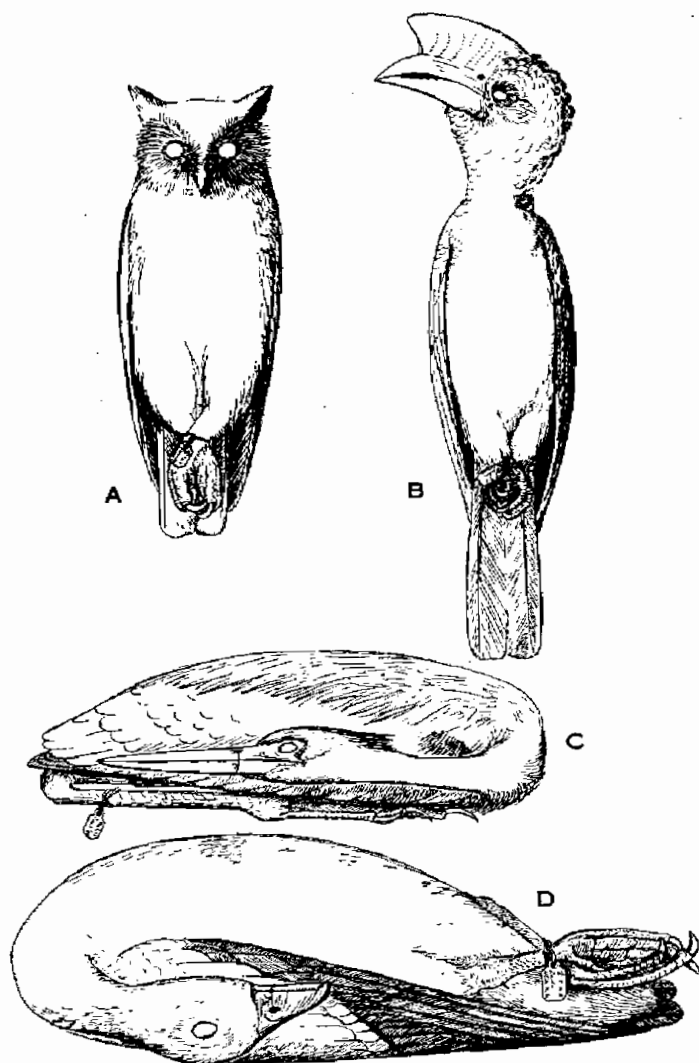


Fig. 20. Method of arranging skins of some large birds. A, owl, B, hornbill; C, large heron; D, goose.

them, from the side, they may be pulled entirely out of the tarsus. (Fig. 19.) The ends attached to the toes may then be cut, or if the toes are very fleshy, they also may be split open longitudinally from below, and more of their tendons excised.

With large herons and other similar wading birds, another slit should be made on the *inner* side of the heel joint (near the upper end of the shank), parallel to the long axis of the limb, and the skin separated as far around the joint as practicable, to be treated with arsenic and borax. With a wire or the long forceps, get as much of this preservative as possible up into the space whence the tendons have been withdrawn.

The feet of pelicans and large vultures are so difficult to preserve in a warm moist climate that the safest way is to slit the skin down the whole length of the tarsus, on its inner side. Remove all flesh and tendons, dust with arsenic and borax or alum, and do not sew up very tightly. Split the underside of the toes, out to the last joint, removing the tendons.

Making up Skins of Large Birds

It is obvious that specimens of large birds, with long necks and limbs, if made up in the same way as small birds, would be very difficult to transport or store in boxes. When a bird exceeds a length of $2\frac{1}{2}$ feet, either the neck or the feet, perhaps both, will have to be doubled over. A wire, not a stick, is therefore to be put in the neck; and after the skin has been filled out and sewed up, it is bent into the desired form, care being taken that no part of the bird's plumage shall become entirely hidden. Bend the neck down one side of the body, outside the wing, rather than upon the middle of the breast or back. Methods of treating birds of different sorts will be suggested by the sketches in Fig. 20. For large birds the artificial body, preferably of "excelsior" bound with heavy thread, is made smaller than the real body. The neck is wound of cotton or tow, and these softer materials are

used to fill the space remaining beneath the skin. Make such skins only large enough to display all parts of the plumage. Neither can large skins be wrapped wholly in cotton; strips of paper pinned round them, or some open-mesh cloth, will keep them in shape until dry.

