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Title of Study: METHODS OF PRESERVING SMALL ANIMALS USEFUL TO HIGH SCHOOL BIOLOGY TEACHERS

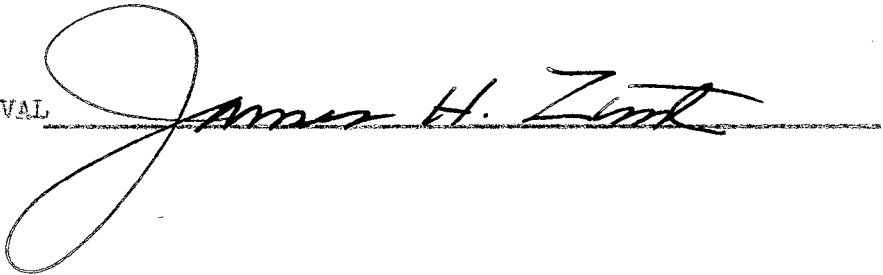
Pages in Study: 37 Candidate for Degree of Master of Science

Major Field: Natural Science

Scope of Study: Since, in the past, there has been a lack of emphasis on science, high school biology seems to have become strictly a text book course. This has been true, especially, in the smaller high schools, where teaching aids in the form of preserved materials have dwindled to none, or perhaps there never were any. This report involves the methods of preserving biological specimens, which can be used by the biology teacher to augment the supply of preserved materials in the department. It deals with the methods of preparing preserved specimen of small mammals, birds, amphibians, reptiles and fish. It cautions against the handling of rodents and lagomorphs which may be carriers of plague, tularemia, and relapsing fever, and gives directions for the treatment of bites inflicted by these animals.

Use of the Study: To act as a guide to aid in the relatively inexpensive preparation of preserved specimen for the biology class.

ADVISER'S APPROVAL


James H. Zent

METHODS OF PRESERVING SMALL ANIMALS
USEFUL TO HIGH SCHOOL
BIOLOGY TEACHERS

By

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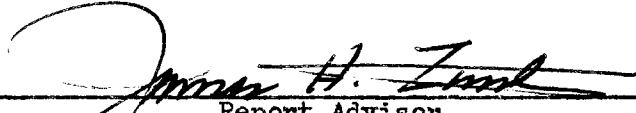
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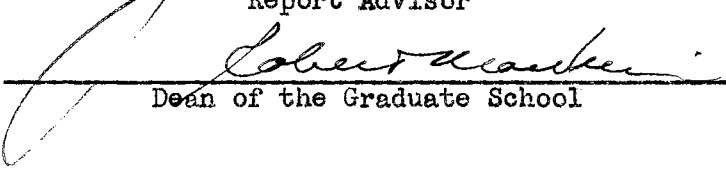
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Report Approved:



Report Advisor



Dean of the Graduate School

ACKNOWLEDGMENT

The writer wishes to express his appreciation for the assistance and guidance given during the preparation of this report by his advisor, Dr. James H. Zant, Director, Supplementary Training Program for High School Science Teachers, Oklahoma State University, Stillwater, Oklahoma.

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A. K.

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CHAPTER I

INTRODUCTION

If there is, at present, a teacher of biology who hasn't been confronted with the problem of preserving a flying squirrel or some other small animal, he probably will be exposed to it soon. Most high school texts have a unit devoted to the study of insects which has methods of collecting and preserving them sufficiently discussed. These same texts, however, omit methods of preserving such things as small mammals, birds, fishes, reptiles and amphibians. This same information, which is a necessary item in the Biology teacher's storehouse of data, is not discussed in the courses in Biology which are required of a person for a teaching field in this subject.

Due to an insufficient supply of funds in the life science department of the school, which is common in most high schools in our country, this department can not be very well supplied with preserved materials from the biological supply houses. These materials are relatively expensive and, although well preserved, are not everlasting and must be replaced from time to time.

With the above facts in mind this report is prepared as a guide to aid in the relatively inexpensive preparation of preserved specimen which can make learning in Biology class an adventure not soon to be forgotten. With the aid of preserved materials and just a little bit of imagination the student can be taken on a trip through the

country side, seeing many of the wonders of nature, without leaving the classroom. This method of teaching, however, is not intended to take the place of the field trip, which when properly conducted is an excellent teaching device.

CHAPTER II

EQUIPMENT

For the projects mentioned in this report the following equipment is ordinarily used:

Large and small scalpels

Small, pointed scissors

Metric rule

Long slender forceps or tweezers

Toothbrush for removing dirt, dried blood, and absorbent from
the skins

Needles

Thread

Pins

Cotton, tow and excelsior for stuffing

Fine hardwood sawdust or corn meal for absorbent

White arsenic (arsenious oxide)

Powdered alum (potassium ammonium sulfate)

Borax

Cotton cops

Salt

Acetone for cleaning fur and feathers

A painting duster for fluffing feathers

Labels

The alum and white arsenic are to be mixed in equal portions and used to poison and preserve the skins. This mixture is a poisonous substance and should be handled with extreme care. The borax is not poisonous to man and serves the same purpose as the above mixture; therefore, it may be used more advantageously by the teacher since these materials preserved in this manner will be handled frequently.

CHAPTER III

PRESERVING SMALL MAMMALS.

It is hard for the beginner to understand that a specimen has no scientific value without a label. It is impossible to record too much data about the specimen, and most people do not record enough.¹ The labels can be any size; however, generally they are rather small, $\frac{1}{2}$ inch by $2\frac{1}{2}$ inches or $\frac{3}{4}$ inch by 3 inches. The label should be prepared in the following way. The locality should be on the first line of the label. On the second line is the date and the name of the collector is found on the third line. The fourth line is for the measurements of the animal in millimeters. The sex and the number of the collection are placed at the right end of the label. On the back such things as the scientific name, common name, and any other information like habitat or elevation are placed.

Another type of record is the field catalogue. It should be kept in conjunction with the label and should be guarded against loss. It can serve possibly as a means of identification should a label be accidentally destroyed.

It is essential that the specimen be accurately measured before the skinning process is begun. This is necessary because the skinning,

¹Ernest S. Booth, How to Know the Mammals, (Dubuque, 1950) W. C. Brown Company, p. 23.

stuffing and drying frequently distorts the different body parts. The measurements to be taken are: total length, length of tail, length of hind foot, and length of ear.

The total length of the animal, taken with the animal stretched on its back, is the measurement from the tip of the nose to the end of the tail vertebrae. The length of the tail is measured, with the tail at right angles with the back, from the base to the end. The length of the hind foot is the distance from the heel to the tip of the most distant claw. The ear is commonly measured from the notch to the tip, but occasionally may be measured from the crown, which is indicated on the label. When no indication is made regarding how the ear was measured it is understood to be from the notch.²

Small mammals should be skinned as quickly as possible after coagulation of the blood is complete. With slight variations the following method for skinning small mammals is followed.

The animal is placed on the work bench on its back. The skin of the abdomen is pulled taut and with the small scapel an incision from the lower end of the breast bone to the base of the tail is made, being careful not to cut through the abdominal wall into the body cavity, since blood or other body fluids which might soil the hair would be released. (Fig.1)

The skin at the sides of the incision is pushed back with the thumbs and is detached from the flesh of the abdomen. At this point corn meal or sawdust is applied to absorb the moisture. The

²Lloyd G. Ingles, *Mammals of California*, (Stanford University, 1947) Stanford University Press, p. 238.

