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Directions for Collecting, Preserving and
Transporting Specimens of Natural History
prepared for the use of the Smithsonian
Institution.

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DIRECTIONS

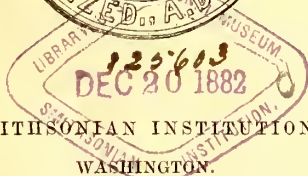
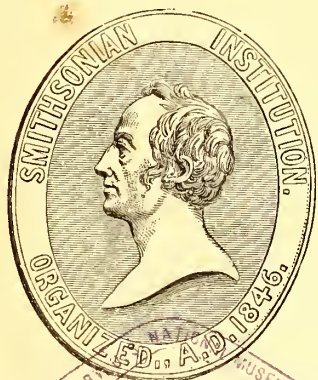
FOR

COLLECTING, PRESERVING, AND TRANSPORTING

SPECIMENS OF NATURAL HISTORY.

PREPARED FOR THE USE OF

THE SMITHSONIAN INSTITUTION.



SMITHSONIAN INSTITUTION:
WASHINGTON.

JANUARY, 1852.

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INTRODUCTION.

THE following directions have been prepared with the view of furnishing, in the least possible space, such hints as may enable travellers and others to secure and preserve the different objects of Natural History with which they may meet. Many persons only require a little knowledge of taxidermy to induce them to commence making collections of new or rare species. Officers of the Army and Navy, Clerks of Trading Posts, Indian Agents, Land Surveyors, Missionaries, &c. very often have it in their power to procure specimens of the highest interest.

As very much depends upon facilities of transportation, application has been made by the Smithsonian Institution to the Secretary of War, for permission to call upon the Quartermaster Department for assistance. This has been readily granted, as will be seen by the annexed letter.

The Navy Department has also expressed its willingness to aid the Institution in the transportation of specimens in reasonable amount. Collectors of Customs, and Naval Storekeepers on the coast, will generally receive cases, and keep them until a convenient opportunity occurs for sending to Washington, or some convenient Atlantic port, in vessels of war, storeships, revenue cutters, &c. The vessels and trains of the Quartermaster Department returning empty from the interior, or the coast, can generally transport a moderate quantity of matter without inconvenience or expense.

For all assistance which may be rendered either in gathering specimens, or in aiding in their transportation, full credit will be given by the Institution in the annual reports to congress, catalogues and labels of collections, and in other ways.

SPENCER F. BAIRD,
Asst. Sec. S. I. in charge of Museum.

[COPY.]

WAR DEPARTMENT,
Washington, January 17th, 1852.

SIR:—

In reply to your letter of the 7th instant, asking whether authority can be given to the Officers of the Quartermaster Department to receive and transmit specimens of Natural History for the use of the Smithsonian Institution, I have the honor to inform you that directions have been given through the Quartermaster General to furnish the facilities you ask for, whenever it can be done without expense to the United States.

Very respectfully, your obedient servant,

C. M. CONRAD,
Secretary of War.

Prof. JOS. HENRY,
Secretary Smithsonian Institution.

‡ I. INSTRUMENTS, PRESERVATIVE MATERIALS, &c.

1. IMPLEMENTS FOR SKINNING.

THE implements necessary in skinning vertebrated animals are :
1. A knife, such as is used for ordinary dissection, and which may be replaced, in extreme cases, by a penknife. 2. A pair of sharp-pointed scissors, and one with strong short blades. 3. Needles and thread for sewing up the incisions in the skin. 4. A hook by which to suspend the carcase of the animal while the operation of skinning is going on. To prepare the hook, take a string, of from one to three feet in length, and fasten one end of it to a stout fish-hook which has had the barb broken off. By means of a loop at the other end, the string may be suspended to a nail or awl, which, when the hook is inserted into the body of an animal, will give free use of both hands in the operation of skinning.

