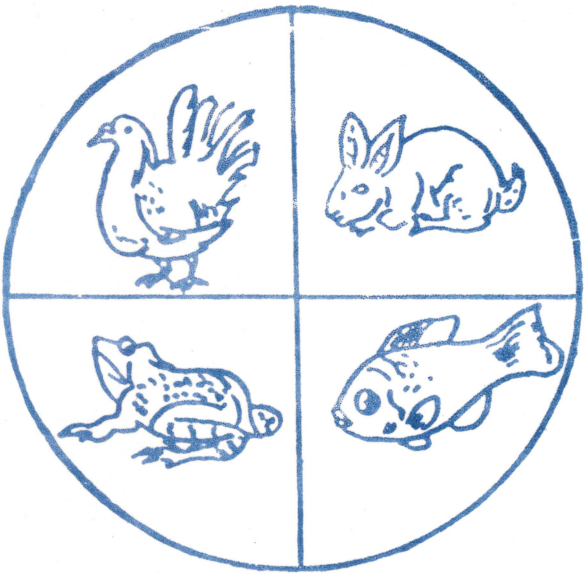
THE PRESERVATION OF ZOOLOGICAL SPECIMENS

By

P. JAWAHAR., B.Sc., M.A.

Curator, Zoology Section,

Government Museum, Chennai - 600 008.



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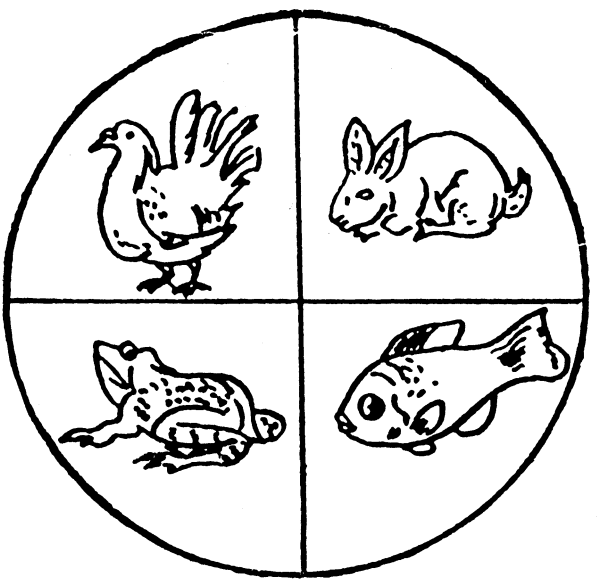

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PREFACE

This book is authored by Thiru P.Jawahar, Curator, Zoology Section, who has been working in the field of "Preservation of Zoological Specimens" for more than two decades. It was first published in 1997. Though this book is meant for the students of Zoology, this woud serve as a useful guide for those who are concerned with preservation of zoological specimens.

In this book the methods of preparation of Zoological Specimens are dealt with. Zoological specimens are easily perishable objects. They require special care and attention. Scientific knowledge of the methods of preservation is essential for the proper preservation of zoological specimens. Therefore, this book on Preservation of Zoological Specimens is published separately. This book deals with Taxidermy and various methods and techniques adopted for preservation of zoological specimens, both Invertebrates and Vertebrates. The methods of wet and dry preservation and recent techniques adopted are also dealt with in this book.

Since the copies have been exhausted due to high demand, this republication has been done at such a short interval from the date of original publication.

2000 AD

(R.Kannan)

FOREWORD

Zoological specimens are the most easily perishable objects. They require special care and attention. Scientific knowledge of the methods of preservation and skill are essential for the proper preservation of Zoological specimens. Thiru P. Jawahar, Curator for Zoology Section, in this book enumerates the various methods and techniques adapted for preservation of Zoological specimens, both Invertebrates and vertebrates. He deals with the methods of wet and dry preservation and some advanced techniques adapted in the field.

I am very happy to write this foreword to this book, authored by Thiru. P. Jawahar who has been in this field of preservation of Zoological speciomens for more than two decades. Though this book is meant for the students of Zoology, this would serve as an useful guide for all those who are concerned with the preservation of Zoological specimens. I wish him all the best in ventures of this kind.

27.5.97

K. DHEENADHAYALAN, I.A.S.,
Commissioner of Museums, Chennai.

THE PRESERVATION OF ZOOLOGICAL SPECIMENS

Preservation of objects is the primary concern of any museum. Zoological specimens require a special care and attention. Decay sets in immediately after the death of the animal and steps should be taken at once to ensure the preservation as far as possible to the living condition. One should aim at preserving the colour, form and general appearance of the living material in the preserved objects. Zoological material preserved in museums generally include animals and their various parts such as skeletons, eggs, nests, etc., The methods of preservation of the animals belonging to the various groups are described here.

Certain animals can be preserved in dry condition and certain animals in wet condition. The following liquid chemicals are mainly used for preserving the animals in wet condition, formalin, rectified spirit. Rectified spirit which is available in 96-98% concentration can be used as it is without mixing with other chemicals. Formalin is unsuitable for preserving certain animals which contain calcareous matter either in the form of shelly coverings as in Molluscs, or in the form of spicules as in sponges and holothurians. The commercial formalin is 40% strong, and as this is too strong for animal preservation, it should be diluted suitably. Generally a strength of 4% formalin is quite suitable for preserving animals, especially of the soft-bodied types such as jelly-fishes, sea-anemones, etc., This 4% strength can be obtained from the commercial formalin by adding 9 parts by volume of water to 1 part by volume of the commercial formalin. This 4% formalin is deleterious to specimens and the evolution of formaldehyde gas results in the cracking of glass jars. It is therefore necessary that the formalin should be neutralised by the addition of 10gms. of borax to every litre of 4% solution. A good method is to tie up the borax in a muslin bag and drop it into the jar of formalin.