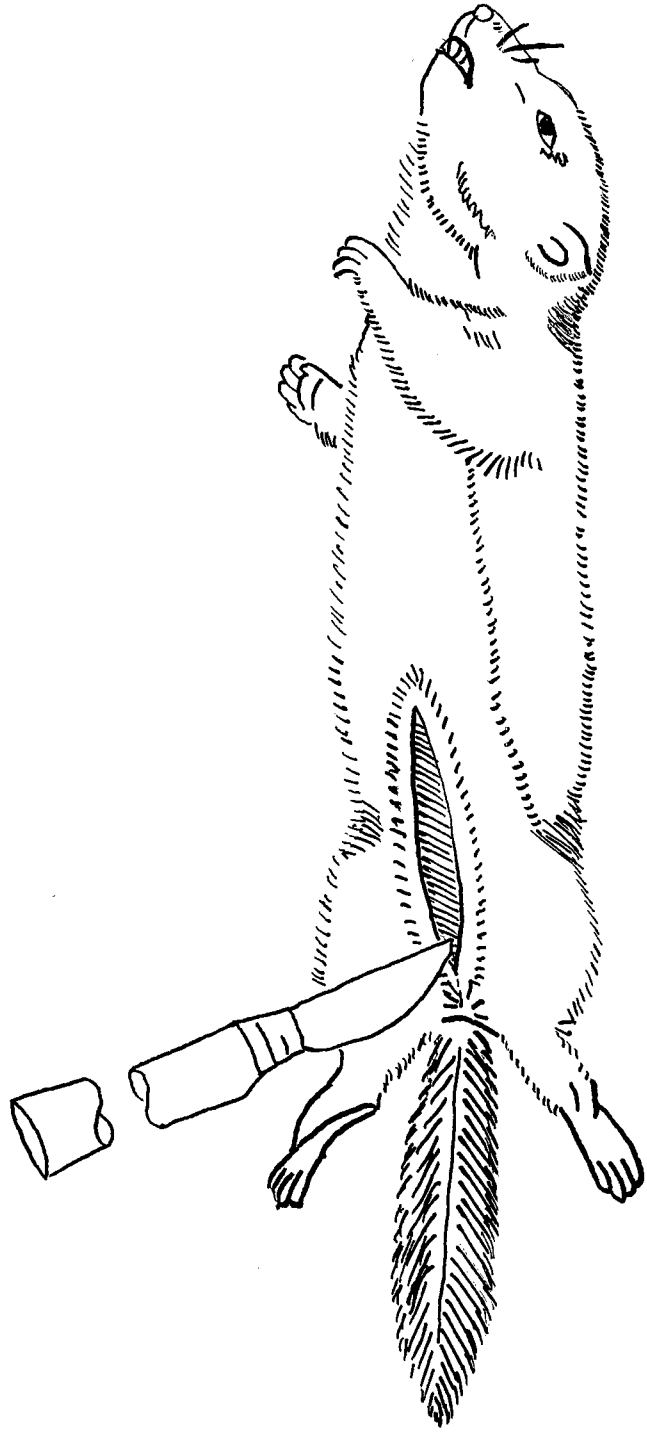


Fig. 1. Opening Cut on Abdomen in Small Mammals

skin is loosened as far around on the back as possible with the thumb and fingers separating it from the flesh. This exposes the thigh. Then the skin is freed from the flesh of the legs by pulling in opposite directions on the thigh and skin. (Fig. 2)

The leg is then severed at the knee joint. At this point in the skinning process some variations arise. Some people disarticulate the leg as close to the body as possible while others do so at various distances from the body.

The skin is now stripped down to the ankle joint and the flesh peeled off the remaining leg bones. In animals such as the skunk or muskrat, which tend to have a plump fleshy foot, it is necessary to make a longitudinal incision along the sole of the foot so it can be inverted and the flesh properly cleaned away. The other hind leg is treated in the same manner.

Now the skin should be freed from the flesh to the base of the tail. By working carefully the skin is loosened from the base of the tail by using the thumb and forefinger. Then by giving a steady pull the tail bone is slipped out of the skin. (Fig. 3) This is an easy process in skinning mice and chipmunks provided the tail has not been injured. In larger animals this process may require various degrees of effort. The skunk and muskrat have tails that do not slip. These should be opened with the scapel on the underside, along the entire length, and the tail vertebrae removed with the aid of the scapel.

The skin should now slip easily from the mid-part of the body to the front legs, which are treated in the same manner as the hind

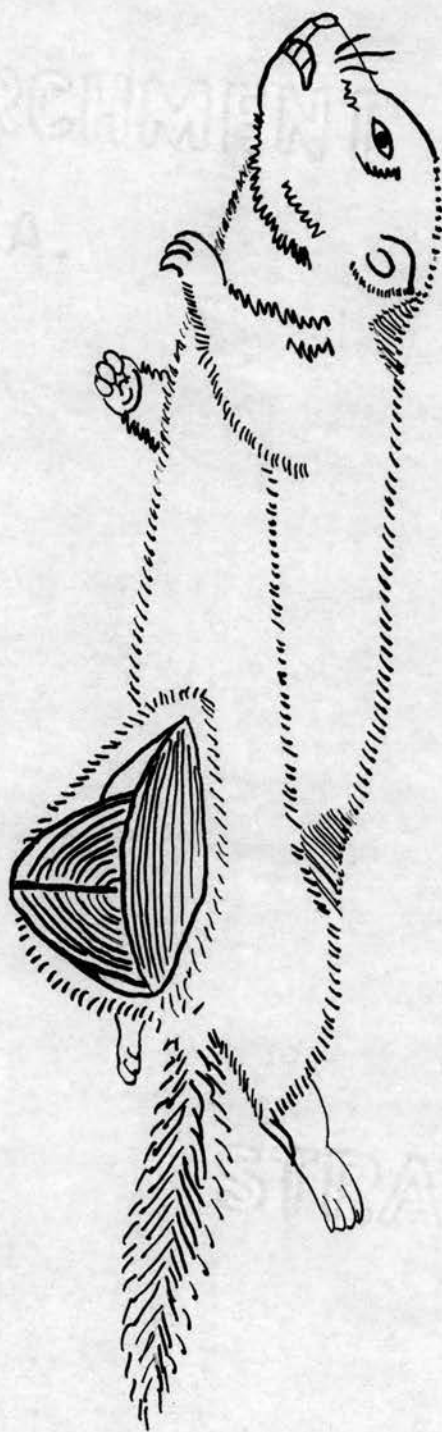


Fig. 2. Skinning Out Hind Legs

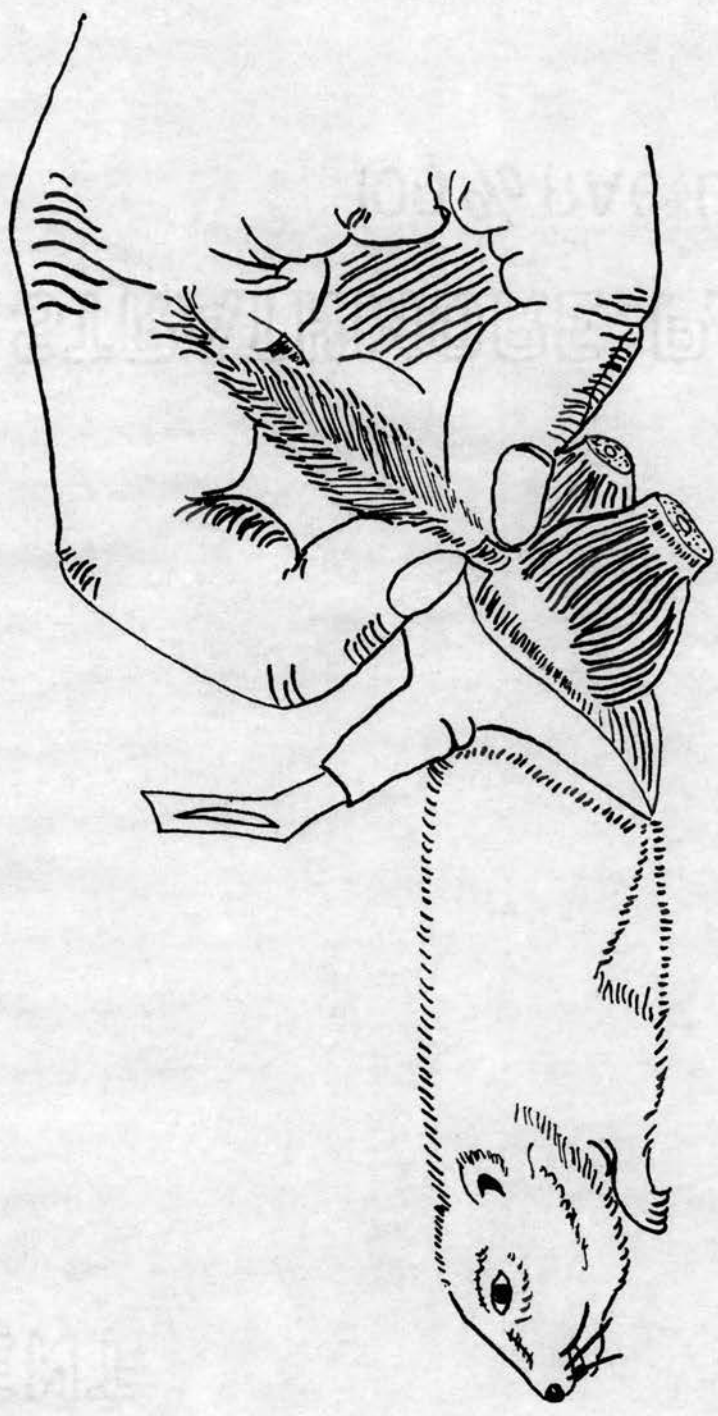


Fig. 3. Removing Tail from Skin

legs.

Upon completion of the skinning of the forelegs, the skin should again slip easily to the ears. These are severed with the scapel as close to the skull as possible. Continue skinning the head until the eye sockets are reached. Here considerable care should be taken so as not to cut the lids. Work slowly with the scapel, keeping close to the edge of the bony orbit, until you see, through a thin membrane under the edge of the scapel, the dark portion of the eye. You may cut through this membrane without doing any damage to the eyelids. If you have been careful the lids will not be cut anywhere. The skinning is continued until the nose is reached. The skin is now freed entirely by cutting through the cartilage at the end of the nose, taking care not to injure the skin of the muzzle. (Fig. 4)

It is essential that liberal quantities of absorbent be used during the entire skinning process in order that the fur is not damaged by the body fluids.