2. PRESERVATIVES.

The best material for the preservation of skins of animals consists of powdered arsenious acid, or the common arsenic of the shops. This may be used in two ways, either applied in dry powder to the moist skin, or else mixed with alcohol or water to the consistency of molasses, and put on with a brush. To the alcoholic solution should be added a little camphor. There are no satisfactory substitutes for arsenic ; but, in its entire absence, corrosive sublimate, arsenical soap, camphor, alum, &c., may be employed.

The proper materials for stuffing out skins will depend much upon the size of the animal. For small birds and mammalia, cotton will be found most convenient ; for the larger, tow. For those still larger, dry grass, straw, sawdust, bran, or other vegetable substances, may be used. Whatever substance is used, care must be taken that it be perfectly dry. In no event should animal matter, as hair, wool, or feathers, be employed.

‡ II. SKINNING AND STUFFING.

I. BIRDS.

Whenever convenient, the following notes should be made previous to commencing the operation of skinning, as they will add much to the value of the specimens:—

1. The length, in inches, from tip of bill to the end of the tail; the distance between the two extremities of the outstretched wings; and the length of the wing from the carpal-joint. The numbers may be recorded as follows: 44, 66, 12 (as for a swan), without any explanation; it being well understood that the above measurements follow each other in a fixed succession. These numbers may be written on the back of the label appended to each specimen.

2. The color of the eyes, that of the feet, bill, gums, membranes, caruncles, &c.

3. Are the heels covered or uncovered by the feathers of the belly?

4. Attitude of the body when at rest, whether vertical, oblique, or horizontal. Does the bird perch or not?

5. Position of the wings, whether supported or hanging, crossing on the tail or not. Are they continuous and covered by the feathers of the mantle (back) and breast for the upper third, the half, or the two-thirds of their length? Their extremity; does it reach the end of the tail, the half, or the fourth of its length? The three last points will be of great use in mounting the specimens.

Immediately after a bird is shot, the holes made by the shot should be plugged up, and the mouth and posterior nostrils plugged with cotton, to prevent the escape of blood and the juices of the stomach. A long narrow paper cone should be made; the bird, if small enough, thrust in, head foremost, and the open end folded shut, taking care not to break or bend the tail feathers in the operation.*

When ready to proceed to skinning, remove the old cotton from the throat, mouth, and nostrils, and replace it by fresh. Then take the dimensions from the point of the bill to the end of the tail, from the tip of one wing to that of the other, when both are extended, and from the tip of the wing to the first or carpal-joint, as already indicated.

* Crumpled or bent feathers may have much of their elasticity and original shape restored by dipping in hot water.

This being done, make an incision through the skin only, from the lower end of the breast bone to the anus. Should the intestines protrude in small specimens, they had better be extracted, great care being taken not to soil the feathers. Now proceed carefully to separate the skin on each side from the subjacent parts, until you reach the knee, and expose the thigh; when, taking the leg in one hand, push or thrust the knee up on the abdomen, and loosen the skin around it until you can place the scissors or knife underneath, and separate the joint with the accompanying muscles. Place a little cotton between the skin and body to prevent adhesion. Loosen the skin about the base of the tail, and cut through the vertebræ at the last joint, taking care not to sever the bases of the quills. Suspend the body by inserting the hook into the lower part of the back or rump, and invert the skin, loosening it carefully from the body. On reaching the wings, which had better be relaxed previously by stretching and pulling, loosen the skin from around the first bone, and cut through the middle of it, or, if the bird be small enough, separate it from the next at the elbow. Continue the inversion of the skin by drawing it over the neck, until the skull is exposed. Arrived at this point, detach the delicate membrane of the ear from its cavity in the skull, if possible, without cutting or tearing it; then, by means of the thumb-nails, loosen the adhesion of the skin to the other parts of the head, until you come to the very base of the mandibles, taking care to cut through the white nictitating membrane of the eye when exposed, without lacerating the ball. Scoop out the eyes, and, by making one cut on each side of the head, through the small bone connecting the base of the lower jaw with the skull, another through the roof of the mouth at the base of the upper mandible, and between the jaws of the lower, and a fourth through the skull behind the orbits, and parallel to the roof of the mouth, you will have freed the skull from all the accompanying brain and muscle. Should anything still adhere, it may be removed separately. In making the two first cuts, care must be taken not to injure or sever the zygoma, a small bone extending from the base of the upper mandible to the base of the lower jaw-bone. Clean off every particle of muscle and fat from the head and neck, and, applying the preservative abundantly to the skull, inside and out, as well as to the skin, restore these parts to their natural position. In all the preceding operations, the skin should be handled as near the point of adhesion as possible, especial care being taken not to stretch it.

