

INSTRUCTIONS FOR PREPARING MAMMAL SKINS.

BY C. BODEN KLOSS, F.Z.S.

I have been invited by the Editors to draw up in some detail instructions for preserving the skins, etc., of mammals, for the use of those who wish to make collections. They have been written in the East for tropical residents, and if some makeshifts have been recommended, it is because it is impossible to send to a dealer and obtain a standard article at two or three days notice.

The business of preparing a mammal skin is really so easy, that with a little instruction and practice it can be successfully undertaken by any fairly intelligent individual; so there is no need to feel discouraged if at the first attempt it doesn't seem so simple, or the result so good, as was hoped for.

These instructions are to a great extent based on those drawn up by Mr. Gerrit S. Miller of the United States National Museum.¹ I learnt to preserve animals with an American friend whose collections were reported on by Mr. Miller, and who occasionally received from the latter suggestions as to the preparation of specimens; as I have met with no better method than that with which I first became acquainted I naturally propound it here. I have made, of course, various departures from the system advocated by Mr. Miller, and, in the same way, any one who learns to skin from this article will eventually evolve ways for himself that suit him better than mine do.

There is naturally more than one method in practice; for instance some collectors take off skins by a cut made *across* the lower abdomen: but I have described here one which seems to me as simple to carry out and as productive of good results as any.

The paper has been primarily written for members of the Natural History Society of Siam, and there is one thing about that country which should give encouragement and interest; which is that it has been investigated zoologically so little that there are still to be made plenty of discoveries in which any enthusiast may have a share.

APPARATUS, ETC.

If the collection of mammals of small to moderate size is to be undertaken, it is well to lay in the following apparatus and materials:—

Scalpel or penknife.

Scissors, one blade at least pointed.

Small stone for sharpening knives.

Forceps 5 inches long with rounded ends two or three millimetres broad.

¹ Directions for preparing specimens of mammals. Part IV of Bulletin of the United States National Museum, No. 39. Third edition, revised. 1912.

Forceps 9 or 10 inches long for handling cotton bodies, etc.
File.
Pliers with cutting edge for wire.
Compasses or dividers.
Metric rule.
Galvanised iron wire of several sizes. ¹
A mixture of three parts powdered alum and one part arsenic,
by weight.
Cotton-wool, jute, wood-wool or coir. ²
Labels for skins and skulls. ³
Needles and thread, and pins.
Spirit in a wide-mouthed receptacle.
Sawdust. ⁴
Specimen box with trays. ⁵

All the above are desirable for systematic work, but an occasional skin can be made in a sufficiently satisfactory manner with nothing more than a knife, some wood-ashes, dried grass or leaves.

1. It is not easy to indicate in a few words the kind of wire necessary where it is not sold by named sizes, but a supply ranging from one to three millimetres in diameter should be provided; the smaller sizes being for shrews, bats, rats, squirrels, and the larger for monkeys, civets, etc. If much collecting is expected, stretch and straighten, cut to suitable lengths and point beforehand. Some experience is necessary to judge of the lengths required: a wire that is too short is useless.

2. Two kinds of cotton-wool are desirable; a good quality for wrapping tail-wires of small animals, such as is sold in rolls by chemists; a commoner sort for filling small skins, of a kind that is sold in the bazaar for a few cents a bundle; silk-cotton will serve but is scarcely so easy to work with.

Wood-wool is the material used in packing china, glass and fragile articles; a limited amount can often be obtained from chemists and provision dealers.

Coir is the cleaned fibre obtained from the husk of the coconut, and is very useful for filling the skins of medium-sized and large animals.

3. Skin labels can be made of pieces of foolscap about 4 inches long by $1\frac{1}{2}$ inches wide; this is doubled longitudinally and one end then folded back for about three-quarters of an inch, the thread being passed through a hole there. No. 12 cotton should be used, the ends knotted together at half to three-quarters of an inch from the end of the label, (see Fig. 1.). For skull labels, pieces of thin visiting-card about 1 inch by $\frac{1}{2}$ inch can be recommended.

4. Fine sawdust obtained by sifting through a piece of mosquito net is invaluable for cleaning skins, soaking up blood and grease, and for obtaining a grip on slippery surfaces. If sawdust is not to be had, sand or dry earth will serve at times.

5. I recommend collecting boxes made as follows:—built of half inch planks well planed down, internal dimensions, 28 inches long, 14 inches wide and 10 inches deep. The box should be fitted with a number of light trays of various depths, say, one of three inches, one of one inch, and six of one-and-a-half inches, the latter size being that in most demand. The frames of the trays (*i.e.*, the sides and ends) should be well put together and the corners strengthened internally by extra wood, while a hole should be cut in either end for ease in lifting. The bottoms should be of some soft thin wood that will take pins easily and should be only lightly attached to the frames. This tray-fitted box should go into a second just large enough to contain it with its staple and padlock.