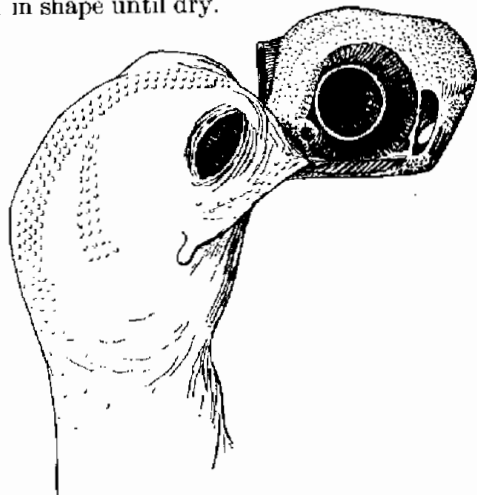


Fig. 21. Owl's head after skinning and cleaning; to show the way the empty eyeball is retained.

Treatment of the Head in Owls

The eyes of owls have a peculiar shape, the front protruding in such a way that if the whole orbits are filled with round balls of cotton, the facial expression will be largely lost.

Treat the eyes of owls as follows: Do not remove them from the orbit, in which they are fixed rigidly. Cut away the transparent skin (the cornea) in front of pupil and iris; then with the small forceps and a small wad of cotton force out all the liquid from within the eye, drying the interior with cornmeal. Take care that the liquid does not fall on the feathers.

The brain is removed through the base of the skull as usual; but there will be no opening from the brain-space to

the orbit, for the latter is still filled by the shell of the eyeball, as in Fig. 21.

So instead of stuffing out the eyes from behind, round lumps of cotton are wedged into the front of the emptied eyeballs, through the lids, after the skin of the head has been turned back, and when the skin is finally being filled out.

The false neck, with its stick or wire, is not inserted into the throat of an owl, but is wedged tightly into the brain-space at the back of the skull. This will bring the head and face into a far more owl-like position. (Fig. 20, A.) A projecting wire point may be left at the anterior end of the false neck, to be pushed through the top of the skull and bent over outside the skin. It will hold the head on more securely.

Temporary Preparation of Some Large Birds

The large flightless birds such as the ostrich, cassowaries, and their allies are not to be prepared according to the foregoing method, but must be treated more as a large mammal would be, though the bones of wings and feet, and the skull are retained. The feet especially are to be more fully skinned so that the skin nowhere lies closely against the bone. Only just enough hay or other dry stuffing is used to keep the two sides of the skin apart, and no cuts are sewn up. Instead of arsenic and borax or alum use salt, in a dry climate, or one part salt to three of alum in a humid one. Dry the skin as thoroughly as possible, and fold into a bundle. Never pack in the same box with other skins not treated with salt.

Large, greasy seabirds, and fatty ducks or geese, often impose serious delays upon the collector. To save valuable time they may be skinned out completely, and thoroughly salted, without too close attention to the grease, provided blood stains are carefully removed. Their preparation can be completed by a taxidermist even several months later. In general this procedure is not recommended, for the longer the skins are kept, the more work is involved in their sub-

sequent preparation. In the humid tropics it is not to be thought of.

Determination of Sex

Inspection of the plumage can in no case be relied upon for the bird's sex. Dissection is the only method; and where wounds or incipient decomposition have impaired the evidence, do not write the sex upon the label without a question mark.