The next operation is to connect the two wings inside of the skin by means of a string, which should be passed between the lower ends of the two bones joining the forearm, previously, however, cutting off the stump of the arm, if still adhering at the elbow. Tie the two ends of the string so that the wings shall be kept at the same distance apart, as when attached to the body. Skin the leg down to the scaly part, or tarsus, and remove all the muscle. Apply the arsenic to the bone and skin, and, wrapping cotton round the bone, pull it back to its place. Remove all the muscle and fat which may adhere to the base of the tail or the skin, and put on plenty of the preservative wherever this can be done. Lift up the wing, and remove the muscle from the forearm by making an incision along it, or, in many cases, the two joints may be exposed by carefully slipping down the skin towards the wrist-joint, the adhesion of the quills to the bone being loosened.

The bird is now to be restored to something like its natural shape by means of a filling of cotton or tow. Begin by opening the mouth and putting cotton into the orbits and upper part of the throat, until these parts have their natural shape. Next take tow or cotton, and, after making a roll rather less in thickness than the original neck, put it into the skin, and push firmly into the base of the skull. By means of this, you can reduce or contract the neck if too much stretched. Fill the body with cotton, not quite to its original dimensions, and sew up the incision in the skin, commencing at the upper end, and passing the needle from the inside outwards; tie the legs and mandibles together, adjust the feathers, and, after preparing a cylinder of paper the size of the bird, push the skin into it so as to bind the wings closely to the sides. The cotton may be put in loosely, or a body the size of the original made by wrapping with threads. If the bird have long legs and neck, they had better be folded down over the body, and allowed to dry in that position. Economy of space is a great object in keeping skins, and such birds as herons, geese, swans, &c., occupy too much room when all their parts are in a natural position.

In some instances, as among the ducks, woodpeckers, &c., the head is so large that the skin of the neck cannot be drawn over it. In such cases, skin the neck down to the base of the skull, and cut it off there. Then draw the head out again, and, making an incision on the outside, down the back of the skull, skin the head. Be careful not to make too long a cut, and to sew up the incision again.

2. MAMMALS.

The mode of preparing mammals is precisely the same as the preceding, in all its general features. Care should be taken not to make too large an incision along the abdomen. The principal difficulty will be experienced in skinning the tail. To effect this, pass the slip-knot of a piece of strong twine over the severed end of the tail, and, fastening the vertebræ firmly to some support, pull the twine towards the tip until the skin is forced off. Should the animal be large, and an abundance of preservative not at hand, the skin had better remain inverted. In all cases, it should be thoroughly and rapidly dried.

Skins may also be preserved, for a time, in spirits, in the absence of other preservative. This would, at all events, be better than their drying, especially in localities abounding in noxious insects.

For the continued preservation of hair or fur of animals against the attacks of moths and other destructive insects, it will be necessary to soak the skins in a solution of corrosive sublimate in alcohol or whiskey, allowing them to remain from one day to several weeks, according to the size. After removal, the hair must be thoroughly washed or rinsed in clean water, to remove as much as possible of the sublimate; otherwise, exposure to light will bleach all the colors.

In some instances, large skins may be preserved by being salted down in easks.