When starting on a collecting trip the bottoms should be removed from the trays (the tacks being carefully preserved) and placed on the floor of the box and the frames fitted in above them lining the sides; a large space will thus be available for packing apparatus and preservative materials. The smaller box is then placed within the larger. On arriving at the collecting locality the boxes are unpacked, the stores put in the larger and the trays fitted together in readiness for specimens to dry by day and be boxed up at night in some ant-free place. As the skins become dry they are unpinned from the trays and packed in the larger box.

This double-box system is proposed because I have always found that after a successful collecting trip one requires more boxes on the homeward, than on the outward, journey. The skins which are not yet dry can travel still pinned to the trays.

If it is expected that large or bulky collections will be made, several boxes should be provided.

METHODS OF COLLECTING AND TREATMENT OF SPECIMENS.

Mammals are to be obtained by shooting, trapping and purchase. A rifle is sometimes useful in open country, but nearly all small and moderate-sized mammals to be got by shooting, can be obtained with a twelve-bore gun and the following sizes of shot:—SSG, AA, 2, 5, 8 and, for small mammals at close quarters, cartridges loaded with half charges of powder and shot (10), the case being filled out by wads between the two.

The best trap for small mammals is a horse-shoe shaped pattern called the "Schuyler" which can be bought in nearly every town in the East; for carnivora, strong jaw-traps are best, but less easily obtained locally. They should have a chain or wire rope for attaching them to stout stakes or trees, and the bait should be hung above the pan about knee-high from the ground by a piece of string tied to the top of a long sloping stake.

If the local population is at all energetic or interested, individuals can often be stimulated by offers of reward to snare animals that the collector himself has little chance of obtaining or meeting. The extemporised trap is often better than the manufactured one.

Mammals which come to hand still alive can be killed by chloroform, drowning, or by pressure on the chest—in the case of the smallest kinds between the thumb and fingers; bites and scratches should be guarded against. Larger animals which are wounded and which it is not desirable to shoot again for fear of injuring the skins are most quickly put out of pain by placing a stout stick across the chest and standing on the ends.

Mammals should be skinned as quickly as possible after death. In hot climates they should be gutted as soon as obtained and the body cavity filled with cotton, paper or dry leaves; this practice is especially necessary with those that have been trapped during the night—presuming that the collector will be busy in the field in the morning and will not be able to commence skinning until the approach of mid-day.

If it is not possible to skin a specimen within a few hours after death, a few drops of formalin on the material placed in the body will delay decomposition for some time. Another method that may be resorted to when delay is unavoidable is to shut the specimens in a box in which a few drops of formalin have been sprinkled—but in this case all blood stains must be washed away at first or they will become fixed by the formalin vapour.

Small animals which have been well impregnated with pure formalin become mummy-like and will keep for years, though they do not become pretty objects with the passage of time. The method may serve for the preservation of an odd specimen at a pinch, but a collection made in this way is not likely to gain much appreciation.

MEASUREMENTS AND LABELLING.

The following measurements should be taken with accuracy, of all specimens, *always exclusive of the hair*:—

1. Total Length. (tip of muzzle to tip of tail). Supple the specimen and place it back downwards on the measure, with the tip of the nose held steadily over zero; straighten out the body and tail without unduly stretching them and record the length to the end of the tail vertebrae.

2. Tail. Place the measure on the table so that it projects beyond the edge to the left for half an inch or so. Bend the tail of the specimen back at right angles to the body, fit the apex of the angle to the end of the measure, the body hanging vertically meanwhile supported by the hand (or the latter may be pressed on the base of the tail), straighten out the tail and read off the length.

3. Hind-foot. Measure with the compasses from the back of the heel to the tip of the longest toe, *exclusive of claw*. Straighten the foot before the measurement is taken. In the case of hoofed animals the measurement is taken from the tip of the hoof, bent downwards, to the heel, which is the joint above the cannon-bone. (Fig. 2).

4. Ear. Measure with the compasses from the extreme tip

to the lowest point of the orifice: never to the bottom of a lobe even if that is present as in monkeys, tree-shrews, etc. (Fig. 3).

Record these measurements, just as taken. Afterwards, at ease in the study, it is simple to obtain the length of head and body by subtracting the tail length from the total length. But among the discomforts of the field keep things as simple as possible.