Protozoa or one-celled animals:

Since these are single celled animals and can be seen only with the aid of a microscope, the actual specimens of Protozoans can only be mounted

as microscopic preparations on glass slides. For museum display purposes, enlarged diagrams and models of protozoans are required. Living specimens of these groups may be collected from corallines and seaweeds by picking them off under a lens or by the use of a sieve. The animals may be first placed in 50% alcohol and then in 70% to 90% alcohol or they may be placed directly in neutralised 4% solution of formalin.

Porifera (sponges) :

Sponges should be preserved only by using 90% alcohol. Sponges collected from sea should be thoroughly washed in fresh water. They may also be preserved dry by drying them thoroughly in the sun after washing with fresh water. After drying they may be immersed in clear varnish and redried. The dried specimen may be mounted on a wooden pedestal.

Coelenterata :

This phylum includes the hydroids, sea-anemones, jelly-fishes, corals, etc., Corals are generally preserved as dry specimens, but the small portion of the colony should be preserved in alcohol for examination of the soft parts. For dry preservation, the corals are soaked in tubs of fresh water mixed with bleaching powder for about a day. Then they are washed thoroughly in several changes of fresh water, brushed with a coarse brush and dried in the sun. Then they will be ready for display.

Jelly fishes can be collected by means of tow-net. When collected alive hydroids, sea-anemones and jelly-fishes should be placed in basins of sea water and allowed to expand. When fully expanded they should be narcotised by a few drops of commercial formalin. After narcotisation they may be thoroughly washed in fresh water and transferred to 4% formalin in which they are preserved.

Wet preservation of Molluscs :

Whenever possible, two series of specimens should be preserved, one of dried shells and one of the shells with the entire animal intact, in fluid for

the study of the soft parts. The best preservative for the soft parts is alcohol. Marine molluscs should be narcotised with magnesium sulphate crystals in an expanded condition and then transferred to successive changes of alcohol of increasing strength, 30%, 50% and 70% to avoid shrinkage and violent contraction. Finally they may be preserved in 70-90% alcohol. Land and fresh water snails and slugs may be killed by plunging them into boiling water at the moment when they are fully extended. This may be done by allowing them to crawl to the end of a twig and then suddenly immmersing the twig. The snails may be washed and preserved in 70-90% alcohol.

Dry preservation of Molluscan shells :

Land and freshwater molluscs should be killed in boiling water, after which the body may be extracted with a pin or a pair of forceps. The shell may then be dried in the air. Marine shells should be washed with freshwater and the specimens burried in sand are kept in the shade until the soft parts dry up. As hot water destroys the lustre of marine shells, they should not be wahsed in it. Many shells possess a calcareous or horny lid or plate covering the aperture of the shell called operculum; after removal of the fleshy contents of the shell, it should be preserved by pasting it on to a plug of cotton-wool inserted into the shell.

Bivalve shells :

When they die, the shells are opened and after the soft parts are extracted, the valves should be closed tightly and tied together with thin white thread. A coating of thin clear varnish may be given over the shells to preserve the colour.

Removing limy secreations : Sometimes shells are covered with calcareous coatings and these must be removed with the help of knife, scraper or sand - paper. After removal of these deposits, the shells usually have a dull, lustreless appearance. To remove these coatings, the shells are dipped in a weak solution of Nitric acid and water, boiling hot. The strength of

this solution, may vary according to the nature of the specimen. After removing the shell from the solution it is washed in clear water and dried.

Echinoderms (starfishes, sea-urchins, sea-cucumbers) :

These are marine animals and may be found between tide marks, lying exposed in sand or in pools. Many are found underneath rocks, stones and seaweed, etc. Except the sea-cucumbers, all Echinoderms can be preserved as dried specimens. To preserve the starfishes dry, they should be taken alive from the sea water and laid on a board until collapsed. Then they are immersed in 10% formalin solution until they swell upto natural shape and harden They are removed from the formalin and dried on a board. The dried starfish may be moth proofed by immersing in Borax solution and then redried. The natural colours may be replaced with oil paints and a coating of clear varnish may be given finally. For preserving sea-urchins in dry condition, they should be placed in freshwater for half an hour and transferred to 4% formalin for few hours and allowed to dry. For the wet preservation of Echinoderms 70-90% alcohol is preferable, specially in the case of sea-cucumbers in which the calcareous spicules in the skin are destroyed by formalin. Sea-cucumber should be narcotised with magnesiumm sulphate or menthol crystals. Then the animals should be gripped with forceps behind the tentacles to prevent their retraction and 90% alcohol should be injected into the body cavity. Then they are mounted on a glass plate and stored in alcohol.

Insects :

The collection and preservation of insects involves the following stages. (1) Collecting, (2) Killing, (3) Relaxing, (4) Pinning and setting (5) Display.