With regard to the tails of mammalia, it may be well to remark that in some it can never be forced off in the common way of doing this operation. This is particularly the case with *beavers*, *opossums*, and those species which use their tail for prehension or locomotion. Here the tail is usually supplied with numerous tendinous muscles, which require it to be skinned by making a cut along the lower surface or right side of that organ, nearly from one end to the other, and removing the bone and flesh. It should then be sewed up again, after a previous stuffing.

3. REPTILES.

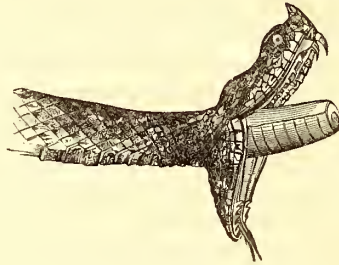
The larger *lizards*, as those exceeding twelve or eighteen inches in length, may be skinned according to the principles above presented, although preservation in spirit, when possible, is preferable for all reptiles.

Large *frogs* and *salamanders* may likewise be skinned, although cases where this will be advisable are very rare.

Turtles and large snakes will require this operation.

To one accustomed to the skinning of birds, the skinning of frogs or other reptiles will present no difficulties.

The skinning of a snake is still easier. Open the mouth and separate the skull from the vertebral column, detaching all surrounding muscles adherent to the skin. Next, tie a string around the stump of the neck thus exposed (see fig.), and, holding on by this, strip the skin



down to the extremity of the tail. The skin thus inverted should be restored to its proper state, and then put in spirit or stuffed, as convenient. Skins of reptiles may be stuffed with either sand or sawdust, by the use of which their shape is more easily restored.

Turtles and tortoises are more difficult to prepare in this way, although their skinning can be done quite rapidly. "The breastplate must be separated by a knife or saw from the back, and, when the viscera and fleshy parts have been removed, restored to its position. The skin of the head and neck must be turned inside out, as far as the head, and the vertebræ and flesh of the neck should be detached from the head, which, after being freed from the flesh, the brain, and the tongue, may be preserved with the skin of the neck. In skinning the legs and the tail, the skin must be turned inside out, and, the flesh having been removed from the bones, they are to be returned to their places by redrawing the skin over them, first winding a little cotton or tow around the bones to prevent the skin adhering to them when it dries."—RICHARD OWEN.

Another way of preparing these reptiles is as follows: Make two incisions, one from the anterior end of the breastplate to the symphysis of the lower jaw, and another from the posterior end of the breastplate to the vent or tip of the tail; skin off these regions and

remove all fleshy parts and viscera without touching the breastplate itself. Apply preservative, stuff, and sew up again both incisions.

“When turtles, tortoises, crocodiles, or alligators, are too large to be preserved whole in liquor, some parts, as the head, the whole viscera stripped down from the neck to the vent, and the cloaca, should be put into spirit or solution.”—R. OWEN.

4. FISHES.

As a general rule fishes, when not too large, are best preserved entire in spirits.

Nevertheless they may be usefully skinned and form collections, the value of which is not generally appreciated. In many cases, too, when spirit or solutions cannot be procured, a fish may be preserved which would otherwise be lost.

There are two modes of taking the skin of a fish: 1st. The whole animal can be skinned and stuffed like a bird, mammal, or reptile. 2d. One half of the fish can be skinned, and nevertheless its natural form preserved.

Sharks, skates, sturgeoons, garpikes or garfishes, mudfishes, and all those belonging to the natural orders of *Placoids* and *Ganooids* should undergo the same process as given above for birds, mammals, and reptiles. An incision should be made along the right side, the left always remaining intact, or along the belly. The skin is next removed from the flesh, the fins cut at their bases under the skin, and the latter inverted until the base of the skull is exposed. The inner cavity of the head should be cleaned, an application of preservative be made, and the whole, after being stuffed in the ordinary way, sewed up again. Fins may be expanded when wet on a piece of stiff paper, which will keep them sufficiently stretched for the purpose. A varnish may be passed over the whole body and fins, to preserve somewhat the color.