Some directions recommend that the length of head and body should first be taken by itself and then that of the tail; but the method is not to be recommended as it is almost impossible to obtain uniformity and accuracy by it. In the case, however, of a few mammals like *Hylomys* and a few bats, etc., it has to be resorted to, and the tail is best measured with the compasses.

On the front of the label write the sex,¹ locality and altitude, collector's number, date, collector's name; on the back the measurements, collector's number, and any short notes desired. Fig. 1 will show how it is recommended that this should be done; the blank space at the top is left for the name of the animal after it has been critically examined.

On the skull label record the same number as on the skin, and the collector's initials; these details should be written in pencil on *both* sides. Care should be taken that no part of this work is overlooked; neither a skin without its skull nor a skull without its skin has half the value of both properly combined.

It is a good practice to keep in book form a register of specimens with columns headed as follows:—

<i>Number.</i>	<i>Locality and Altitude.</i>	<i>Date.</i>
<i>Species.</i>	<i>Sex.</i>	<i>Measurements.</i>

In this book are entered the same details as those recorded on the label with, in addition, an approximate identification of the specimen. By means of it there is no waste of time in learning the last number used, and an idea of the mammals preserved is obtained at a glance. Any information it is desired to record at length (colour of bare skin, further measurements, habits, etc.,) can also be written under the specimen number.

SKINNING THE SPECIMEN.

It will perhaps be best first to give directions for skinning and making up a small mammal, such as a squirrel or rat, which will embody the general principles to be carried out; and to deal with variations afterwards.²

Lay the animal on its back, head to the right and (if it has not been gutted already) with knife held edge upwards cut the skin open along the middle line from the lower end of the breast-bone to the vent. Be careful not to pierce the flesh of the abdomen, which is

¹ Male, ♂; female, ♀

² *Vide* "Miscellaneous" and following sections.

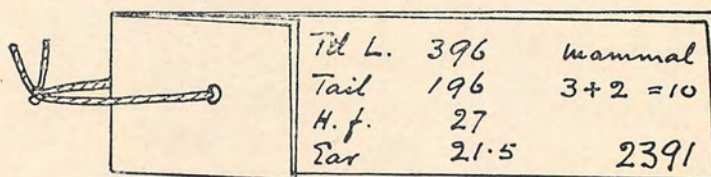
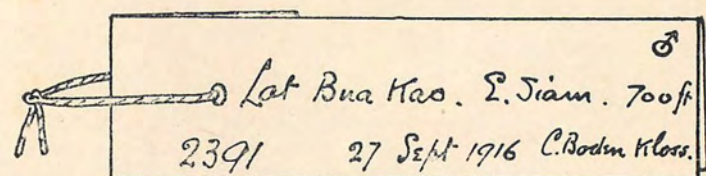


FIG. 1

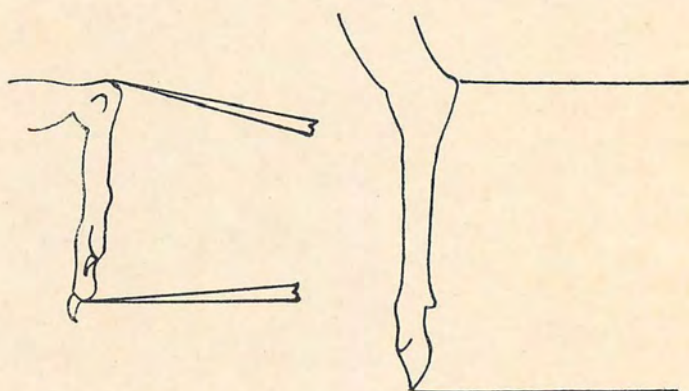


FIG. 2

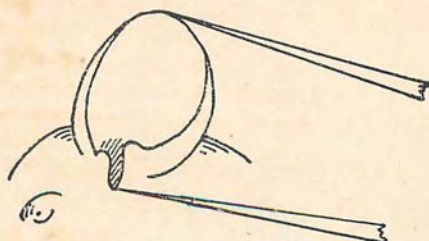


FIG. 3

very thin, or the intestines will protrude and get in the way. Do not be afraid of making a large opening; no object is gained and the skin will probably get badly stretched by trying to prepare the specimen through a small aperture.

Work the skin loose along one side, more by pushing and parting it from the flesh than by cutting; it is surprising how much skin can be freed in small mammals without cutting, but when it is necessary to cut don't hesitate; cut against the skin rather than against the flesh and don't be afraid to work boldly—little niggling cuts waste time.