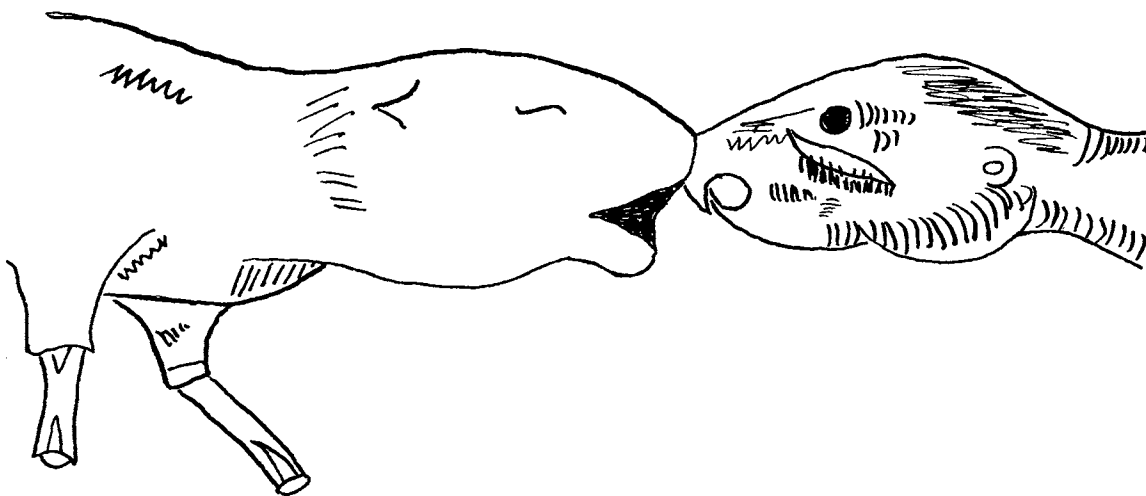


Fig. 4. Skin and Skull Before Letter is Cut Loose

Having completed the skinning process the skull should now be disarticulated at the base and cleaned in the following manner. The flesh is removed from the bone with the scapel. The eyes are cut out as is the tongue. With a short piece of wire, hammered flat at one end and bent up at a right angle, the brains are drawn out through the occipital opening at the base of the skull. Now place the skull in a box or string it up on a thread or cord and place it in the shade to dry.

Now the skin is ready to be treated for drying. All noticeable fat, adherent flesh and loose tissue should be removed from the raw side of the skin, taking care not to stretch it. Corn meal is used here to absorb the grease from the fat, and the flesh is scraped from the skin with the scapel. This must be removed in order for the hair to be set properly by the action of the preservative.

The skin having been thoroughly cleaned of flesh and fat, is now ready to be turned right side out and inspected for dirt and dried blood spots. If it is not perfectly clean it should be cleaned with acetone and dried with corn meal and then brushed.

The skin is again inverted and is ready for the preservative to be applied. The preservative may be a one to one mixture of white arsenic and alum or it may be borax. Arsenic compounds are poisonous and should be handled as such. Borax is not a poisonous substance and may be used more advantageously by the teacher if it is desirable. If the arsenic-alum mixture is used, dust it over the entire inner surface of the skin, so that every part of the skin is covered. The arsenic protects the skin against pests and the alum

preserves it. If borax is used, it should be rubbed well into the skin, scraped off, and again rubbed in. The lips should now be sewed together by passing the needle from side to side and then through the front of the two lips. (Fig. 5)

Wrap cotton strips around the leg bones to approximate the size of the legs with the flesh attached. (Fig. 6) The skin is now ready to be turned right side out. This may be a little difficult and may be easier by wrapping one leg at a time, beginning with one of the forelegs, and turning it by this method.

The skin is now ready for stuffing. A properly stuffed skin should have approximately the same measurements as before skinning. A wild animal is seldom extremely fat nor is one exceptionally thin. A piece of cotton batting is rolled in such a manner so that when finished it is essentially the size of the carcass of the animal. With the forceps grasp the end of the roll of cotton which is to go into the head of the bird and insert it into the opening in the abdominal region of the skin. (Fig. 7) Slip the skin over the roll of cotton until the end held by the forceps reaches the nose. Remove the forceps and work the skin over the hind part of the roll.