In the case of *Ctenoids*, perches and allied genera; and *Cycloids*, trouts, suckers, and allied genera; one-half of the fish may be skinned and preserved. To effect this, lay the fish on a table with the left side up; the one it is intended to preserve. Spread out the fins by putting underneath each a piece of paper, to which it will adhere on drying. When the fins are dried, turn the fish over, cut with scissors or a knife all around the body, a little within the dorsal and ventral lines, from the upper and posterior part of the head, along the back to the tail, across the base of the caudal fin down, and thence

along the belly to the lower part of the head again. The dorsal, caudal, and anal fins, cut below their articulations. This done, separate the whole of the body from the left side of the skin, commencing at the tail. When near the head, cut off the body with the right ventral and pectoral fins, and proceed by making a section of the head and removing nearly the half of it. Clean the inside, and pull out the left eye, leaving only the *cornea* and pupil. Cut a circular piece of black paper of the size of the orbit and place it close to the pupil. Apply the preservative, fill the head with cotton as well as the body. Turn over the skin and fix it on a board prepared for that purpose. Pin or tack it down at the base of the fins. Have several narrow bands of paper to place across the body in order to give it a natural form, and let it dry. The skins may be taken off the board or remain fixed to it, when sent to their destination, where they should be placed on suitable boards of proper size, for permanent preservation.

Such a collection of well-prepared fish will be useful to the practical naturalist, and illustrate, in a more complete manner to the public, the diversified forms and characters of the class of Fishes, which specimens preserved in alcohol do not so readily show.

§ III. PRESERVING IN LIQUIDS, AND BY OTHER MODES BESIDES SKINNING.

1. GENERAL REMARKS.

The best material for preserving animals of moderate size is alcohol. Next to this, rum or whiskey (the stronger the better) may be employed. When spirits cannot be obtained, the following substitutes may be used:—

I. GOADBY'S SOLUTION.—A. *The aluminous fluid*, composed of rock salt 4 oz.; alum 2 oz.; corrosive sublimate 4 grains; boiling water 2 quarts. B. *The saline solution*, composed of rock salt 8 oz.; corrosive sublimate 2 grains; boiling water 1 quart. To be well stirred, strained, and cooled.

II. A strong brine, to be used as hereafter indicated for Goadby's Solution.

III. In extreme cases, dry salt may be used, as in salting herring, &c.

To use Goadby's Solution, the animal should first be macerated for a few hours in fresh water, to which about half its volume of the concentrated solution may then be added. After soaking thus for some

days, the specimens may be transferred to fresh concentrated solution. When the aluminous fluid is used to preserve vertebrate animals, these should not remain in it for more than a few days; after this, they are to be soaked in fresh water, and transferred to the saline solution. An immersion of some weeks in the aluminous fluid will cause a destruction of the bones. Specimens must be kept submerged in these fluids. The success of the operation will depend very much upon the use of a weak solution in the first instance, and a change to the saturated fluid by one or two intermediate steps.

The collector should have a small keg, jar, tin box, or other suitable vessel, partially filled with liquor, into which specimens may be thrown as collected. They should be alive, or as near it as possible when this is done, as besides the speedy and little painful death, the animal will be more apt to keep sound. The entrance of the spirit into the cavities of the body should be facilitated by opening the mouth, making a small incision in the abdomen a half or one inch long, and especially by injecting the liquor into the intestines through the anus, by means of a small syringe. After the animal has soaked for some weeks in this liquor, it should be transferred to fresh. Care should be taken not to crowd the specimens too much, and the slightest taint of putridity should be the signal for the employment of fresh spirits. When it is impossible to transfer specimens to fresh spirits from time to time, the strongest alcohol should be originally used.