When the hind-leg is well exposed and the skin loosened round the base, push it up from the outside and cut it through at the knee-joint. Pull the leg up from the inside stripping the skin right down to the heel and clear the flesh from the bone by cutting it through round the ankle and stripping it upwards, leaving the leg-bone attached to the foot.

Do the same with the other side and leg and then skin across the rump as high up as possible and round and up the base of the tail. Then by holding the tail-bones lightly between the forceps or the finger-nails, placed close against the inner side of the skin to retain it, with the other hand pulling against these, draw the tail-bones out.

Now turn the freed skin inside out over the shoulders and head, and skin upwards; a greater amount of cutting will be necessary here, as skin and flesh are rather firmly connected and it is well to skin as cleanly as possible at first, as much trouble is thus saved later on. While this is being done any pull on the skin should only be maintained at the place where the knife is being used, otherwise the skin may get unduly stretched or torn; the body will have to be turned occasionally so that skinning may be done evenly all round.

When the fore-limbs appear cut them through at the shoulder, work them out of the skin as far as the wrist, free the bone from flesh and cut away everything above the elbow.

Skin up the neck, working evenly round it, and when the ears appear cut them carefully through as close to the skull as possible but don't injure the latter. Soon after the ears are passed, the eyes will be reached; work the skin as far forward as possible and cut it free close to the bone without damaging the latter or the eyelids; a finger of the left hand placed on the outside of the skin and eyeball will be of assistance in obtaining this result.

Cut the skin from the skull until the lips are met; these are to be carefully separated from the jaws close to the bone until the skin hangs by the tip of the muzzle only: cut through the cartilage here close to the skin taking care not to injure the extremities of the nasal bones.

The business of skinning is much facilitated by a free use of sawdust which soaks up blood and grease and enables a grip to be taken on the slippery flesh and inner side of skin.

TREATMENT OF THE SKULL.

Cut or twist the skull from the body, taking pains not to injure it in any way, and attach the label immediately. Skulls can then wait until the skins have been attended to.

In the case of small mammals like bats, shrews, rats or squirrels, if spirit is available, it is only necessary to attach the label: this is best done by passing one of its threads up into the mouth through the flesh below the tongue and tying it tight up to one side of the jaw: or a length of neck may be left attached to the skull and the label tightly tied to this. It is then put into spirit: if only a little of the latter is available, and room is required, the skull can be taken out after two or three days and dried.

If no spirit is at hand the brain should be extracted through the *foramen magnum*—the opening by which the spinal cord joins the brain. *In no case may the back of the skull be cut away in any manner or the edges of the foramen injured.* By first thoroughly breaking up the brain with a bit of stick or wire it can always be jerked or scooped out; water will help. The skull can then be placed to dry in the sun or above a fire where animals cannot get at it. Don't put any alum or salt on it.

With larger skulls the flesh and muscles of the temples and jaws, and the tongue and eyes, should be roughly cut away (care being taken that the delicate bones of the roof of the mouth are not injured) and the cranium emptied as already explained. They can then be put in spirit or dried straight away; but whether put in spirit or dried without previous treatment it is a good plan to soak all skulls in water for a few hours to extract as much blood as possible.

Skulls are finally cleaned by boiling or maceration, but this should not be undertaken in the field as the teeth and small bones frequently become loosened and get lost. The proper cleaning of skulls is something of an art and in the case of small ones, at any rate, should be left to a practised workman.

After the label is tied on, make a loop of the free ends of the threads; by means of this the skulls can, when dry, be threaded on a string or wire and run little risk of getting lost.

Dried uncleaned skulls should never be mixed with the skins as they may possibly breed beetles or other insect pests.

TREATMENT OF THE SKIN.

Examine the skin and remove any flesh and fat still adhering: a few scraps of the former do not matter, but no large expanse nor lumps must remain. It is imperative that all fat should be cleared away: this is done by slicing it off with a knife, and scraping or snipping with scissors. Happily most animals are not fat, for the operation is tedious, but preservatives will not penetrate through fat; also the skin will become greasy and spoil. A good deal of fat can be finally absorb-

ed by rubbing with sawdust. Skins which are very fat and dirty may be washed with soap, or soda, and water, and dried with sawdust after draining.

Large blood-stains can be washed away with a pad of wool and water and the fur dried with sawdust: small ones may be left till the skin is dry and then cleaned by brushing or rubbing with sawdust.

Treat the inside of the skin with preservative applied with a brush or pad of wool, not forgetting the limbs: if the inside has got so dry that the powder will not adhere, damp it. Ordinarily, more preservative is not called for than will stick to the skin, but the lips, wrists and ankles should be freely treated and some powder should be shaken, or rammed with a wire, down the tail. Small skins can be proceeded with as soon as the preservative has been applied.