Fig. 5. Method of Sewing Lips

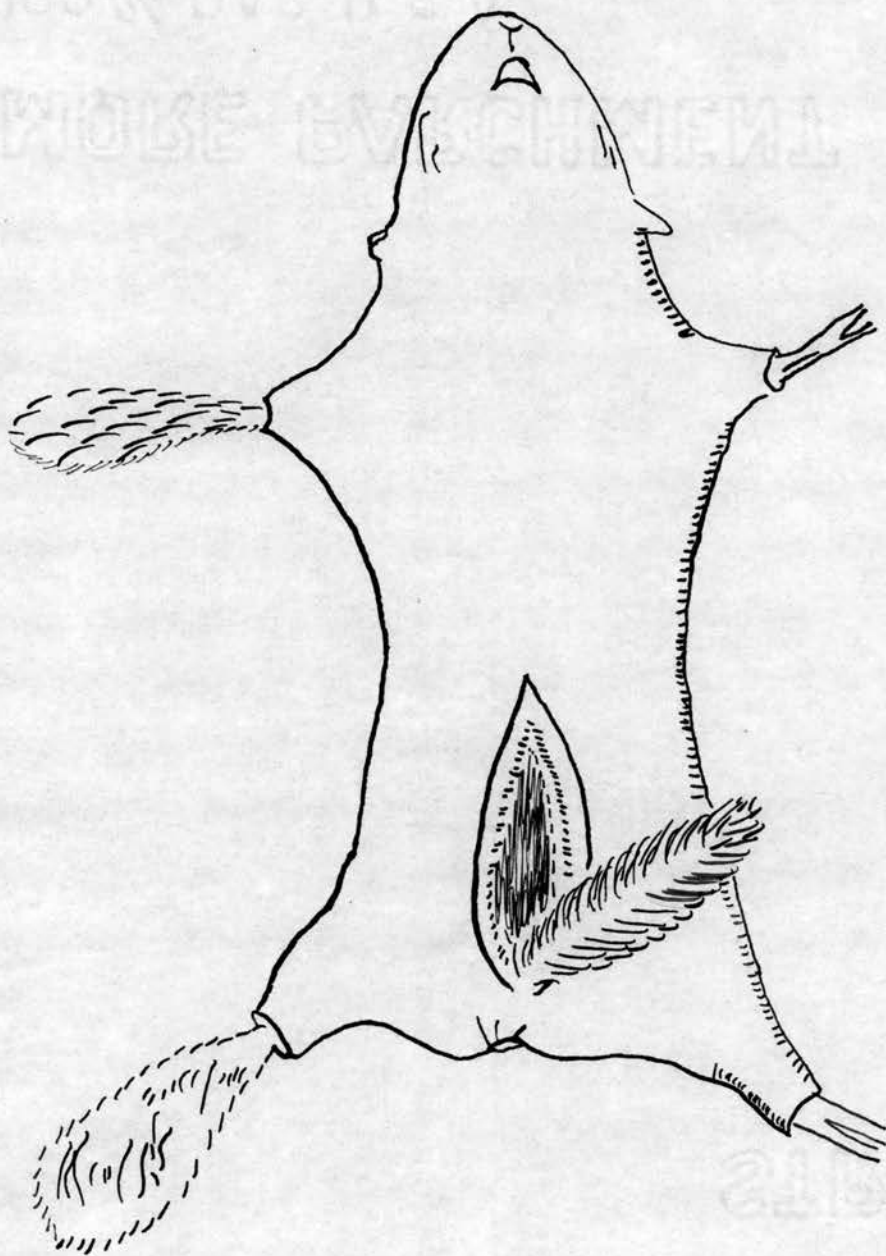


Fig. 6. Method of Twisting Cotton around Leg Bones

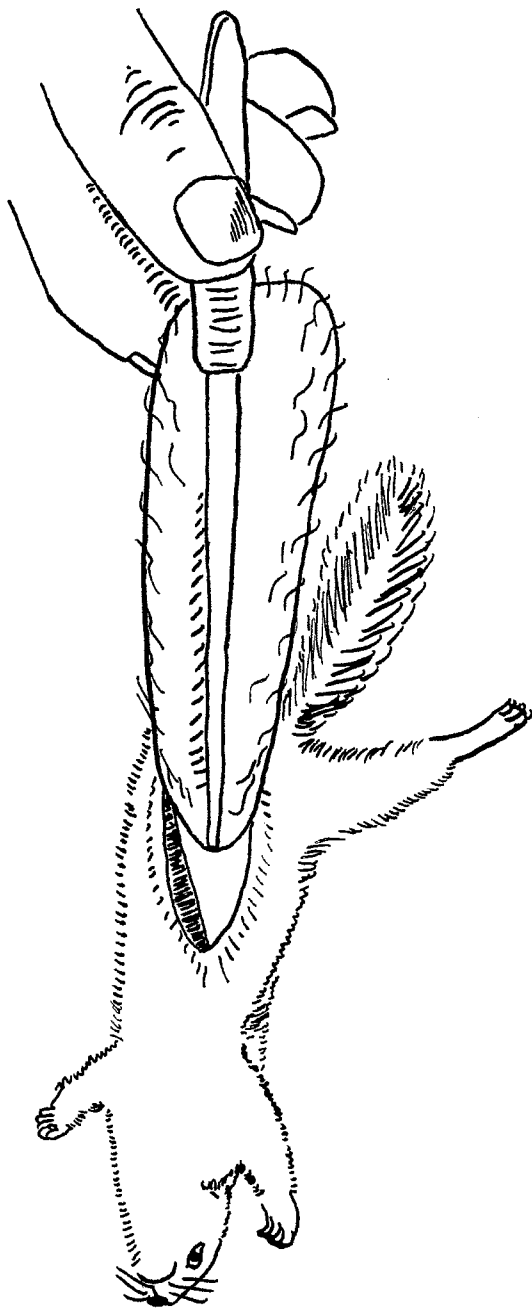


Fig. 7. Inserting Body Filling

A tail wire, wrapped with cotton and covered with preservative is inserted through the abdominal opening into the tail. Care must be taken so that the wire reaches the tip of the tail and that enough preservative is present to fix the hair of the tail to prevent its slipping. To give added support to the tail this wire should reach about one third of the distance of the body with a loop in this end of the wire.

Uneven places in the skin should be filled in with pieces of cotton and then the skin is ready to be sewed up. Sew as indicated in the illustration (Fig. 8), carefully pulling the thread tight to close the opening. Make a loose knot in the thread and carefully slip it down tight against the skin. Then the excess thread is cut away leaving a skin ready to be pinned in its proper shape and allowed to dry. (Fig. 9)

Later, if it is desirable, this type of skin can be relaxed and mounted to give a life-like pose of the animal. (Fig. 10) This, however, is a tedious process and should be second choice to mounting a fresh skin.

In many of the accounts of rodent and lagomorph species attention has been called to the fact that individuals may be carriers of plague, tularemia, and relapsing fever.

Tularemia has been isolated from the following rodents and lagomorphs:

- Beechey Ground Squirrel (*Citellus beecheyi*)
- California Meadow Mouse (*Microtus californicus*)
- Deer Mouse (*Peromyscus maniculatus*)
- Dusky-footed Wood Rat (*Neotoma fuscipes*)
- Norway Rat (*Rattus norvericus*)
- California Jack Rabbit (*Lepus californicus*)

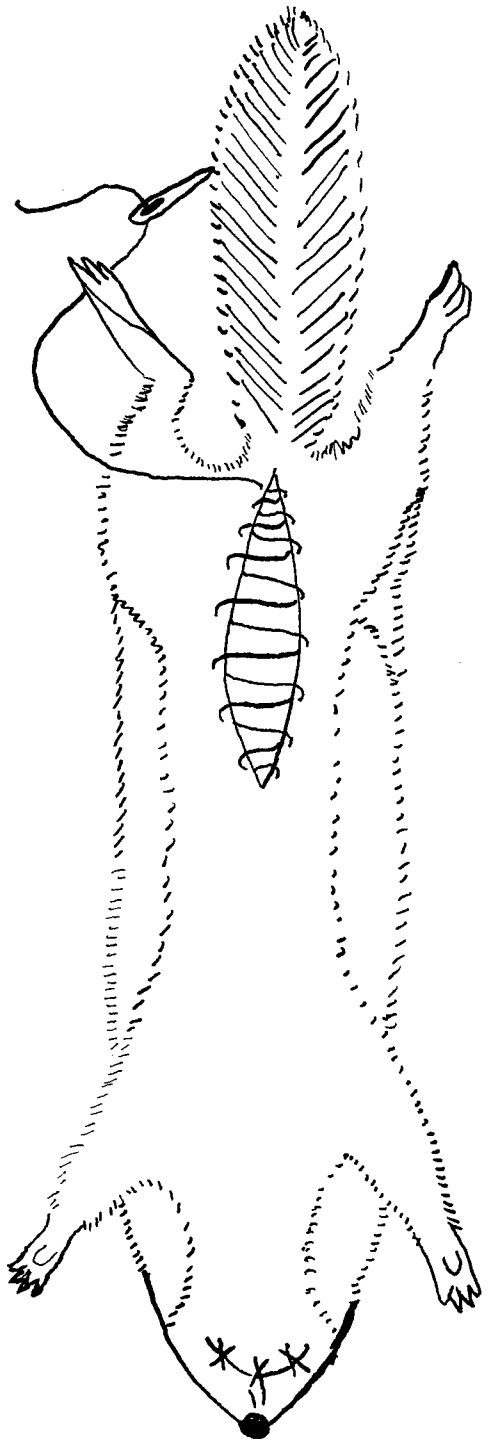


Fig. 8. Method of Sewing the Finished Skin

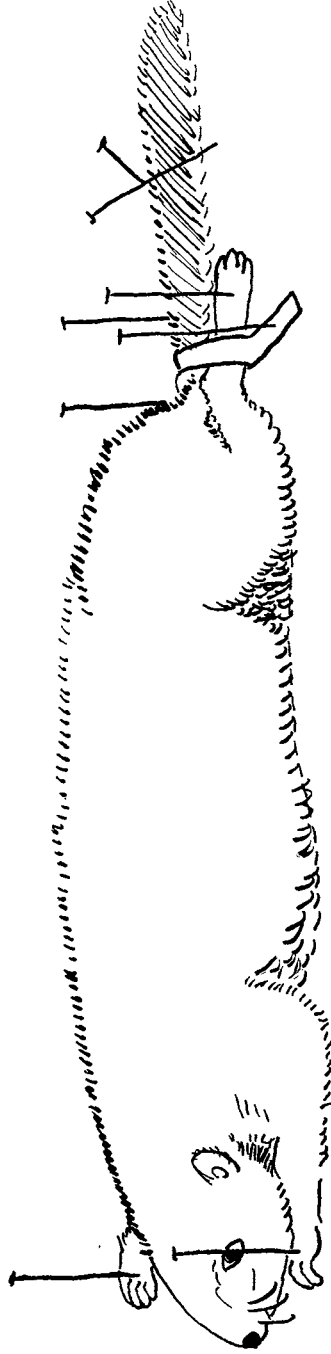


Fig. 9. Finished Skin Pinned for Drying

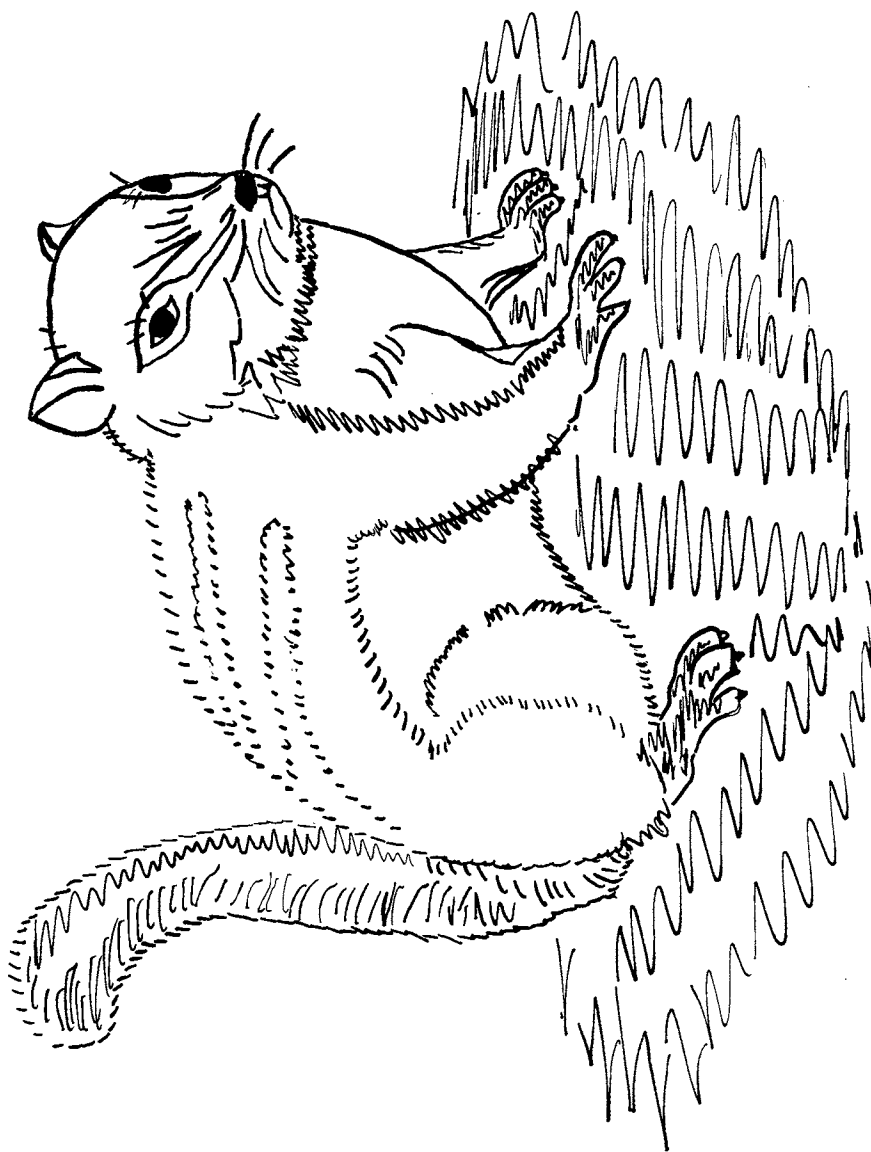


Fig. 10. Mounted Skin

Relapsing fever has at the present time been isolated only
from:

Chipmunk, species not known (genus *Eutamias*)
Douglas Squirrel (*Tamiasciurus douglasii*)

Plague has been found in the following rodents and lagomorphs:

Beechey Ground Squirrel (*Citellus beecheyi*)
Belding Ground Squirrel (*Citellus beldingi*)
Townsend Ground Squirrel (*Citellus townsendii*)
Golden-mantled Ground Squirrel (*Citellus lateralis*)
Rock Squirrel (*Citellus variegatus*)
Chipmunk, species not known (genus *Eutamias*)
Douglas Squirrel (*Tamiasciurus douglasii*)
Northern Flying Squirrel (*Glaucomys sabrinus*)
Yellow-bellied Marmot (*Marmota flaviventris*)
Bushy-tailed Wood Rat (*Neotoma cinerea*)
Dusky-footed Wood Rat (*Neotoma fuscipes*)
Desert Wood Rat (*Neotoma lepida*)
Pinyon Mouse (*Peromyscus truei*)
California Meadow Mouse (*Microtus californicus*)
Northern Grasshopper Mouse (*Onychomys leucogaster*)
Botta Pocket Gopher (*Thomomys bottae*)
Ord Kangaroo Rat (*Dipodomys ordii*)
Nuttall Cottontail (*Sylvilagus nuttallii*)
Cottontail, species not known (genus *Sylvilagus*)
Black-tailed Jack Rabbit (*Lepus californicus*)

In collecting dead or live rodents and lagomorphs from traps,
use gloves or forceps to place them in a paper bag folded tightly at
the top. These sacks are then placed in a tight container with enough
chloroform or formaldehyde to kill the fleas and other ectoparasites.
When skinning use rubber gloves, which before being removed should be
dipped in a warm solution of Lysol or Formalin (3 or 4 per cent).
All instruments used in skinning should likewise be sterilized. NEVER
HANDLE A DEAD OR SICK RODENT-----IT MAY HAVE DIED OR BE DYING OF THE
PLAGUE. Many diseases are transmitted to man through bites. These
should be carefully cleansed with a warm antiseptic solution and painted
with iodine. It must be remembered that, although a rodent may appear

to be healthy, the fleas on its body and its body fluids may be capable of infecting man.³

³Lloyd G. Ingles, Mammals of California, (Stanford University, 1947) Stanford University Press, pp. 246-247.

CHAPTER IV

PRESERVING BIRDS

Birds can be collected by trapping or by shooting, the size of the shot depending on the size of the bird. Care should be taken in trapping and handling not to mutilate the body and also to keep the feathers as clean as possible. Plug the mouth and the throat with cotton to prevent bleeding; also the anus.

Prepare a label as indicated in the chapter on mammals except for the measurements. The following measurements of birds are to be taken and recorded in order on the label and in the field catalogue:

1. The total length ---- tip of bill to tip of tail
2. Wing ---- from wrist joint to tip of longest feather
3. Tail ---- from extreme base to tip
4. Bill ---- from tip to edge of feathers on top
5. Tarsus ---- from heel joint to angle of toe with tarsus
6. Middle toe ---- from angle of tarsus and toe to base of claw.

The sex is determined when the bird is skinned, as usually it cannot be ascertained externally.

Place the bird on the work bench with its head to your left (right if you are left-handed). A region of skin with no feathers can be exposed along the abdomen of most birds by blowing on the abdomen. Make an incision along this line from the middle of the sternum to the anus, being careful to cut only through the skin. (Fig. 11) A bird's skin is very delicate and is easily torn; therefore, great care must be taken to prevent tearing.

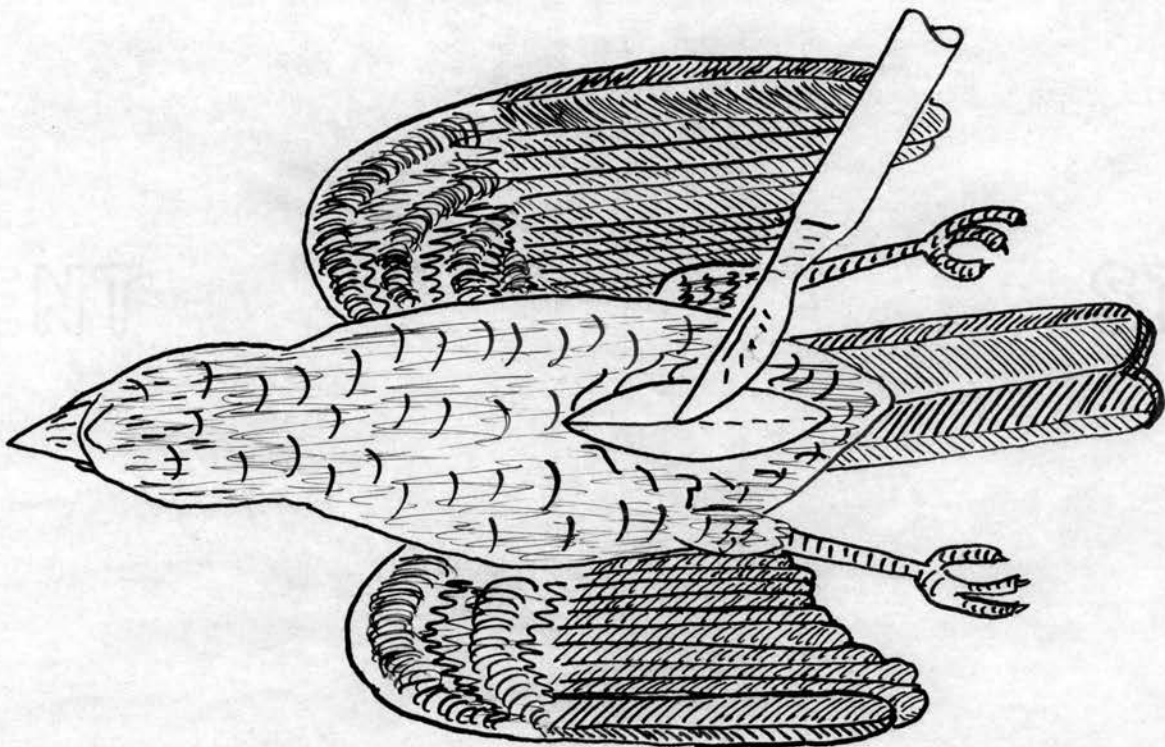


Fig. 11. Line of Opening Cut on Abdomen

Separate the skin from the breast bone using your fingers or the handle of the scapel. Continue this loosening along both sides of the cut down toward the anus until the knees are reached. Use an adquate amount of absorbent to absorb the blood and juices and keep your fingers dry and the feathers from sticking. Holding the foot push the knee farther into view and clip the leg at that point.¹ (Fig. 12) Loosen the skin farther back and treat the other leg in the same manner.

Work the skin away from the flesh on each side of the rump until it is free all the way around, connected at the tail only. Cut the

¹A Field Collector's Manual in Natural History, (Washington, D.C. 1944) The Smithsonian Institution, p. 26.