To pack the specimens for transportation, procure a small keg, which has been properly swelled, by allowing water to stand in it for a day or two, and from this extract the head by knocking off the upper hoops. Great care must be taken to make such marks on the hoops and head, as will assist in their being replaced in precisely the same relative position to each other and the keg, that they originally held. At the bottom of the keg place a layer of tow moistened in liquor, then one of specimens, then another of tow and another of specimens, and so on alternately until the keg is filled. Replace the head, drive down the hoops, and fill completely with spirits by pouring through the bung-hole. Allow it to stand at least half an hour, and then, supplying the deficiency of the liquor, insert the bung and fasten it securely. An oyster-can or other tin vessel may be used to great advantage, in which case the aperture should be soldered up and the vessel inclosed in a box. A glass jar or bottle may also be employed, but there is always a risk of breaking and leaking. In the absence of tow, chopped straw, fine shavings, or dry grass may be substituted.

It is sometimes necessary to guard against the theft of spirits employed, by individuals to whom the presence of reptiles and fishes in the liquor is no objection. This may be done by adding a small quantity of tartar emetic, ipecacuanha, quassia, or some other disagreeable substance. The addition of corrosive sublimate will add to the preservative power of the spirit.

Should the specimens to be packed vary in size, the largest should be placed at the bottom. If the disproportion be very great, the delicate objects at the top must be separated from those below, by means of some immovable partition, which in the event of the vessel being inverted will prevent crushing. The most imperative rule, however, in packing, is to have the vessel perfectly full of something, any vacancy occupied only by air exposing the whole to the risk of loss. In carrying specimens in liquor when travelling, an almost insuperable difficulty is found in preventing rubbing, owing to the necessity of leaving enough space for the addition of specimens. This danger may be obviated by introducing an India-rubber, or oiled silk bag or bladder, provided with a valve, and blowing it up enough to fill the unoccupied space.

It often becomes a matter of great importance to separate the specimens of one locality from those of another, in the same vessel. This may be readily done by having a number of small bags made of mosquito net stuff, lino, or other porous material, and from six to twenty inches long, by two to six wide. They are made like pillow-cases, open at one end, and sewed around the other three edges with coarse stitches. The specimens, on being gathered, may be put into a bag of proper size, and the mouth closed by tying a piece of thread. A number may be marked on the bag with a pencil, or with ink on a parchment label, placed inside or tied to one corner. These bags are of incalculable service on a march, or in transporting collections, the individuals of which are to be kept separate for any purpose whatever.

2. VERTEBRATA.

Fishes under six inches in length need not have the abdominal incision. Specimens with the scales and fins perfect should be selected, and, if convenient, stitched or pinned in bits of muslin, &c., to preserve the scales. In general, fishes under twelve or fifteen inches in length should be chosen. The skins of larger ones may be put in liquor. It is important to collect even the smallest.

With regard to the *sharks* and *skates*, it will be best to take the jaws and vertebral column as well as their skins. But, as it very often happens that bodies in a state of decomposition are met with upon the beaches or shores, it should then never be neglected to take these hard parts. The tail of skates is also desirable. If convenient, some vertebræ and teeth may be preserved in spirits for microscopic examination.

Reptiles, as already observed (p. 9), should be preserved in liquids when their size does not forbid this mode of preservation. Persons at leisure may find pleasure in preparing the skins of many small kinds as a double series.

A collection of birds in alcohol or spirit would be a valuable acquisition to a public collection, as much is still to be learned with regard to their anatomical structure. There are no birds, with the exception of the large ostriches, which could not be collected for that purpose. This is a matter to which the collector should be especially attentive. Skins, however, of the first few individuals of rare species should be secured. And on a march it will not often be convenient to preserve specimens in spirit, as the space allotted for collections in alcohol is generally required for reptiles, fishes, small mammalia, and invertebrata.