MAKING UP THE SKIN.

Tear off a tapering piece of cotton-wool and wrap the slender end round an arm-bone a little above the wrist: do not wrap thickly here as all that is needed is that the wool may get a tight grip of the bone so that it will not slip when the limb is returned to its proper position: the broad end of the cotton should fill the upper part of the limb where there is no bone and project a little into the body-space. After wrapping the bone pull or push it so that the limb comes right side out. Having wrapped both fore-limbs turn the body, skin right side out and proceed in the same way with the legs.

Next take a piece of galvanised wire (of about the diameter of the lead in a pencil or a little larger) long enough to reach from the tip of the tail to the upper end of the body-opening, straighten it and point one end with the file. This wire is to support the tail and before insertion has to be wrapped with cotton-wool.¹ The best way to do this is to take a long slender wisp of wool much thinner at one end than the other, moisten the point of the wire and lay it on the table with one inch or so of the butt projecting: lay the cotton also on the table with its narrow end on the wire about half-an-inch below the point, the wire and cotton forming a **Λ**, place the left hand over both to keep them in position and with the other hand twist the wire towards the right; the result should be that the cotton becomes firmly wrapped about the length of the wire, tapering smoothly and evenly from butt to point, so that both together can be inserted into the tail; *the pointed end must reach the extreme tip*, otherwise the latter will get broken when dry. (However it is effected, the wrapping must be done so smoothly and tightly that it can be passed on the wire down the tail to its extremity without jamming or breaking the skin).

Take a piece of cotton-wool of a size to fill approximately the head and body of the skin, and pass a few turns of thread round one

1 Of the better kind referred to in the first section.

end, to more or less shape it and hold it together, for a distance representing the head and neck; wrapping with thread is not essential but frequently renders more easy the insertion of the stuffing material into the skin. Grasp the wrapped portion with the forceps and pass it into the body and up the neck until the end can be seen and gripped through the mouth opening; then remove the forceps from within and work the skin of the neck and body over the wool; or the latter can remain compressed in the forceps until the skin of head and shoulders has been arranged.

See that the wool of the limbs projects into the body, that of the fore-limbs towards the tail, that of the legs towards the head, and, if the body is not sufficiently filled out already, small pieces of wool can be inserted with the forceps where called for; this will often be necessary where limbs and tail join the trunk. Hold the cotton tightly in the forceps while inserting it and do not release it until it is in place.

The tail wire should be surrounded by the wool of the body, and the filling of the head drawn well up into the muzzle.

Now sew up the belly opening; it is not necessary to do this so carefully that no traces of a cut are visible, a few stitches inserted close to the edges are sufficient, but care should be taken that no undue amount of skin is sewn in or a false idea as to the breadth of the under-surface will be given.

Arrange the skin of the eyes neatly, and by passing a needle and thread through the top of the lower lip and once through each side of the upper lip, draw the edges of the mouth together and tie them so.

The filling material must not have been so forced into the skin that the specimen is hard and unyielding, but on the other hand sufficient must have been used to do away with any wrinkles or bagginess when the skin is sewn up.

Cut and straighten a couple of wires, a little longer than the distance between the fore and hind claws and sharpen one end of each. Cut small slits in the skin of the palms and soles and pass the pointed end of a wire through the sole of a hind-foot, work it gradually through the body-filling and out at the palm of a fore-foot on the same side. The fore-limbs should now lie close to the sides of the neck; and feet parallel to the tail, pointing backwards and soles downwards. Tie the skin label to the right hind-leg above the heel.

The skin ought now to be in fair shape, but place it belly downwards on the table and with the measure or a flat piece of wood, beat it along (not across) the back and sides; in fact treat it as if it were a pat of butter being smacked into shape; this process will smooth and flatten the stuffing material within so that when the skin dries it will do so without showing lumps and wrinkles.

No special effort should be made to get the specimen to assume a life-like shape, though the head and body and the tail should be of approximately the same length as before skinning. What should be

aimed at is uniformity in the appearance of animals of a kind; the sides should be parallel, the head and back of the same level throughout, and the head and neck together of about the same diameter. (Figs. 4 and 5).

The specimen should now be ready for placing in a tray.

PINNING OUT AND DRYING.

Place the paws close to the head and press pins through them firmly into the tray; pin down the legs in the same manner, parallel to the tail. See that each pair of limbs is drawn out to the same extent, that the digits are close together and that the claws do not stick out upwards or sideways. If the tail will not lie correctly by itself, a few pins, crossed above it in pairs, will cause it to do so.