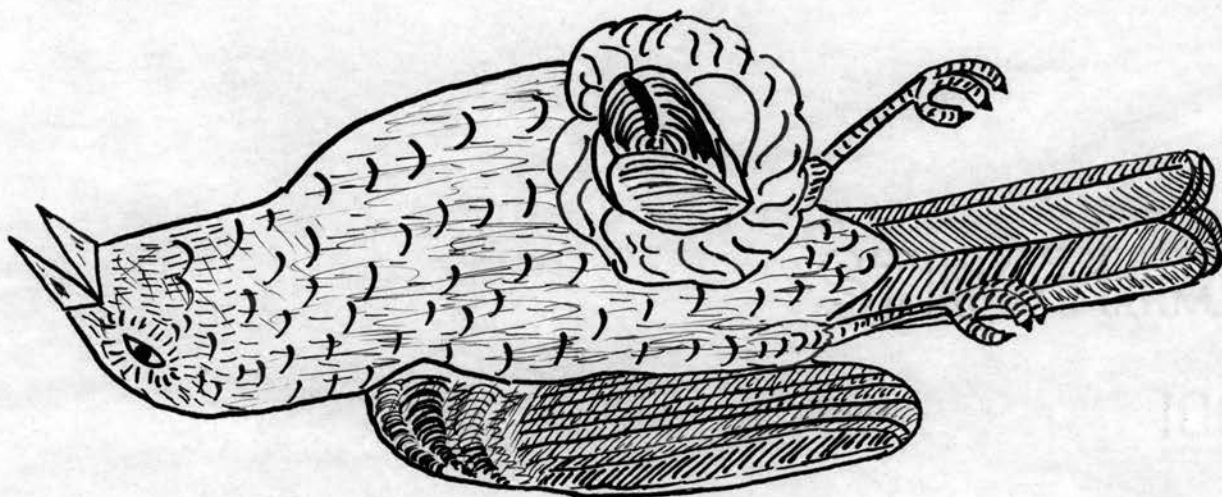


Fig. 12. Exposing the Knee

tail free at the base (Fig. 13), being careful not to damage the bases of the tail feathers or they will fall out. It may be necessary to use an abundance of absorbing material here, since at this stage abdominal juices are apt to flow freely.

The skin will now slip easily until the wings are reached. With the scissors or scapel clip the wings as close to the body as possible, and continue the process of skinning until a membranous piece of skin attached to the ears appears. Carefully remove this ear skin from the skull without tearing it. The eyes are next reached. Cut the membrane over the eyeballs being careful not to injure the lids. Loosen the skin to the base of the bill and leave it hanging at this point.

With the scapel cut the base of the skull completely through,

²John Rowley, Taxidermy and Museum Exhibition (New York, 1925), D. Appleton and Company, p. 63.

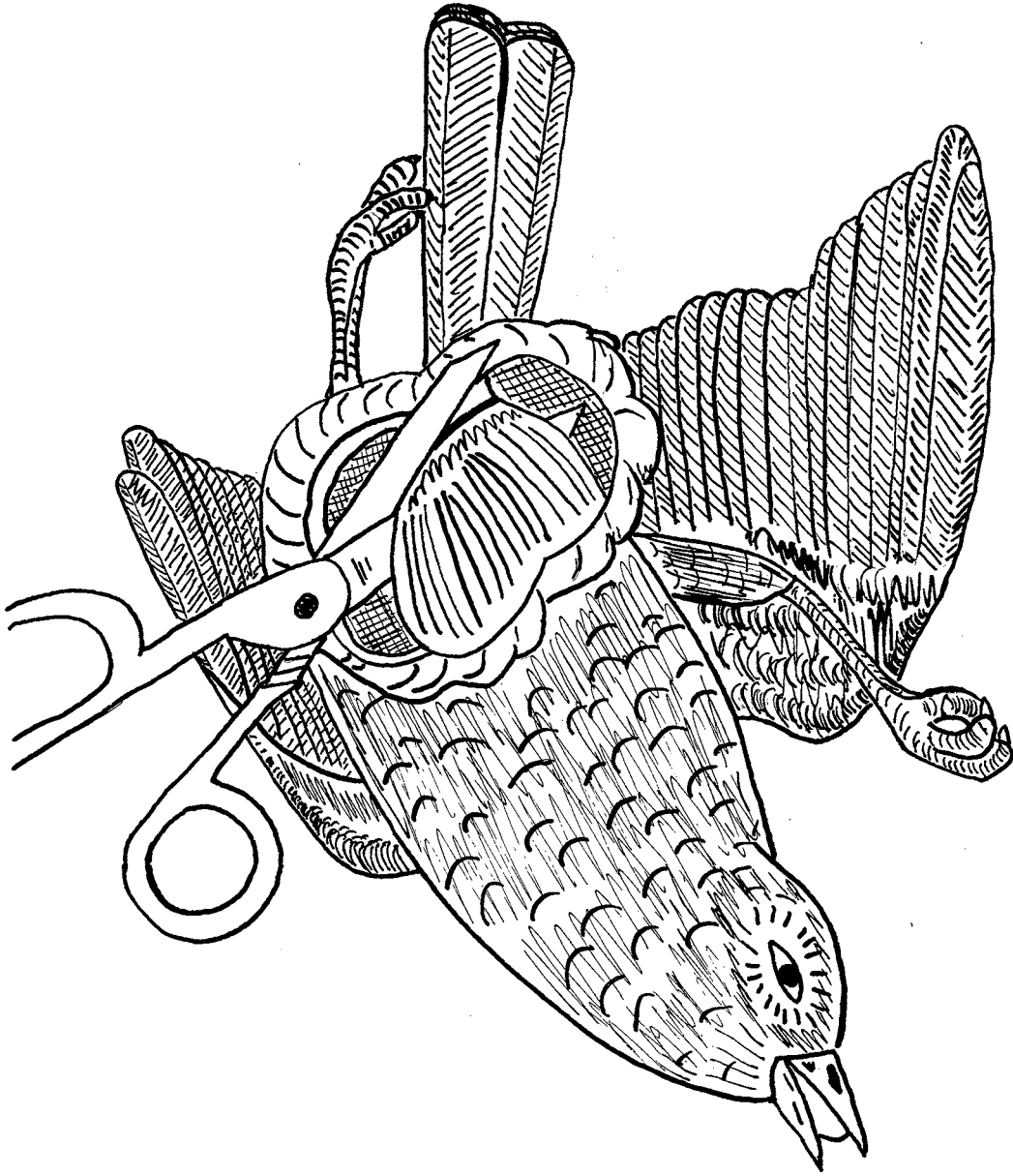


Fig. 13. Severing the Tail

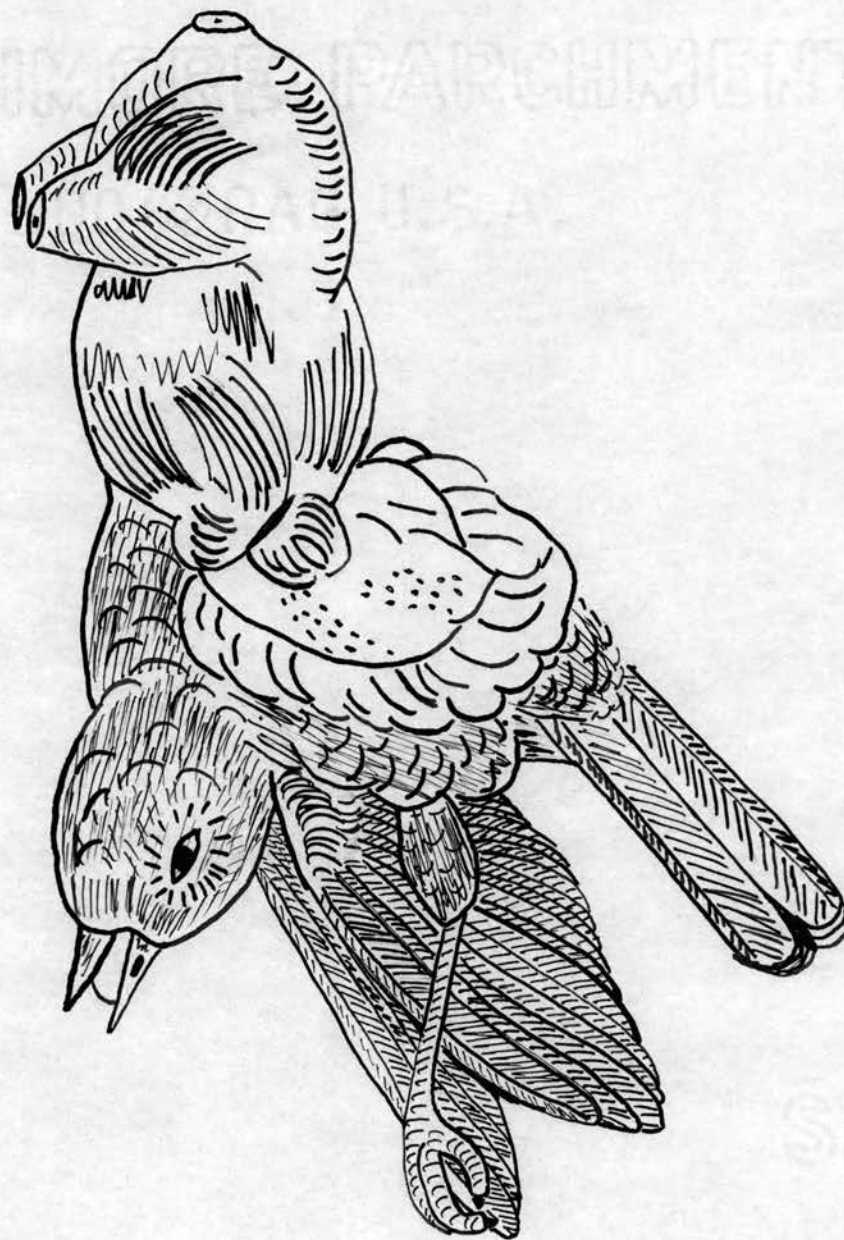


Fig. 14. Skinning the Body

crosswise, severing the head from the neck and exposing the brain. Remove the tongue and the eyes with the scapel point. With the scissors, make a V on the under side of the skull running parallel with the sides of the bones of the bill, the points of the scissors reaching into the brain cavity. The ends of these cuts, which correspond to the upper ends of the V, terminate at the cut previously made with the scapel across the base of the skull. Make a third cut with the scissors across the apex of the V, and draw out the V-shaped piece of bone bringing with it a mass of brain and muscle.² Clean the remaining flesh from the skull and it is complete.