Insects such as bees, wasps, butterflies and dragon-flies may be collected with the help of insect net. After collecting the specimens, they are transferred into a kilner jar. The kilner jar is a wide-mouthed jar with an air-tight glass stopper. At the bottom of this jar layer of lumps of Potassium cyanide packed in tissue paper are placed. Two or three

circular pieces of blotting paper cut to the size of the circumference of the jar are placed on the cyanide layer to absorb moisture. As Potassium cyanide is extremely poisonous, the kilner jar should be handled with care. An alternative method is to place cotton balls soaked in chloroform at the bottom of the wide-mouthed jar with air-tight lid.

Relaxing :

The relaxing jar is prepared as follows :

A few crystals of Para-dichlorobenzene may be put inside the jar and two circular pieces of blotting paper are placed on the chemical. Insects die in a few seconds when dropped into the kilner jar. The specimens should never be left in the kilner jar longer than in necessary, since cyanide changes the colour of the specimens. Then these specimens are transferred into the relaxing jar to render them sufficiently flexible. After a few hours, when the wings and legs of the insects are soft, they are ready for pinning. Then the insects are taken out and mounted on the mounting board. The mounting board consists of two cork sheets which can be adjusted according to the size of the body of the insect. The specimen is placed on the mounting board and wings are spread out in the case of butterflies with the help of forceps. Entomological pins should be used for pinning the insects. One pin should be fixed through the thorax of the specimen, so that it can be handled easily. Paper strips can be used to spread and mount the wings of butterflies. The mounting board with the insects pinned on them are placed in a dry cage with some naphthalene and left to dry for about 5 days. At the end of this period, paper strips and pins except that passing through the body of the insect are removed. The insect can be handled by means of this pin.

Moths and large, fleshy bodied grasshoppers are preserved in the same way, but in moths with bulky bodies, it is necessary to slit open the underside of the abdomen, remove the visceraa, stuff the abdominal cavity with some cotton-wool soaked in 4% formalin, and then the two

ends of abdominal wall are brought together and stitched or pasted with the help of quick-fix.

Storage of Insects :

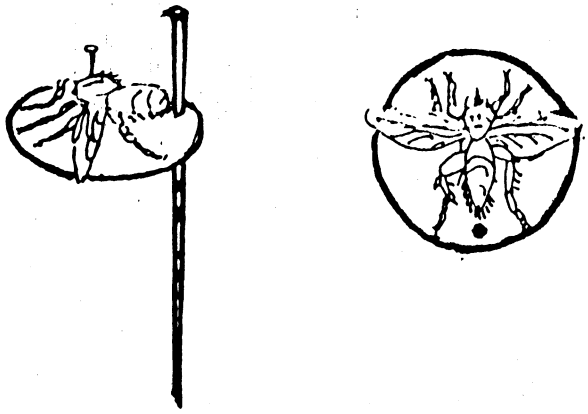
Insect storing drawers with cork lining and perforated naphthalene chamber all round and a framed glass lid fitting tightly on the top are used for storing the insects. A large number of such drawers with knobbed handles can fit one below the other in almirah like insect cabinets. The essentials for storing insects permanently are to keep out dust, to keep them dry, to keep them in the dark and keep out pests.

Disinfectants :

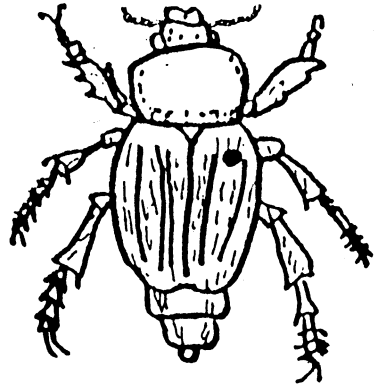
Insects that have been collected and stored must be protected from the ravages of a variety of pests that may attack them. The following agents are used : Powdered naphthalene or Para-dichlorobenzene crystals are placed in a narrow perforated chamber all around in the drawers and boxes containing the insects. In addition to this, a compact plug of cotton rolled round a long, stout pin is dipped in a solution of Lysol and camphor or a mixture of chloroform, creosote and naphthalene and pinned in the corners of the storage box.

Dry preservation of crab :

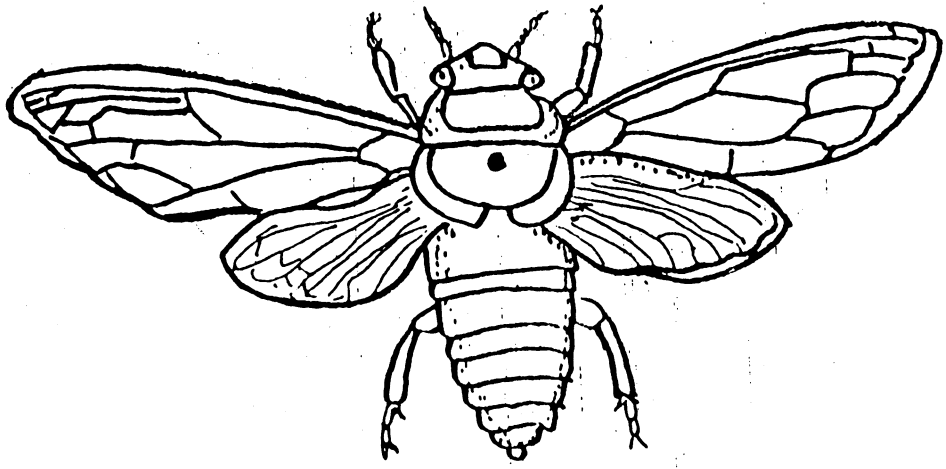
The abdominal flap on the ventral side is opened and a slit is made. Through this opening all the flesh and muscles from inside the body and the bases of the legs are removed with a pair of forceps and mounted needles. The legs may be detached in this process and each leg has to be cleaned of its fleshy contents individually and pasted back into position with quickfix, preferably with a wire anchorage internally. The interior of the body is then thoroughly washed with water and then soaked for a few hours in 40% formalin or a saturated solution of Borax. The interior is then stuffed with dry cotton and the abdominal flap folded back into its natural position and pasted with quickfix and wound up with the body with thread. The legs may be properly arranged and fixed in their correct positions on