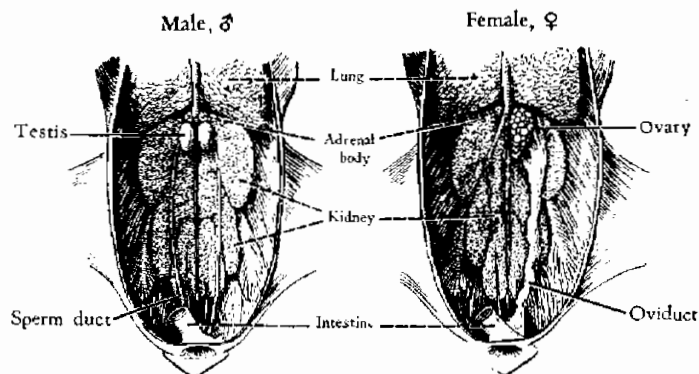


Fig. 22. Dissections of male and female birds, to show the reproductive organs, by which the sex is recognized, and adjacent structures.

When the body is completely removed from its skin, cut open the left side from the vent to the anterior ribs. Force the edges apart, and pressing the intestines aside, look for the sexual organs. These will be found in the small of the back close to the backbone, and near the forward ends of the kidneys, which fill the roof of the abdominal cavity. They are shown in Fig. 22.

The male organs (testes), two in number, are usually white or yellow but occasionally much darker, and lie side by side. They are of smooth rounded or ovoid form, large and conspicuous in the breeding season; but they may become extremely small in winter. Do not confuse them with the "adrenal

bodies," smaller and flatter bodies (yellow or orange), lying a little farther forward, in the anterior border of the kidneys.

The female organs consist usually of a single ovary, lying a little to the left side. A vestige of the right ovary may be present. In the non-breeding season the ovary is a mass of small ova or rudiments of eggs, much less regular in shape than the testis of the male, and likely to be flattened, with evident granular structure. The female has adrenal bodies the same as the male. As the time for laying approaches, some of the ova become greatly enlarged, to form the yolks of the eggs.

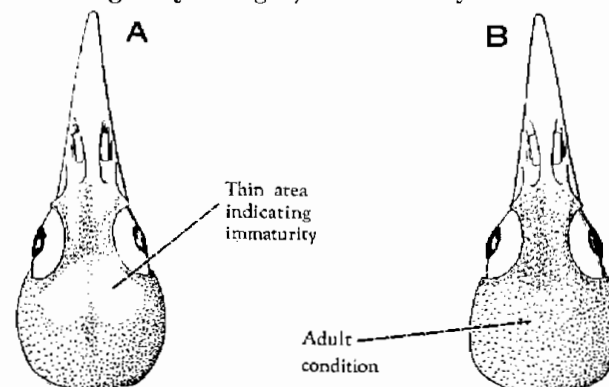


Fig. 23. Skull roof of (A) immature and (B) adult perching birds, to show the clear, thin area which indicates a young bird.

At this time too, the oviduct, a tube leading from the neighborhood of the ovary down the left side to the vent, becomes conspicuous—being usually whitish.

Determination of Age

From the condition of the sexual organs, and that of the bird's whole body, the bones in particular, the collector ought to be able to detect signs of immaturity far more accurately than is possible from a dried skin. He might note his opinion on the label, using "ad." for adult, and "im." for immature, the latter designating any bird which has not assumed its full plumage.

Fortunately there is a simple method of determining, in the case of practically all perching birds (=ordinary song-birds and their near allies) whether the specimen is a bird of the year or not. In the nestling the bony roof of the braincase is very thin and transparent, formed of a single thin sheet of bone; that of the adult is more opaque, being formed of two layers of bone, separated by air spaces traversed by fine bony rods. Holding an adult skull up to the light, after removal of the brain, one will note that the roof of the skull, back of the eyes, shows fine dark specks all over. (Fig. 23, B). By reflected light these specks may look lighter than the neighboring bone.