Large-headed birds like ducks, woodpeckers, and hornbills have heads too big to allow the skin of the neck to be worked over them. In such cases when the base of the skull is reached, cut it loose from the bones and muscles of the neck. When you have finished the rest of the preparation of the skin, poison it and turn it right side out. Then make an incision down the back of the head and loosen the skin around it until you can skin and prepare the head as directed above for ordinary birds. After the head skin is poisoned and the eyes are in place, sew up the cut in the back of the head with fine stitches.³

The wings are now cleaned by peeling the skin over the bones from the inside as far back as the elbow joint, and removing the flesh. The muscles in the forearm in small birds can be removed

²John Rowley, Taxidermy and Museum Exhibition (New York, 1925), D. Appleton and Company, p. 63.

³A Field Collector's Manual in Natural History (Washington, 1944), The Smithsonian Institution, p. 31.

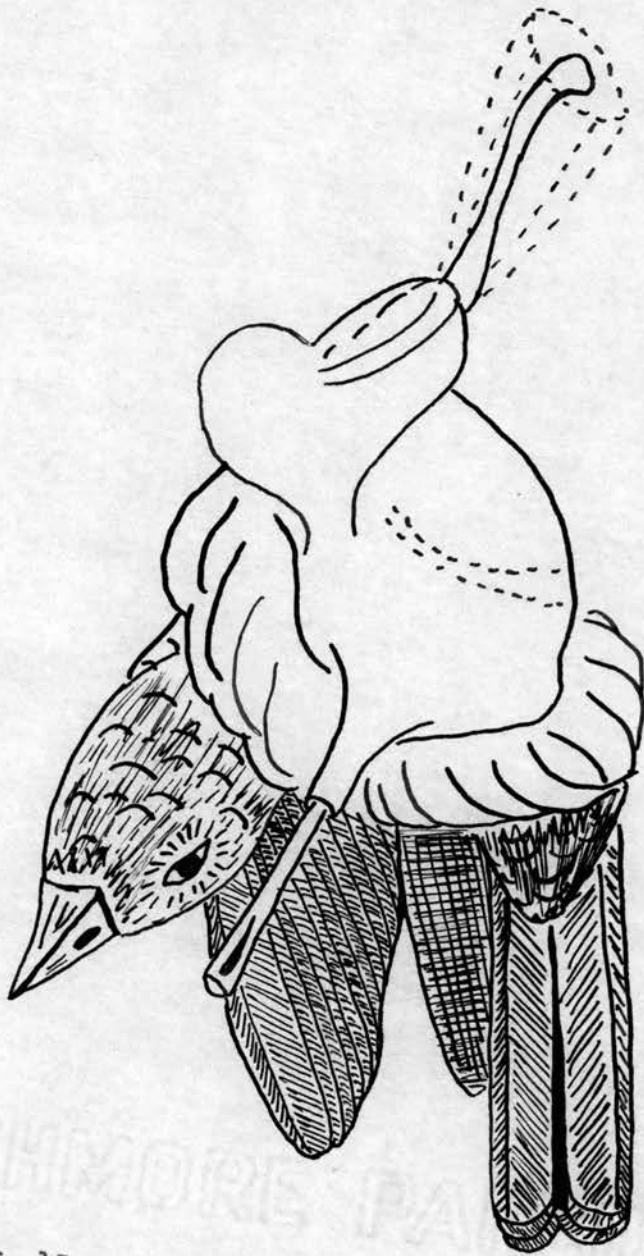


Fig. 15. Method of Skinning Wing from Inside

from the inside without any difficulty. In large birds an opening is made inside the wing, lengthwise of the bones, and afterward sewed up. Remove the flesh from the legs and the excess meat and fat from the tail. Carefully remove any fat that sticks to the inside of the skin. Dust the skin with preservative in sufficient quantity to coat the inside of the skin.

Turn the skin right side out and holding it by the bill, shake it gently to aid in getting the feathers back in place. The skinning process is now complete and the skin is ready to be stuffed.

Any blood stains or dirty spots appearing on the feathers should be removed with acetone. By rubbing the spots vigorously with a wad of cotton soaked in acetone the blood dissolves and comes off on the cotton. In rubbing feathers be sure to rub with the grain of the feather. Add dry corn meal to hasten drying and fluffing of the feathers.

A fluff of cotton batting should be wound around each leg bone and the legs turned right side out. Take a bunch of cotton batting of the approximate amount necessary to fill the body and roll it between the palms, around a knitting needle, until it attains the proper size to fill the neck. Insert it through the opening in the skin and work it through the neck until it is firmly in place in the skull. Remove the needle and work the body skin forward to reduce the length of the neck.

The ends of the wing bones are brought together as nearly as they would be in life when the wings are closed, and tied together with a thread. Adjust the wings and holding them in place, fluff the remaining bit of cotton in the body to produce a pear-shaped

body. Be sure to put enough cotton in the skin because a little plumpness is desirable.

A few stitches are taken now to bring the edges of the belly skin together. (Fig. 16) Cross the legs and tie them together. The tail should be slightly spread by reversing the natural overlapping of the tail feathers. Finish the head by inserting the proper amount of cotton in the throat and then tie the mandibles together with a thread until they have dried.

Determine the sex of the bird by cutting through the abdominal wall and pushing away the intestines. Close against the small of the back, if the bird is a female there will be the ovary, a mass of spherical ovules, large or small according to the season, and often obscure in immature specimen. If the bird is a male you will see two, oval, lightly colored testes. Put the sex on your label and tie the label