Method of pinning small insects



Method of pinning a beetle



Method of pinning a large insect

a board with pins passed over them criss-cross and allowed to dry. After a few days when the specimen is completely dry; the pins and thread are removed and the original colours are replaced with oil paints and finally coated with clear varnish. It is therefore advisable to make water colour sketches of the live crabs before they are killed and preserved. Large prawns and Lobsters may also be preserved as dry specimens as above. It is necessary to have a wire armature inside the limbs for proper support to the dry preserved specimen. Crabs can also be preserved in wet condition.

Preservation of eggs :

In the case of bird's egg which has thick shell, the inner contents have to be removed by making small hole. Before that, the egg is shakened well and egg drill is used for making the hole. Keep the egg drill on the flat side of the egg and slowly rotate it on the egg. After making a hole, the contents of the egg can be removed by using the blow pipe. Keeping the blow pipe at one end and blow out the contents completely from the shell. Then wash the interior of the shell with water, remove the water and pour 40% formalin and shake it well. Then remove the formalin and allow it to dry. After complete dry, egg shell can be mounted inside the show case. The hole on the egg must go on the other side, so that the hole will not be visible. In the case of leathery eggs, an incision is made and the inner contents are scrapped and removed. Then the interior of the leathery egg is washed with water, then 40% formalin is poured and after 15 minutes formalin is removed. The interior is then stuffed with dry cotton and the two edges are brought together and stitched. It can be mounted on a plywood placing the stitched portion on it.

Preservation of fishes :

An accurate coloured sketch of the fish should be prepared before preservation, such a coloured sketch is indispensable for painting the dry preserved speciments or casts of fish intended for display, in thier natural colours.

Wet preservation of fishes :

For study purposes, it is necessary to preserve fishes in fluid. For preserving fishes in wet condition either 4% formalin or 90% alcohol can be used. At first, the preservatory fluid has to be injected from the mouth to the tail so as to preserve the internal organs. Then the specimen is mounted on a glass plate by using nylon thread passing through the specimen. Then the whole mount with the specimen is completely immersed in the jar containing the preservative fluid. Then the mouth of the jar is closed with lid and sealed. This method is followed generally for preserving the smaller animals in the wet condition.

Colour preservation :

The specimens preserved either in Rectified spirt or in formalin lose their original colour within a few days. To retain the original colour of the specimen, following mixture of chemicals can be used.

1. Glycerine - 75% by volume
2. Rectified spirit 20% by volume
3. Mercuirc chloride 3% by volume
4. Chloroform 1% by volume
5. Acetic acid 1% by volume

This mixture of chemicals is able to maintain the colour of the specimens for about 12 to 15 years. This same mixture of liquid chemicals should be injected into the specimen also. Here Glycerine is used to maintain the colour of the specimen, rectified spirit is used as preservative and to absorb moisture, Mercuric chloride, called corrosive sublimate is used to retain the structure of the animal, chloroform is used to give clearness to the solution and Acetic acid to prevent the growth of the fungus.

Dry preservation of fish :

Fish should first be washed with alum water to remove the slime. Then the fish is laid on a sheet of brown paper and a contact outline of the body is traced on the paper. The specimen is then pasted all over with a sheet of tissue paper to prevent the scales from dropping away while skinning. when the paper pasted has become dry and stiff, the fish is laid on its better side and an incision is made with a scalpel the full length of the uppermost side along its middle line from the tail fin to the joint in the shoulder girdle. The shoulder hinge is cut through with a cartilage knife. A cross incision is made along the end of the tail fin where the skin joins it. Then the body is carefully removed from the skin, using a dull knife. The roots of the fin bones are dissected and cut free from the body. The body is cut free from the skin at the shoulder girdle. The eyeballs and brain are removed by scooping them out with a curved scraper. The skull is left intact and the skull bones are scraped clean. Arsenical paste is applied inside the skin and all over the skull.

Making artificial body :

The contact outline marked in the brown paper is cut along the marked line and it will be pattern for the mannikin. This paper pattern is now traced around on a piece of wood or thin 1/2 inch dealwood board. This board will be the core of the artificial body. A row of little flat headed nails are driven in all round the edge of the core-board. Fine tow is wrapped round the core board and shaped flat artificial body. This artificial body is laid into the skin and the edges of the skin are stitched from the tail end. The cheeks are stuffed with tow and the ends of upper and lower jaws are pinned on to this mass of tow. Then this specimen is placed on a board or a plywood, the fins are spread out and pinned at the margins. The tissue paper on the outer surface of the specimen may be removed with the help of cotton soacked in water. Then it is allowed to dry for a few days. A glass eye of the appropriate size and colour is set on the view side of the

fish with a papiermache lining in the eye socket. When this is completely dry, the fish is painted in natural colours.