As the young bird develops, the transparent area of the skull top becomes restricted, the dotted structure appearing around its edges, especially behind, until after three months there is only a relatively small area where a single layer of bone persists. (Fig. 23, A.) This is usually near the mid-line, just behind the orbits; but in some families such as the swallows the last traces of these areas are found farther back, and more laterally placed. After some six months this sign of immaturity is completely lost.¹

Perching birds which are thus found to be immature should be noted on the label or in the field catalog as "s.n.o." (=skull not ossified); others which have skulls of adult structure, "s.o." (=skull ossified).

Do not attempt to use this method for other groups of birds until by careful study it is found reliable. Woodpeckers and other families of small birds may have skulls of such different structure that it cannot be applied.

Notes on Stomach Contents

Information which one may wish to preserve as to the habits of a bird should certainly include the results of ex-

¹A very few exceptional species among Passeres retain a thin area in the skull roof throughout life. Information as to such a character is always desirable.

amination of stomach and crop. The ornithologist will seldom be competent to name accurately all the insects, other animals, or fruits which have been eaten. It will nevertheless be worth while to have a list of the insects arranged according to orders or common names and numbers of individuals consumed, or brief mention of the nature of fruits or other

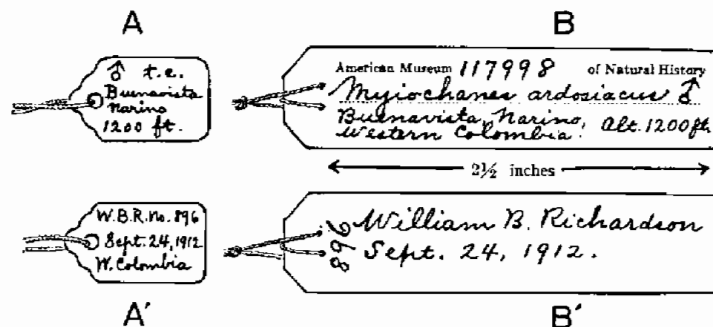


Fig. 24. Sample labels: A, front, and A', back of collector's tag; B and B', front and back of permanent museum label.

objects swallowed. In the case of any species whose diet offers particular interest, the stomachs may be removed entire, labeled to correspond with the individual specimen, and preserved in alcohol or formalin, for future examination by experts at home.

The Label

The label is tied securely to the crossed feet of the birdskin, as described on page 23. It should never exceed 3 inches in length and $\frac{1}{4}$ inch in width. If possible, use the permanent label of the museum or other institution for which the collection is being made. In case a small tag is used in the field, it is to be regarded as sacred, and must remain attached to the skin even when another museum label is added later. When writing on either side of the label, always keep the string to the left; this facilitates its reading. Examples are given in Fig. 24.

(1) Sex.—The spear and shield of Mars (♂) are used as the sign of the male sex, the mirror of Venus (♀) as that of the female.¹

The condition of the reproductive organs is of interest as indicating sexual maturity or the reverse, of the individual, as well as the season of reproduction. It may be noted on the field label by means of the following abbreviations:

"t.e." = testes enlarged, when the increased size would indicate that breeding was under way.

"t.n.e." = testes not enlarged, when there is no possibility of the bird being in condition to breed.

Intermediate conditions may be indicated by "t.so.e." (=testes somewhat enlarged) and "t.sl.e." (=testes slightly enlarged). Corresponding conditions of the ovary would be written "o.e." "o.n.e." and so on.

Any inequality in size of the male organs, the presence of a right ovary, or abnormality in the reproductive organs is worthy of special note.

(2) Locality where the bird was taken, not abbreviated so as to be unintelligible save to the collector himself. Always give the state or country, as well. In mountainous regions the altitude is an essential adjunct to the locality.

(3) Date when the bird was taken. Do not use an Arabic numeral to indicate the month, for different usage in America and in Europe often makes it impossible to decipher. Even a Roman numeral is not preferable to a three-letter abbreviation of the name of the month. But every letter on the label must be written legibly, or if necessary printed.