Long ears like those of rats and flying-foxes should be pressed back on to the head or neck and held in place until dry by a band of paper across the head with the ends pinned down outside the forelegs. (Figs. 4 and 5).

Animals with ears like squirrels in which both sides are furred, should have one ear pressed against the crown and the other bent downwards so that the colour of front and back surfaces can be seen at a glance. When the specimen is pinned out it may be given a final smoothing and shaping.

All mammals should dry somewhat flattened, which is the reason that trays of various depths have been recommended, as when the specimens are put away for the night the necessary pressure will be given by the tray above them. For shrews, pygmy-squirrels, and mice, trays of an inch in depth are almost more than sufficient, while even the largest mammals that the collector is likely to pin out for drying (civets, giant-squirrels, mouse-deer), should not be more than two and a half inches in depth from back to belly. An inch-and-a-half tray is suitable for the majority of small mammals.

It is not advisable to expose skins to direct sunlight if conditions will permit of drying less drastically, as such treatment often causes them to warp and buckle: cover them with a thin cloth or sheet of paper. However in very damp situations one is glad to dry specimens by any means available and periods of sunshine must be made the most of. If they have to be dried above fire take care that they don't get discoloured by smoke; it is a good plan to dry small skins pinned separately to bits of board and well wrapped up in paper, while larger ones can be wrapped in a cloth.

When the skins are quite dry, unpin them, and if they are to go on a long journey, wrap each small one separately in paper.

MISCELLANEOUS.

In making "cased" skins of ungulates it is necessary to slit up the backs of the legs for some inches above the bases of the hoofs, as

otherwise the skin there cannot be freed from the bone (Fig 6, unbroken lines).¹ Cut away all muscles and tendons about the hoofs and lower legs.

Work the knife deeply round the bases of the hoofs and treat those places liberally with preservative. Afterwards a few stitches at intervals will be sufficient to draw the edges of the openings together. In horned animals the neck should be severed after it has been skinned as far as possible from the body end. To get out the head, a V shaped incision is made between the bases of the horns and continued down the nape in the form of a Y as far as is necessary. The skin surrounding the horns is cut through close to the base of the latter. (Fig. 7.).

In medium-sized and large animals the lips should be pocketed or split from the inner side where they were freed from the jaws, and much of the flesh between the skin and the mucous membrane cut away.

Working from the base where they were cut from the skull, the skin of the ears should be separated as far as possible from the cartilage within, and treated with plenty of preservative.

If the skin is thickened anywhere, as on the shoulders of pigs, it should be freely and deeply cross-hatched with a knife on the inner side, to allow the preservative to work through to the outer surface.

Animals of the size of the barking-deer or larger should have plenty of preservative *rubbed* into the skin, especially about the thicker portions, feet and lips. For twelve to twenty-four hours the skin should then remain rolled up into a bundle to sweat, hair side outwards and head and limbs in the middle, before it undergoes any further treatment.

If it is to be filled out with stuffing material it should not be rammed too full of the latter. Flatten it by beating or pressure, arrange the fore-limbs against the neck, and bend the hind-limbs forward at the groin until they lie along the sides of the belly, the hoofs pointing slightly outwards. The tail should be bent round against the belly. Keep the limbs in place while drying with a lashing of string, and make the ears dry close against the nape. It is often convenient for purposes of handling, to strengthen the specimen by thrusting a stout pointed stick through the body from mouth to vent.

Mammals above the size of a barking-deer make rather bulky specimens if their skins are filled out, and they are generally preserved flat unless specially intended for mounting. An excellent method of dealing with medium-sized mammals, however, is to make "cased" skins of them in the first instance, and afterwards, when they are nearly dry, to remove the filling material from the neck and body, flatten out these parts and then double the skins across the middle

¹ "Cased" skins are those which are only partly opened, and are thus distinguished from "flat" skins, which are completely opened.