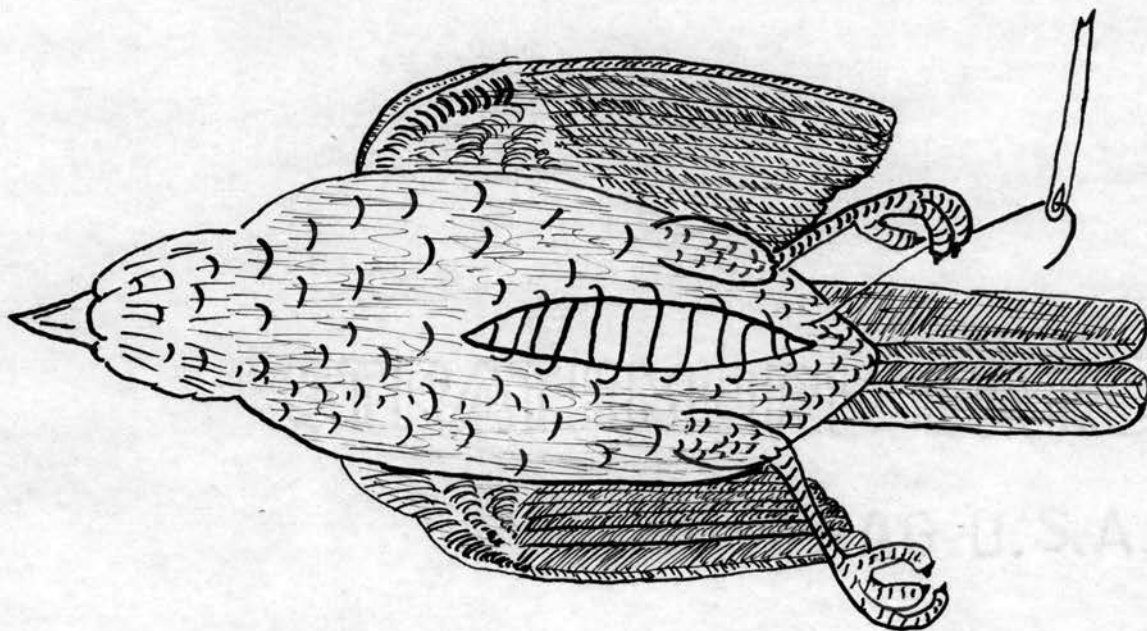


Fig. 16. Method of Sewing Stuffed Skin

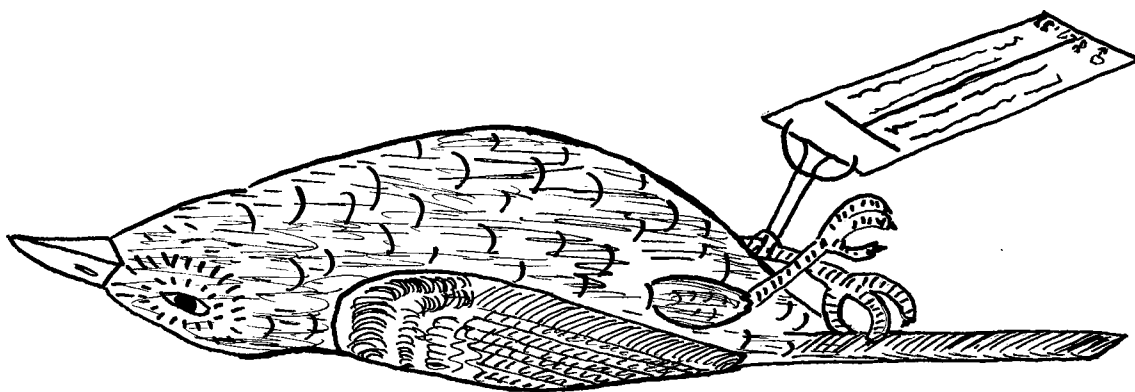


Fig. 17. Finished Skin

to one leg above the point where the two legs cross.

Wrap the stuffed skin in a thin sheet of cotton batting and allow it to dry. The specimen is now finished and can be stored in a minimum of space. (Fig. 17)

CHAPTER V

PRESERVING AMPHIBIANS, REPTILES AND FISH

Most reptiles and amphibians (frogs, toads and salamanders) are preserved in jars full of either formalin solution or undenatured alcohol. Of the two alcohol is much the better as it keeps the specimens relaxed, but it is also harder to get and is more expensive.

For frogs, toads, salamanders and smooth skinned lizards use a 6 per cent formalin solution. This means one part of formalin to sixteen parts of water. For most reptiles use a 10 per cent formalin solution, or one part of formalin to ten parts of water. Even if you plan to use alcohol, both reptiles and amphibians should be placed in the formalin solution first for at least twenty-four hours.

To put your specimens in alcohol, first take them out of the formalin solution and wash thoroughly, allowing water to pour over them for several minutes. Then place most reptiles in 75 per cent alcohol. Place amphibians and smooth skinned lizards in 65 per cent alcohol.

All specimens should have tiny slits cut at regular intervals down the middle of their bellies and throats with a single-edge razor or a sharp knife. This allows the formalin or alcohol to enter inside the bodies and help preserve them.

Each specimen should have a label attached to the foot or body by a string. On this label mark with black India ink the number, name (if identified), the date, the place captured and any other important

information. Use the same number in your notes about the specimen. Each jar containing specimens should be labeled on the outside with the same sort of information.

Snakes and lizards may be skinned with a scapel, single-edge razor or sharp knife. These skins are good for display mounts of different types of reptile skins, but the job of mounting such skins on a clay or wax model cannot be done very satisfactorily save by an expert. One reason is that the skins usually stretch too much in skinning, so that the mounted skin does not have the natural appearance of the living animal.

To skin a snake or lizard, cut down the middle of the belly. Be careful not to cut into the body cavity. Work the skin free from the flesh with your fingers. A snake is soon stripped of its skin, except the skin of the head, which is often hard to get off. If this is too hard, cut off the head. On lizards make side cuttings down the middle of the underside of the legs. For completing the skinning of lizards follow the directions given for skinning mammals in Chapter I. Skins of lizards and snakes should be pinned out on a flat board (bottom side up), and rubbed with preservative and allowed to dry. Keep a correctly filled out label with each skin.

After these skins are dry they may be unpinned and turned around face down on your final mounting board. Here they are pinned or glued and any information about them printed below each skin.

Fish may be preserved for study by placing them in 10 per cent formalin, prepared by diluting commercial formalin with 9 parts of water to 1 part of formalin. For proper preservation there should be at least twice as much preserving fluid as fish. An easy way to

judge when this limit is reached, is to start with a jar two-thirds full of preserving fluid. Since this leaves half as much room, or one-third of the jar, for fish, when the liquid reaches the top of the jar, no more specimens should be added. Fish over 5 inches long should be split in order to admit the preservative into the body cavity. If this is not done the internal organs are likely to decompose and spoil the specimen. Slitting should be done on the right side of the body because the left side is the one usually studied in detail.

After several days it is preferable to transfer the specimens to 70 per cent grain alcohol or 40 per cent isopropyl alcohol, but if these are not available the specimens may be left in formalin. In the latter case, a weaker solution, 1 part of commercial formalin to 19 parts of water, should be used for storage. The addition of ordinary borax at the rate of one-half teaspoon per quart of fluid in both the original and the storage solutions will aid in keeping the specimens in good condition.

For fish that are too large to preserve conveniently by the above method the following method of preserving may be used.

Lay the fish on its better side on the dampened table top or on wet oil cloth. Make an incision with shears, the full length of midside from the tail fin to the joint in the shoulder girdle. Use tinner's shears on a heavy skin. Cut through the shoulder girdle hinge with a cartilage knife.

Leave the fish lying flat as much as possible while skinning. That is, the skin should lie on the table and the body should be

maneuvered out of it. Do not bend the skin endwise. Sidewise turning of the skin from the incision does no harm, but endwise rolling of a fish skin breaks the epidermis and forces the scales out of their sockets.

Make a cross-incision along the end of the tail fin where the skin joins it. Lay the corners back and cut through the base of the fin bones. Use care not to damage the skin on the other side of the tail. Prepare to remove the body from the skin; use a dull knife for the job. Peel the end of the tail free from the skin. Lift the tail and bend it gradually forward and up from the skin, then lay the tail down. Peel the skin of the side away from the body on each side of the long incision until the center of the back and belly are reached.

Dissect a considerable amount of fin bone roots out and cut them free from the body, leaving one-fourth to one-half inch of the roots intact on the fins.

Again lift the end of the tail and proceed to separate the body from the prone skin. It is handy to have an assistant to hold the body of a large fish while the operator gives his entire attention to the skinning job. When the skin is freed as far as the shoulder girdle, lay the carcass back in the skin. Using heavy shears cut the body free from the skin at the shoulder girdle.

With a curved scraper-tip remove the eyeballs. Cut around inside the rims of the eye sockets to open way for removing the cheek muscles. Use a round-ended table knife to release the cheek skin from the meat, and a curved scraper to remove the cheek meat. Leave the skull whole except the brain case. Nip this out with bone-snips. Scrape forward in the face in front of the eye sockets and remove

all of the fat and gristly material there. Scrape the skull bones clean, and rub dry borax in. Wash the gills with borax water, then dust them with dry borax.

Slit the skin that covers the long interior muscles in the lower jaws and scrape out all of the meat. Rub borax in. Leave the tongue and its roots undisturbed, except for slitting the skin under the tongue and scraping out all fatty material. Rub borax in after scraping. Leave the roof of the mouth intact and rub it with dry borax.

Spread the body skin open like a mat and scrape off all adhering meat and fatty tissue. Use a dull tool and scrape from end of the tail toward the head. Give special attention to removal of meat that spreads fanwise over the butts of the tail-fin bones. Rub dry borax all over the skin, inside and outside, after scraping it, also on fins. Keep the borax-cured fish skin extended and rolled up in a piece of oilcloth, smooth side in. This skin may be mounted at a later time if desired.

BIBLIOGRAPHY

- Bailey, Florence Merriam. Handbook of Birds of the Western United States. New York: Houghton Mifflin Company, 1927.
- Booth, Ernest S. How to Know the Mammals. Dubuque: W. C. Brown Company, 1950.
- Brown, Vinson. How to Make a Home Nature Museum. Boston: Little, Brown and Company, 1954.
- Ingles, Lloyd G. Mammals of California. Stanford: Stanford University Press, 1947.
- Kostler, William J. Guide to the Fishes of New Mexico. Albuquerque: University of New Mexico Press, 1957.
- Miller, David F. and Glenn W. Blaydes. Methods and Materials for Teaching Biological Sciences. New York: McGraw-Hill Company Inc., 1938.
- Pray, Leon L. Taxidermy. New York: The MacMillan Company, 1946.
- Rowley, John. Taxidermy and Museum Exhibition. New York: D. Appleton and Company, 1925.
- Staff of the Smithsonian Institution. A Field Collector's Manual in Natural History. Washington: The Smithsonian Institution, 1944.
- Stebbins, Robert C. Amphibians and Reptiles of Western North America. New York: McGraw-Hill Company Inc., 1954.
- Turttox Service Department Publication. Biological Field Work Including a Directory of Summer Camps and Biological Stations. Chicago: General Biological Supply House, 1947.

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