3. INVERTEBRATA.

INSECTS, BUGS, &c.—The harder kinds may be put in liquor, as above, but the vessel or bottles should not be very large. Butterflies, wasps, flies, &c., may be pinned in boxes, or packed in layers with soft paper or cotton. Minute kinds should be carefully sought under stones, bark, dung, or flowers, or swept with a small net from grass or leaves. They may be put in quills, or small cones of paper, one in each. They may be killed by immersing the bottles, &c., in which they are collected, in hot water, or exposing them to the vapor of ether.

It will frequently be found convenient to preserve or transport insects pinned down in boxes. The bottoms of these are best lined with cork or soft wood. The accompanying figures will explain, better than any description, the particular part of different kinds of insects through which the pin is to be thrust: beetles (Fig. 1) being pinned through the right wing cover or clytra; all others through the middle of the thorax, as in Fig. 2.

The traveller will find it very convenient to carry about him a vial having a broad mouth, closed by a tight cork. In this, should be contained a piece of camphor, or, still better, of sponge, soaked in ether, to kill the insects collected. From this, the specimens should be transferred to other bottles.

Fig. 1.

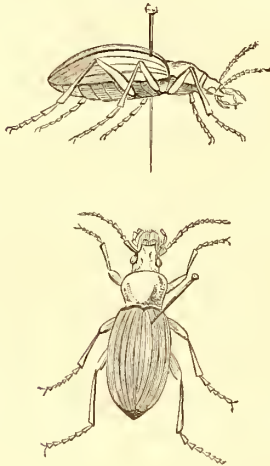
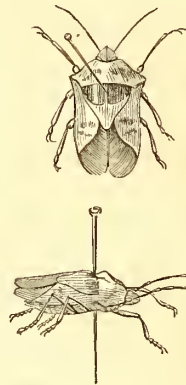


Fig. 2.



Ether will be found most effective in killing all insects that cannot or ought not to be immersed in alcohol. All those that can support the immersion in this liquid without injury may readily be killed in this way.

The camphor should always be fixed in the box containing insects, as it would break the feet and antennæ of the latter if in a loose and crystalline state. It may be kept in a piece of muslin or canvas, and then pinned at the bottom of the box.

Marine shells, crabs, worms, sea cucumbers, star fishes, sea urchins, and polypes should be put in spirit and in small vessels, so as to prevent too great pressure. Sea urchins and star fishes may also be dried after having been previously immersed for a minute or two in boiling water, and packed up in cotton, or any soft material which may be at hand.

The hard parts of corals, and shells of mollusca may alone be preserved in a dried state. The soft parts are removed by immersing the animals for a minute or two in hot water, and washed clean after-

wards. The valves of bivalve shells should be brought together by a string.

Spiders, scorpions, centipedes or thousand-legs, earth-worms, hair-worms, and generally all worm-like animals to be met in fresh waters, either clear and running or still and putrid, cannot be better preserved than in the strongest alcoholic liquor, and in small bottles or vials.

‡ IV. EMBRYOS.

Much of the future progress of zoology will depend upon the extent and variety of the collections which may be made of the embryos and fœtuses of animals. No opportunity should be omitted to procure these and preserve them in spirits. All stages of development will be equally interesting, and complete series for the same species are of the highest interest. Not only the domestic mammalia, as horse, cow, sheep, hog, dog, &c., should be collected, but also any of the wild animals, as deer, bears, wolves, foxes, antelope, and any and every species. Whenever any females of such mammalia are killed, the uterus should be examined for embryos, and the smaller or more minute, in many cases, the more interesting. When eggs of birds, reptiles, or fish are emptied of their young, these should be preserved. It will be sufficiently evident that great care is required to label the specimens, as in most cases it will be impossible to determine the species from the zoological characters.

‡ V. NESTS AND EGGS.