These three items must never be omitted from a label, for a simple catalog number on the field label is of no interest if the notebook with the data is lost. But since it is advisable to have a field label of reasonably small size, the more lengthy remarks as to age, ripeness of the reproductive organs, and color of unfeathered parts (eye, beak, feet, and any naked

¹Museum experience shows the necessity of writing the sex mark with the greatest care. The worst offence, perhaps, is the use of an inverted ♀ to mean male.

skin), may be confided to the field catalog. In general, however, the more information on the label the better. 7×9 inches is a good size for the notebook. In it one may add anything that seems of interest with regard to the bird's habitat, its food, nesting, molt, migrations, and ecological status. There is no advantage in the collector's writing the scientific name of an adult bird on its label in the field, and often he cannot know it. But in a field catalog, after the serial number of the specimen, it is advisable to enter some common name for the species or its family.

If a native name can be secured this will often serve the purpose, and will record linguistic material of value to anthropologists, who themselves are often unable to secure such accurate identification of native names for birds.

A great deal might here be added concerning life-histories, were space available. Nests and eggs are of interest only when the owners are identified beyond question, and then solely as part of the life-history of the species. More can be learned by watching a nest than by merely blowing its eggs. Other data of interest include accurate weights of birds and their unblown eggs, the length of the period of incubation, intervals between laying of successive eggs, and temperatures of birds (taken through gullet or rectum, *immediately* after death, with a clinical thermometer reading to 115° F.) In the field notebook write on only one side of the sheet, so that pages or parts of them may be cut out and reassembled, if desirable, according to species, at some future time. This will save the trouble of recopying half of the writing.

The Drying of Birdskins

Use every means to dry the specimens promptly, without exposing them to excessive heat. In a dry or cold climate there is no difficulty, but in a tropical rainy season it may become necessary to place them in the sunshine as often as the clouds part, or to hang them in the neighborhood of a fire,

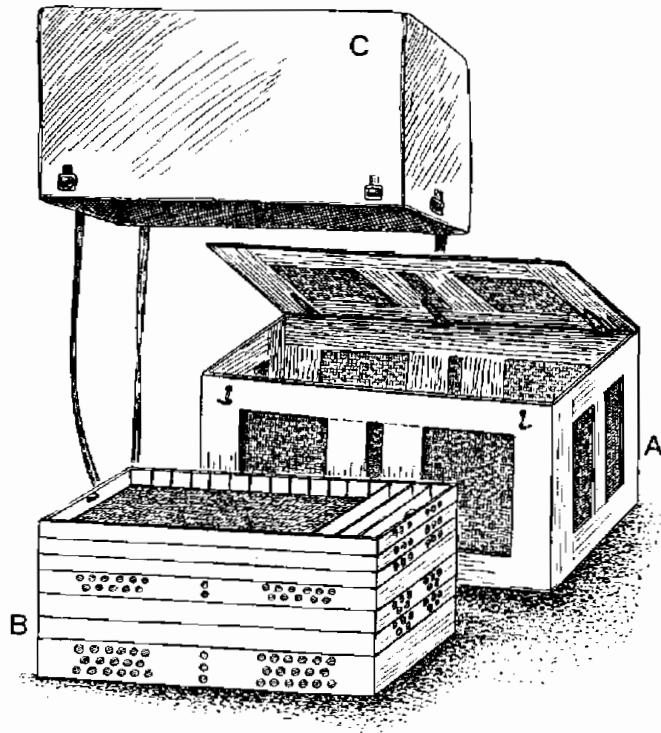


Fig. 25. A drying box very convenient for travel in the tropics. The top and sides have wire screening for ventilation, the bottom being solid. Inside dimensions of the box (A) are $71.5 \times 38 \times 38$ centimeters, or approximately $28\frac{1}{4} \times 15 \times 15$ inches. The width is the same as the depth, so that in very wet weather the box may be turned on its side, the trays (B) slid in as drawers, and a lantern or oil-stove placed beneath it to create a draft of dry air. An apron of canvas fastened around its lower edge will direct the air from the lantern.