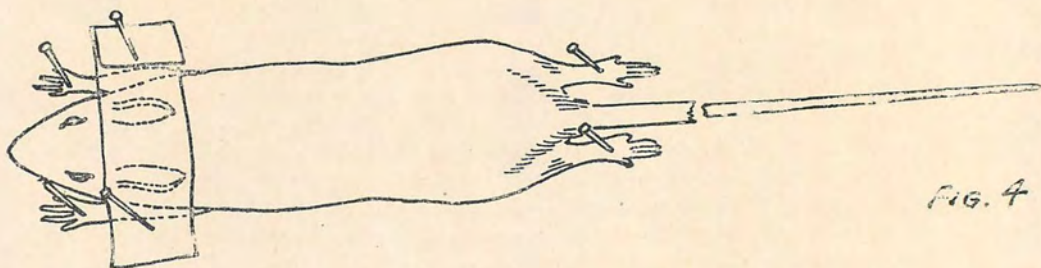


FIG. 4



FIG. 5



FIG. 6

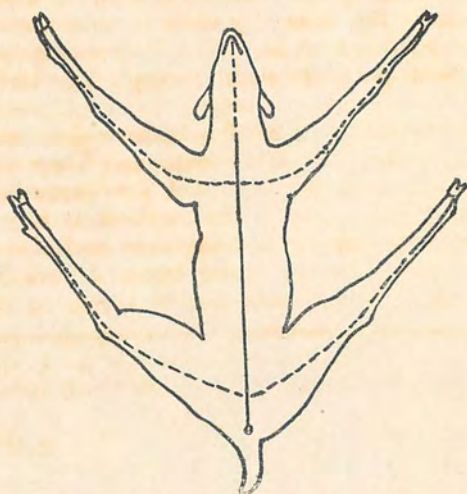


FIG. 7

of the back outwards, so that head and buttocks come together. Monkeys should always be wired, and so cannot be folded up, but the larger civets, jackals, barking-deer, serows, etc., make very satisfactory specimens treated in this manner.

In animals larger than a common squirrel, a filling of wood-wool or coir is preferable to cotton and it will not be possible to insert more than the head and neck in one piece. Do not make the latter too long; if it has stretched longitudinally in skinning it can be shortened to some extent by stretching it laterally afterwards.

The wrists and ankles of monkeys are so slender that it is very difficult to get at the extremities from inside the limb-skin. Palms and soles, therefore, should be slit open from the base of the digits, and the cuts continued for two or three inches along the inner side of the wrists and round the heels up the back of the ankles. Clean the extremities of flesh and fat, open up the skin as much as possible and force a pointed wire, etc., up the fingers to give the preservatives, which should be freely applied, an opportunity to penetrate to the tips.

The collector will have to be guided by circumstances as to whether he leaves the limb-bones of monkeys in the skin (leg and thigh, arms and forearm) or removes them all; the latter is the less ideal, through decidedly the quicker method, in spite of the fact that stuffing material will have to be put into the limbs piece-meal by means of a ram-rod. In either case wires should be used as directed for smaller mammals. After the specimen is flattened out, the tail should be bent at the root to lie along the under-surface; if it extends beyond the head it should be recurved at the end; the bends in the tail-wire should be curves, not sharp angles; the fore-limbs should be bent at the arm-pits until they press against the belly with the hands touching; and the legs turned up at the groin until they lie along the sides of the body.

Specimens thus shaped are not pinned out. Bind the limbs in position until dry: it is sufficient to close the mouth by tying the lips together with single stitches in two or three places. Flatten the muzzle and don't try to model the face at all.

Animals like cats, civets and giant-squirrels should also have the tails bent round to lie against the under surface of the body: this position does not interfere with pinning out on trays, and is the safest place for the tails of all medium-sized animals.

The palms and soles of cats, dogs and civets should be opened up by longitudinal cuts for purposes of cleaning, applying preservative and hastening drying. Whenever the cut is a long one the edges should always be brought together with a few coarse stitches.

In getting out the tails of monkeys, cats, etc., some force will have to be used. Skin as much as possible round the rump and root first, then grasp the vertebrae lightly between the flat sides of a couple of sticks held rather loosely together; place a foot on the base of tail,

the animal lying on the ground back-upwards, and pull the skin off the bones; the hands, both available for the purpose, holding the sticks in such a manner that while the bones slip through easily, the skin cannot follow.

BATS.

These should be skinned much as directed above, but the greater part of the thigh and upper-arm bones should be left in the skin, though their heads may be cut off; and they need not be wrapped. If the tail is very short or slender it may be left in the membrane, cutting it off where it joins the rump.

Pin the specimen to dry with the forearms lying close against the sides of the body and the legs backwards as in other mammals. The fingers and membrane should be gathered up and held in place by pins close against the forearm, and the extremities of the wings may be allowed to dry pressed against the abdomen where they will not be in danger of getting broken. Care should be taken that the thumbs do not project in drying and that their claws lie close up against the wings.

Except "flying foxes" and other large species, the majority of bats should be preserved in fluid.¹

LARGE MAMMALS.

The skins of large mammals such as sambar, tiger, etc., are preserved flat: they are opened by cuts made as shown in Fig. 6 (unbroken and dotted lines together).