Preparation of Arsenical paste :

This paste is prepared by mixing equal proporations of Arsinous oxide, Zinc oxide and soap shavings in water and boiled. When the paste becomes creamy colour, handful of camphor is added to this paste and allow it to cool down. This paste is used for preserving the skins of fished, reptiles, birds and mammals.

The preservation of Amphibians and Reptiles :

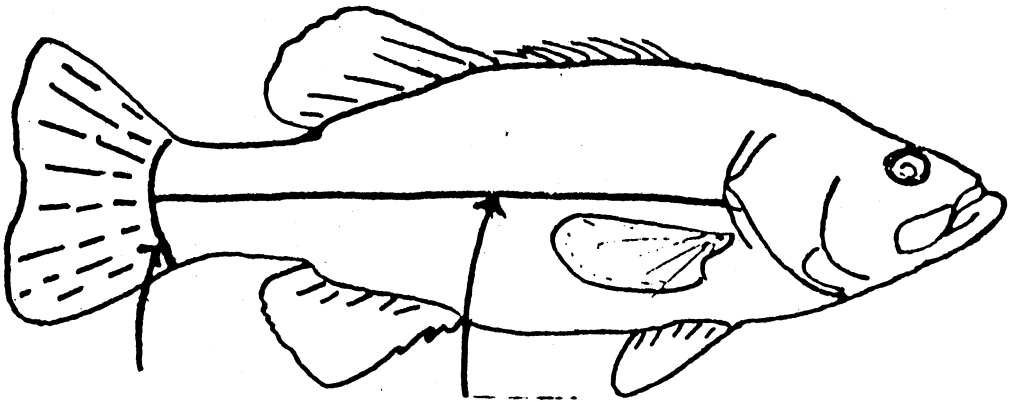
The majority of frogs and toads are preserved in a wet condition. 90% alcohol may be used for permanent preservation.

Wet preservation of Reptiles :

All reptiles such as crocodiles, turtles and large tortoises and snakes of greater length than 10 feet and those of large girth such as Python and Boas, the preservation of the entire animal in alcohol is impracticable. In such cases, dry preservation has to be resorted. To prepare the skin of a crocodile, it must be cut through along the middle of the under side, from the chin to the end of the tail. All flesh is scraped away from the inside of the skin and powdered alum is rubbed into the skin on its flesh side. After removing the flesh portions alum and arsenical paste are applied all over, the inner surface of the skin. Then it may be stuffed and mounted, using an artificial body made of tow. Artificial eyes of appropriate size and colour are fixed inside the eye sockets.

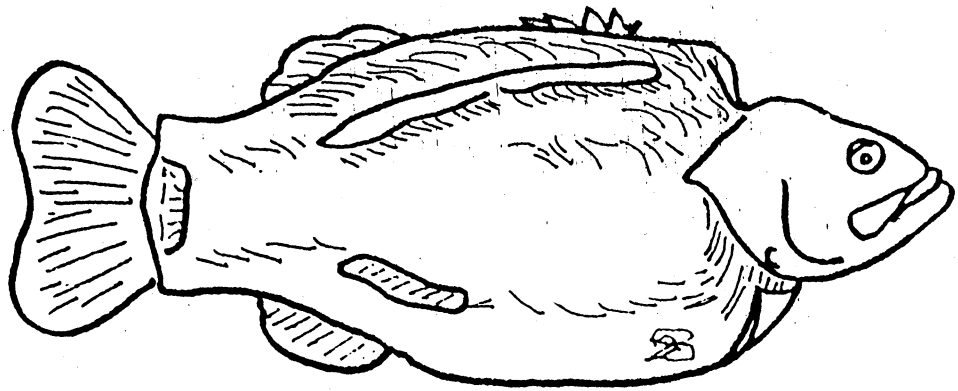
The preservation of Birds and Mammals :

It involves killing, skinning, preservation and mounting. If the specimen is alive, chloroform is used for killing, by keeping the specimen in a cage. Incision is made on keel portion and slowly remove the attachments of muscles from the skin using a sharp scalpel leaving the limb bones (upto



Incision across base of tail fin

Main body incision



The cleaned skin

Tibia) and the skull. The contents of brain and eyes can be removed by using a hooked spoon. Then Arsenic paste is applied on the inner surface of the skin and the skull. Artificial body has to be prepared by using tow around the galvanised wire. One end of the wire from the artificial body is placed on the tail region, another end pass through the skull. Another galvanised wire is passed through one limb, cotton or tow is wound around this wire to the size of thigh muscles originally removed, the end of this wire is passed through the false body and bent. another galvanised wire is passed through another leg and then into the false body and bent. then two ends of skins brought together and stitched, feathers are arranged to cover the stitching, then the specimen has to be brought to shape and the two ends of wires from the legs can be fixed on the wooden pedestal. Paper bands are used to keep the wings in position and allowed to dry. After a few days, the paper bands are removed, appropirate size and colour glass eyes are fixed inside the eye sockets. The excess wire coming out of the skull has to be cut off along the head portion.