There are seven trays of wood, well shellacked, with wire-gauze bottoms, each with removable slats to hold the skins in place. The trays are of three different depths, and in two of the deeper ones the slats run lengthwise. Holes drilled in the sides or ends of the trays facilitate aëration.

The canvas cover (C) is used to keep out damp night air, and serves as a protection from rain while traveling. It should be made very loose, to allow for shrinking.

though not in the smoke. Never place them in air-tight boxes till thoroughly dry. Some sort of a crate enclosed with wire-gauze will protect the specimens from mice and insects meanwhile, or they may be placed on flat rectangles of substantial wire netting, swinging shelf-like, one above the other, by strings attached to their corners. Such shelves should fit in one of the trunks or boxes, so as to be stowed away in the bottom when not in use. Insects may be discouraged from climbing along the cord which sustains such a drying rack by wetting it with kerosene or coal-oil.

For traveling there is nothing so effective as a specially constructed drying box, with open spaces on several sides, covered with wire gauze, and fitted inside with several light trays, of varying depth. The bottom of the trays is of wire netting, and they are crossed by upright slats to keep the birdskins in place. A waterproof canvas cover will keep off rain, on the march; and it may be put over the box at night to lessen humidity. Beware of small ants which invade the drying box and eat small holes everywhere in the specimens. Naphthaline flakes sprinkled over the skins will protect them temporarily.

Beetles (*Dermestes* and allies) will often gnaw at the horny sheath of the bill or the scutes of the feet, while the skins are drying. A simple way to discourage them is to paint all such parts, as soon as the specimen is made up, with a *thin* solution of arsenical soap, which will dry and leave almost no trace. Insects seem to be aware of the presence of the poison without tasting it.

Arsenical soap for this purpose may be made by boiling white arsenic powder a few hours in a thick solution of laundry soap—in an old pot, and *out-of-doors*—until all the arsenic is dissolved or at least held in suspension. The proportions may be about one tablespoon full of arsenic to a small cake of soap.

When important feathers have been accidentally pulled out or broken by shot, they may be replaced or repaired with thick shellac. Glue is often softened again by atmospheric moisture.

Packing of Birdskins

A soldered tin box encased in a wooden one is the ideal packing, but is seldom available and rarely necessary. Wooden packing boxes may be made sufficiently tight; and if plenty of naphthaline flakes or moth-balls of the same chemical be scattered within, they will need no further inspection before arrival at their destination. Besides preventing the ravages of insects, naphthaline has a beneficent action in discouraging mold, if used generously.¹

Never pack birdskins permanently till they are thoroughly dry. A single moist skin of a large bird may do great harm to the rest of the contents of a box. Never pack in the same box any other skin which has been treated with salt, for should it pass through a rainy district the salt will inevitably absorb moisture. Salted skins of large mammals must be kept by themselves.

Burlap dipped in tar is often used to envelop bales of goods shipped to the tropics, and this material tacked over the outside of the box will give a decided protection from rain and from the attacks of termites or white ants. The box may be lined with it, provided that plenty of paper is added to prevent the tar from touching the specimens.

The individual birdskins, with or without their cotton wrapping, are rolled in cylinders of paper and packed tightly enough to prevent any displacement during transportation. If rather thin paper is used, and the smaller specimens are

¹Paradichlorobenzene (of which "globol" and "paraide" are trade-names) is a more energetic insecticide than naphthaline, but it evaporates far more rapidly than naphthaline, and is therefore less suitable for field work. A mixture of the two substances is excellent.

placed carefully in the hollows left between the larger ones, it is astonishing how many will go into the box. This is often of prime importance in overland transportation.

Skeletons or skulls must not be packed with birdskins unless the bones have been poisoned with arsenic, provided also that there is plenty of naphthaline to deal with the insects which are almost certain to be introduced with such bones. No heavy object is to be included in a box of birdskins, for it will shake about and break many of them.