After the median body-cut is made, the skin of the legs should be opened upwards from the feet, cutting up the back of the leg until the first joint is reached, when the cuts should be gradually brought round to the inner side of the limbs.

The measurements already advocated should be taken, together with any others that may seem of interest, such as height at shoulder.

If the mask only is to be kept, an ample length of neck-skin should be retained. All natural folds of skin—eyelids, dewlaps, etc., besides those previously mentioned—must be split and opened out from inside. Skins that are destined for mounting should not be pegged out or stretched while drying, and all the leg-bones should be kept, tied together and labelled. When nearly dry, skins should be rolled up or compactly arranged with as few sharp folds as possible.

A preservative that never seems to fail with large skins, from that of an elephant downwards, is formalin in a four or five per cent solution.

It has, however, one great drawback where facilities for packing are limited and transport of heavy or bulky objects is impossible, in that skins so preserved must not be allowed to dry if subsequent treatment, such as mounting, is required; for once dry and hard

¹ *Vide* "Alcohol and Formalin", p. 245.

it does not seem possible to relax a specimen so treated. Provided, however, that the skin can be kept moist with the preservative fluid, which is sufficient after a few days immersion, there is nothing better than formalin on account of its portability before use and reliability in action.

The next most satisfactory preservative is perhaps salt and alum combined. The first alone is doubtfully effective in keeping the hair fast for any length of time, and the latter by itself will not penetrate thick skins with sufficient rapidity.

At first salt should be plentifully applied to both sides of the skin, and well rubbed in occasionally on the fleshy side with pieces of wood or stone: in the intervals the skin should be folded up, hair side outwards, and allowed to pickle. When twelve to twenty-four hours have elapsed, it should be treated to rubbings of powdered alum and finally allowed to dry. Thickened areas of skin should be cross-hatched or shaved down as much as possible at an early stage of the proceedings.

ROUGH PRESERVATION OF SKINS.

If it is desired to preserve an interesting specimen when no apparatus and preservatives are at hand, take its measurements with twigs, or piece of string or a liana, and skin as directed above. Take special pains to free the skin from all flesh and fat and to clean and open up the feet and ears as much as possible. Then treat it liberally with wood-ashes well rubbed in.

In small mammals, or those with short tails, a skewer of bamboo, piece of rattan or the rib of a palm pinna can be used to extend the tail: but long tails like those of cats, civets, or monkeys should be simply laid along the under side of the body, after making a small slit beneath the tip, to ventilate the inside and aid drying. Wind some crumpled paper or dried grass round the limb bone and fill out the skin with dry leaves, etc. Shape as well as possible and dry quickly.

Large skins should be opened out flat and treated with several applications of wood ashes while drying: hasten the latter process as much as possible.

With fair opportunities for drying there will be good prospects of skins so treated making satisfactory specimens.

ALCOHOL AND FORMALIN.

If it is not convenient to skin small mammals they can be preserved in spirit or formalin.

Add to alcohol (methylated spirit is quite satisfactory) one fifth to one sixth of its volume of water, and mix one part of formalin with twenty to twenty-four parts of water.

Label the specimens in pencil on stiff paper or visiting-card and gut them thoroughly; afterwards soaking them in water for a few hours to extract as much blood as possible. At first keep them immersed in

plenty of fluid, less is required afterwards; and when they are thoroughly preserved they may be packed, merely moistened with the preservative liquid, in tins or bottles.

This method should be used for most bats, especially the leaf-nosed forms and other insectivorous species. Only after several examples of one kind have been collected should one or two be skinned for the sake of their colour, which, in small bats, is not a character of the first importance.

Fairly large animals should be stabbed with a pen-knife a few times in the fleshy parts distant from the body (the upper arms of flying foxes for instance), otherwise the preservative fluid, which works from within the skin, may not have time to penetrate to those portions before they begin to decompose.

SKELETONS.

Remove the skin in a single piece by cutting it open from mouth to vent and slitting up the under side of the limbs from wrists and ankles to the median cut: leave the skin on the fore and hind feet of small mammals. Preserve the flat piece obtained for purposes of identification.

Remove the viscera and roughly clean away the larger masses of flesh from the bones, but do not disjoint any of the latter, except the skull which it may be necessary to separate in order to extract the brain. Soak the bones in water for some hours to remove the blood, and then dry quickly.

Label the various separate parts with the same number and details.

Skeletons of large mammals are prepared in the same way but may have to be broken up for purposes of transport. The skull and limbs can be disjointed from the trunk and the latter prepared in two pieces by carefully separating two of the median vertebrae.