Preservation of mammal : It involves skinning, tanning and mounting. Skinning : Normally, incision is made along the middle of the belly and the body skin is peeled down over the hips. The hip joints and leg muscles are cut from the pelvis. The tail skin is peeled back on the tail. Then the forelegs are cut at the shoulder joints and skinning is continued down over the head. The skull is separated from the neck at its base keeping it attached to the skin at the snout. Brain and eye balls are scooped out from the skull. Arsenic paste is applied over the limb bones and to the skull. Tanning : Previously alum and common salt soultion was used for tanning skins. Now a days, salt is not used, only fine powder of alum is rubbed over the inner surface of the skin. Tissues and flesh are reoved by using grinding stones rubbing over the inner surface of the skin. then the skin will become smooth and dalda is smeared over the inner surface. Then Arsenical paste is applied over the inner surface of the skin and also on limb bones and skull. Mounting : A wooden plank of approprate size for body and limbs form the basic structure and it is covered by brass wire

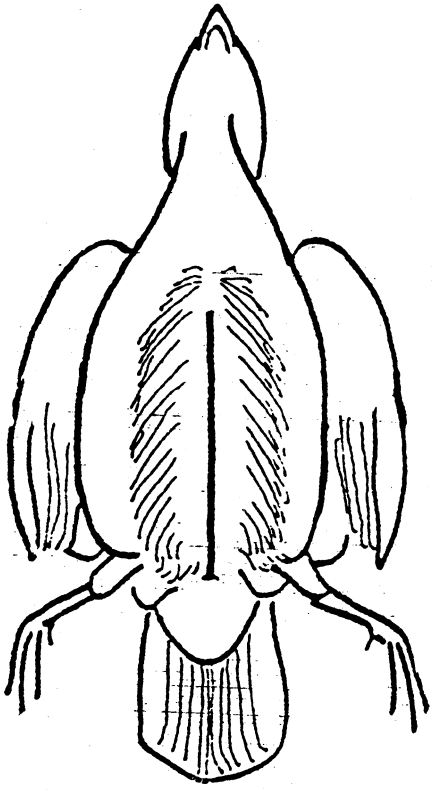
mesh as shown in the picture. Over this structure compo is applied. Compo is prepared by mixing equal quantities of Arsenous oxide, papier masche and glue flakes mixed with water and heated for sometime. After cooling, this paste is applied over the wire mesh and musculature is brought up. Then the preserved skin has to be fixed on this artificial body and stitches are made. Artificial eyes of appropirate size and colour are fixed inside the eye sockets. Then this preserved animal can be mounted on a wooden pedestal or on a branch of tree.

The method of preserving the animals by stuffing and mounting is called Taxidermy. Taxidermy is coined from two Greek words. "Taxis" means arrangements and "derma" means skin, meaning skin art.

The preparation and preservation of Skeletons :

The skeletons of birds and small mammals may be prepared and preserved as ligamentary skeleton, i.e., with the various bones attached by the natural ligaments. The animal is first skinned away, and viscera removed, as much as of the flesh id scrapped away, the brain is scooped out. Then the skeleton is thoroughly washed in running water and is coated with lime (chunam) paste and left to dry for about 2 days. Then all flesh is cleaned with chunam by scraping the bones. After thorough cleaning, the skeleton may be dried in the sun. Finally clear varnish may be applied. The skeleton may finally be mounted on two brass supports fixed to a wooden pedestal. Detached parts of the skeleton may be secured in position with quickfix.

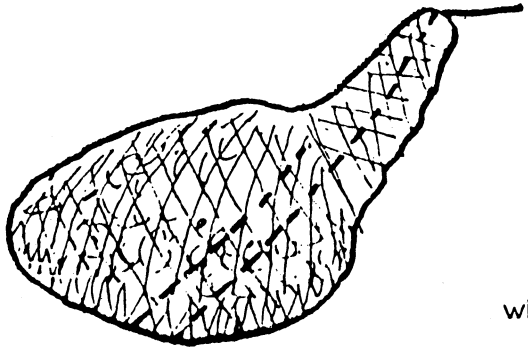
The skeleton of large mammals can be prepared as disarticulated skeletons, i.e., with the various bones taken apart. The skeleton is thoroughtly washed in water and coated with bleaching powder paste and left for about 4 hours. Then it is cleaned thoroughly in running water and dried in the sun. Finally clear varnish coating may be given to the skeleton and mounted with strong metal supports for the skull and neck and the pelvic regions on strong teakwood pedestal.