Customs Regulations on Entering the United States

With few exceptions the importation of wild birds' skins or plumage is forbidden, save when they are intended for scientific purposes, and addressed either to a museum or to a person holding a Federal permit to collect birds in the United States. Do not try, therefore, to bring them through as baggage, without special declaration. Specimens for the American Museum of Natural History should be clearly addressed to the museum, and may be safely turned over to the Custom Office at the port of entry, if so demanded. Notify the Director of the Museum, at the same time, of the arrival of the collection. Similar procedure is advised for other museums and other countries.

Preservation in Fluid

The colors of the plumage may change when the bird is thus preserved, so that the specimens are then of use only for anatomical study. The preserving fluids used are alcohol (about 85%), or formaldehyde (=formalin) at about 3%. Alcohol is preferable when available; some kinds of denatured spirit will serve satisfactorily, provided they do not become cloudy on mixing with water. Strong commercial formalin is usually a 40% solution. Mix one part of such formalin with 15 parts of water. Adding common salt (two tablespoons per quart of formalin solution) prevents the extreme hardening so common with formalized specimens.

The preserving fluids must penetrate the interior of the bird's body. The abdomen and all the larger fleshy masses may be injected with a large hypodermic syringe, if it is to be had. Usually a simple slit through the wall of the abdomen, without disturbing the viscera (intestines, etc.), will allow sufficient penetration by the preservative. Tongues, syringes, and other visceral parts of birds which have been skinned are frequently worth saving in fluid.¹

Each specimen should have a label, bearing at least the locality and date. The sex will not be determined until the bird is dissected at home. The label may be of stout paper which is not affected by fluid, or it may be a tag of pure sheet tin or of lead, with a number stamped on it. Data may be written on paper either with a soft lead pencil, or with waterproof India ink, the latter being thoroughly dried before immersion.

Alcohol in which fresh birds have been dropped will absorb water from them, and become weaker. It is necessary to change it for fresh alcohol before packing for shipment. A few spoonfuls of strong formaldehyde may be added to strengthen a formalin solution, but this is seldom necessary.

For small birds in fluid, glass jars such as are used for preserving fruit will generally suffice, if they are surrounded when shipped with straw or other fiber. It may often be necessary to place the specimens in tins,² which need not be entirely filled with fluid when they are soldered up, provided the birds have been thoroughly preserved for some time. Soldering is not a difficult task if a few rules are borne in mind. The metal to be joined must be clean and bright. The point of the soldering-iron must be clean and have a film of

¹These directions do not cover preparation for histological study, where alcohol is of very little value, but formalin preferable, and other fixing agents commonly recommended.

²"Friction-top" tins are the most convenient, but others will serve as well, especially with formalin.

molten solder adhering to it. To assure the adhesion of the molten solder both to the soldering-iron and to the metal to be joined, use a strong, reliable flux such as hydrochloric (=muriatic) acid into which a bit of zinc has been placed. "Soldering pastes" may work, but often fail when one is least able to replace them with acid. To keep the tip of the soldering-iron clean, during the course of the work, it may be rubbed occasionally on a block or lump of sal ammoniac. If the film of solder is lost by overheating, clean the point of the iron with a file, then heat the iron, wipe the point with acid, and rub in molten solder on a piece of bright sheet iron (= "tin").

The specimens must not shake around in the jars or tins. Pack them tightly, and wrap if necessary in pieces of cheese-cloth.

Preparing Rough Skeletons of Birds

Large birds will generally have their bones preserved in this manner. Thorough cleaning is not the aim; as much flesh is left adhering to them as will soon dry, and the ligaments are wanted to keep the bones attached to one another. If cleaning were too thorough in the field, many of the bones might drop off before the skeleton were safely home.