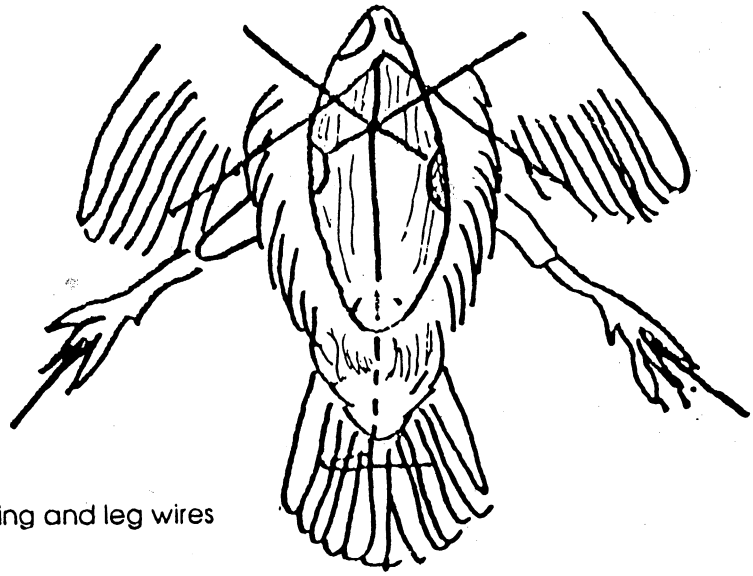
Skinning a bird

The dotted line shows

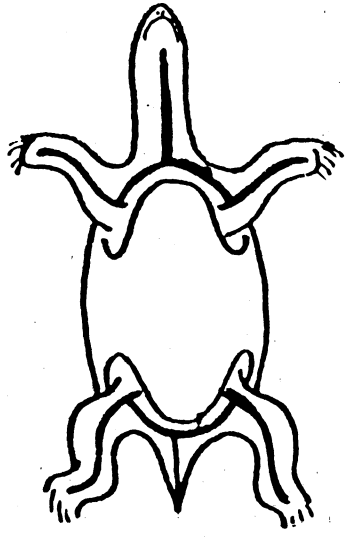
the course of the neck wire



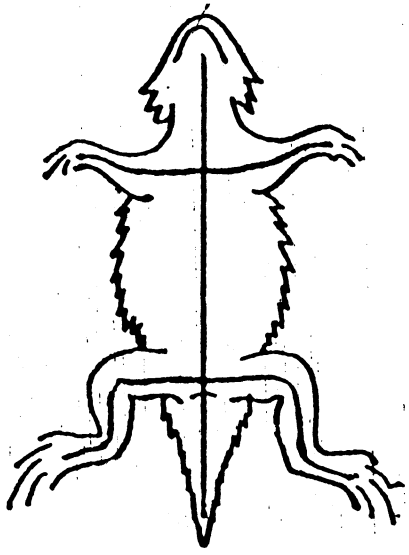
Artificial body



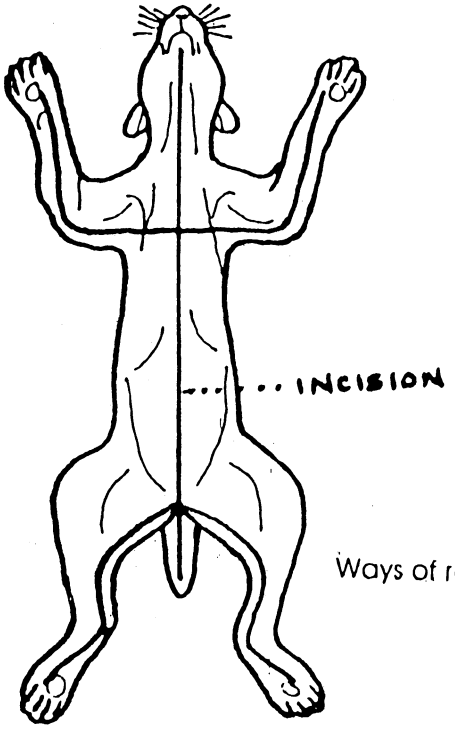
wing and leg wires



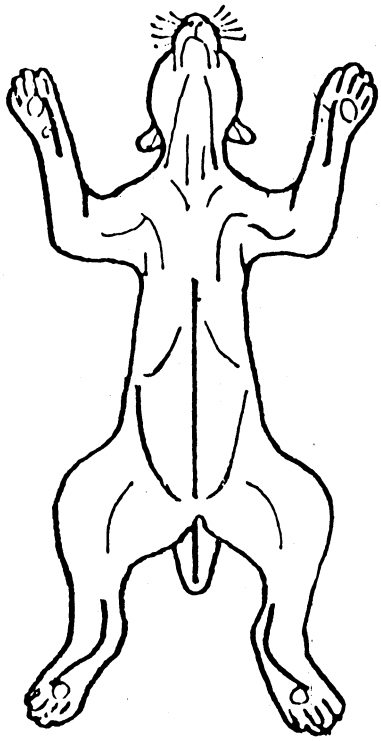
Incisions for skinning a turtle

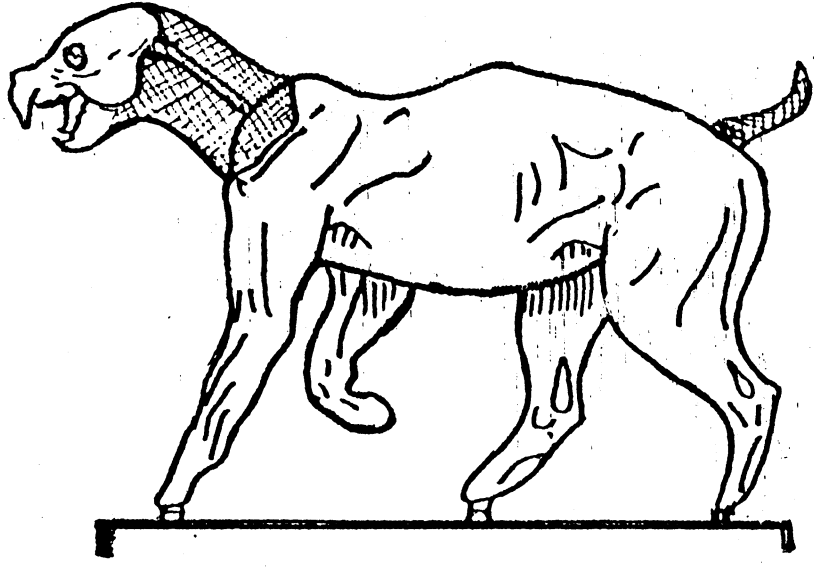


Incisions for skinning a lizard

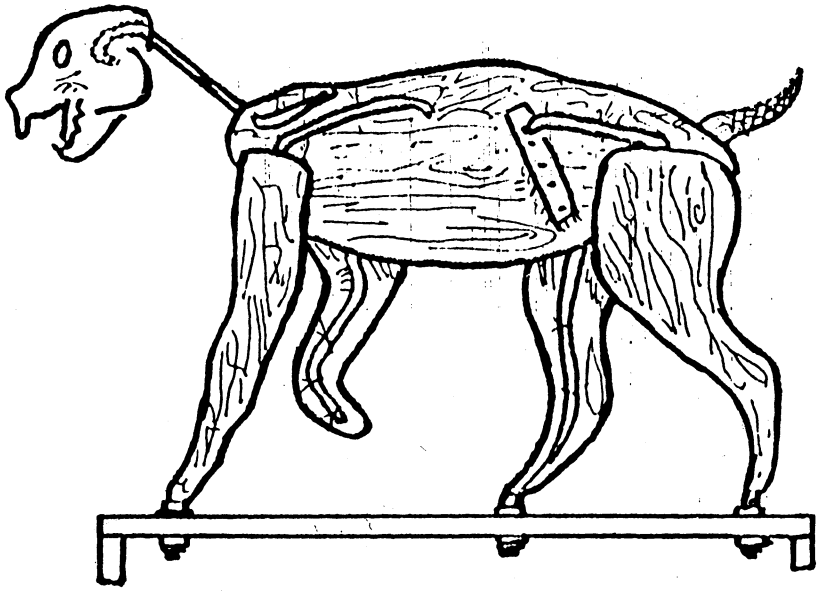


Ways of removing a mammal skin





Finished mannikin



The Core assembly for a Mammal mannikin.

Advanced methods of preservation

1. Plastic infiltration

2. Plastic embedding

3. Freeze drying.

Plastic infiltration :

After preserving the animal in rectified spirit resin is injected to preserve the internal organs. Then it is mounted on a glass plate and immersed in the resin for about 24 hours. Then the mount with animal is taken out and allowed to dry. After thoroughly dried, the animal is seperated from the mount. Fishes and reptiles may be preserved by this method.

Plastic embedding :

A glass container has to be prepared in accordance with the size of the specimen to be preserved. A coating of glycerine is applied to the interior of this container. Synthetic resin is made to solidify in room temperature by mixing 5 drops of catalyst and 3 drops of accelerator to every 100 ccs of resin. The specimen preserved in rectified spirit is laid on the layer of jelly-like solidifying plastic. Two more layers of synthetic resin mixed with catalyst and accelerator have be added over to the specimen and allowed to solidify. Then the solidifed block has to be removed from the container and is polished. By this method some insects, fishes and reptiles may be preserved.

Freeze-Drying :

This method is most spectacular and revolutionary among the recent achievements in the field of preservation. The first step is to pose the specimen suitably. Liquid Nitrogen is used for fixing the individual joints of the specimens in the desired positions. Liquid Nitrogen is an non-poisonous gas available in liquid form in insulated containers. Its boiling point is -197°C, it evaporates rapidly as soon as it is poured out on the