First remove the skin roughly, without including in it any of the bones or claws. In most cases, this skin should be labeled to correspond with the bones from the same individual, and kept; it will be of great value in assuring the specific identification. Disembowel the bird, taking care not to cut the breast bone, ribs, or the small bones near the vent. Detach the legs from the body at the hip-joint and remove the flesh, taking care not to remove the knee-cap.

The flesh may be removed from the wings without separating them from the shoulder; but great care must be taken in removing the large wing-quills not to lose the small bones of the wing tip, especially the one in the alula or bastard wing. From this indeed the feathers need not be removed, and the outermost wing-quills may likewise be left untouched.

Other parts requiring special attention are the plough-share-bone at the base of the tail-quills, the slender points on the under side of the neck vertebrae, and those projecting back from the ribs. It frequently happens that many of the tendons become ossified, as they do in the leg of a turkey. Look out for such on the under side of the neck, in the legs and wings, and along the sides of the back, and do not tear off the muscles as you would if preparing a skin.

Considerable flesh may be left on the neck and back, for it will dry easily, but the large breast-muscles are to be cut away. The hyoid arch, or bones supporting the tongue and attached to the windpipe, should be saved, as should also the wind pipe itself, especially if as in many ducks, it has bony structures developed in part of its length.

The whole neck is kept attached to the body skeleton, and it is carefully separated from the base of the skull, without cutting any bones. The brain of small birds need not be removed, in larger ones it is taken out cautiously, with a loop of wire inserted through the hole by which the spinal cord comes out of the skull.

In many birds, and especially in birds of prey, there is a ring of bones surrounding the pupil of the eye. . . They are not very visible, being enclosed in the front wall of the eyeball. It is therefore best not to remove the eyeball, but simply to puncture it to allow the escape of its fluid contents.

Cormorants have a small bone attached to the back of the skull; other birds have projections of bone at the hind angle of the lower jaw; and some diving birds have elongate processes at the elbow or knee. So it is a good rule not to trim up a bird's skull, or even its limbs, too closely.

Fold up the legs, and place them, with the skull, inside the chest cavity. Do the same with the wings or fold them alongside the body, thus making a bundle which is held together by a few strings till dry. It may be hung up in the meantime by a string attached to the neck; and a thin piece of wood,

tied securely to one of the larger bones (the coracoid, for instance, as in Fig. 26), should bear a catalog number, written with a very black lead pencil.

The data to be entered in the catalog are much the same as those for a skin: Sex (determined by dissection when disemboweling the specimen), locality, and date.

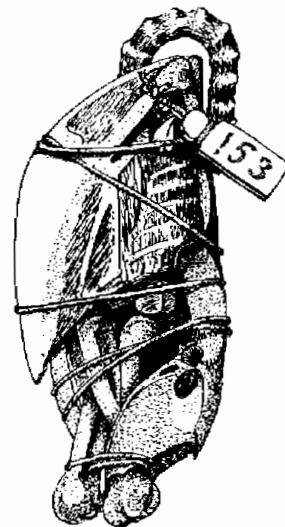


Fig. 26. Rough skeleton of a francolin, dried and bundled together for packing. The tag is of thin wood, bearing a number written with soft lead pencil.

To avoid all difficulties with beetles (*Dermestes*, etc.) which swarm upon dried bones in all tropical countries, dip the whole skeleton, as soon as it is thoroughly dried, into a weak solution (of merely milky tint) of arsenical soap, and hang it up again to dry. If the beetles are allowed to eat away the flesh, many of the smaller bones may be separated, and are almost certain to be lost. For added protection the dried skeleton may be sewn in a piece of cotton cloth.

Unless there are special reasons to be considered to the contrary, the first specimens of any species will always be preserved as skins. Afterwards, if the skeleton is believed to offer points of interest, a few adult specimens, which have not many of their bones injured, may be prepared as skeletons. It has already been explained, however, that small birds, even though desired for their skeletons, are best sent home preserved in alcohol. Such specimens are also of great value for the study of the soft anatomy, and of the arrangement of feather tracts.