joints, leaving no trace of any wetness. Then the specimen is placed inside the freezing chamber in which 0-pressure and temperature-25 to-40°C is maintained. In this method the inner moisture of the animal is completely removed in this temperature and pressure and the animal becomes porous. The time taken for thorough drying depends upon the size and weight of the specimen. Artificial glass eyes of appropriate size and colour are fixed inside the eye sockets replacing the natural eyes.

Clearing and staining small vertebrates for demostrating ossification :

By this method entire skeleton can be studied in relation to the position of the overlying flesh. It is particularly valuable in the study of embryology. The specimen should first be eviscerated and preserved in 95% alcohol. After fixing, the next step is to macerate and bleach the specimen. This is done by placing the specimen in a 2% KOH solution which decolourizes the tissue and makes it jelly-like. If the KOH solution is heated before pouring into the specimen, the process of maceration may be hastened. The solution may become discoloured as the pigments are dissolved out of the tissue, in which case solution should be changed as often as is necessary. In order to hastened the depigmentation bleaching agents such as 3% hydrogen peroxide may be used. If the specimen shows signs of falling apart while in 2% KOH solution, it may be hardened by adding alcohol or glycerine. This will stop maceration. After the flesh has become jelly-like, the next step is to stain the specimen. When the bones become visible through the surrounding tissue the stain rnay be added. The dye used is Alizarin Red. S (Sodium alizarin monosulfonate). A solution of this in glacial acetic acid may be added drop by drop to the specimen in the KOH until the colour of the entire solution is deep wine red. For staining cartilage the following solution is prepared. 100cc 70% alcohol; 2cc. 0.5% HCL and 0.25 gm. Toludine blue are mixed and the specimen must remain for atleast one week. The specimen is then finally mounted and stored in pure glycerine.