Nothing forms a more attractive feature in a museum, or is more acceptable to amateurs, than the nests and eggs of birds. These should be collected whenever they present themselves, and in any amount procurable for each species, as they are always in demand for purposes of exchange. Hundreds of eggs of *any* species with their nests (or without, when not to be had) will be gladly received.

Nests require little preparation beyond packing so as to be secure from crumbling or injury. The eggs of each nest, when emptied, may be replaced in it and the remaining space filled with cotton.

Eggs, when fresh, and before the chick has formed, may be emptied by making a minute hole at each end, and blowing or sucking out the contents. Should hatching have already commenced, an aperture may be made in one side by carefully pricking with a fine needle

round a small circle or ellipse, and thus cutting out a piece. The larger kinds should be well washed inside, and all allowed to dry before packing away. If the egg be too small for the name, a number should be marked with ink corresponding to a memorandum list. Little precaution is required in packing, beyond arranging in layers with cotton and having the box entirely filled.

The eggs of reptiles, provided with a calcareous shell, can be prepared in a similar way.

The eggs of fishes, salamanders, and frogs may be preserved in spirits, and kept in small vials or bottles. A label should never be omitted.

§ VI. SKELETONIZING.

Skulls of quadrupeds may be prepared by boiling in water for a few hours. A little potash, or ley, added, will facilitate the removal of the flesh.

Skeletons may be roughly prepared by skinning the animal and removing all the viscera, together with as much of the flesh as possible. The bones should then be exposed to the sun or air until completely dried. Previously, however, the brain of large animals should be removed by separating the skull from the spine, and extracting the contents through the large hole in the back of the head. In case it becomes necessary to disjoint a skeleton, care should be taken to attach a common mark to all the pieces, especially when more than one individual is packed in the same box.

Skulls and skeletons may frequently be picked up, already cleaned by other animals or exposure to weather. By placing small animals near an ant's nest, or in water occupied by tadpoles, or small crustacea, very beautiful skeletons may often be obtained. The sea beach sometimes affords rich treasures in the remains of porpoises, sharks, whales, large fishes, and other aquatic species.

§ VII. PLANTS.

The collector of plants requires but little apparatus; a few quires or reams of unsized paper, of folio size, will furnish all that will be required. The specimens, as gathered, may be placed in a tin box, or, still better, in a portfolio of paper, until reaching home. Here they are to be spread out carefully between sheets of the paper, and

these laid one on top of the other, with several sheets between each. The pile is now to be placed between two boards, and subjected to a pressure of fifty pounds or less. This may be given by weights, or by means of two straps, one at each end. In travelling, the straps will be found most convenient. The papers must be changed every day, and, when perfectly dry, transferred to fresh sheets. It will be found very convenient to have a number of blank labels, with strings attached, by which they may be fastened on a specimen when collected, as soon as notes of locality, color of flowers, date, &c., are made upon it.

In many instances, old newspapers will be found to answer a good purpose both in drying and in keeping plants, although the unprinted paper is best—the more porous and absorbent the better.

While on a march, the following directions for collecting plants, drawn up by Major Rich, are recommended:—

Have thick cartridge, or envelope-paper, folded in *quarto* form, and kept close and even by binding with strong cord; newspapers will answer, but are liable to chafe and wear out; a few are very convenient to mix in with the hard paper as dryers. This herbarium may be rolled up in the blanket while travelling, and placed on a pack-animal. The specimens collected along the road may be kept in the crown of the hat when without a collecting-box, and placed in paper at noon or at night. Great care should be taken to keep the papers dry and free from mould. When there is not time at noon to dry the papers in the sun, they should be dried at night by the fire, when, also, the dried specimens are placed at the bottom of the bundle, making room on top for the next day's collection. A tin collecting-box is very necessary; plants may be preserved for two or three days in one if kept damp and cool. It is also convenient in collecting *land-shells*, which is generally considered part of a botanist's duty. A collector should also always be provided with plenty of ready-made seed-papers, not only for preserving seeds, but mosses and minute plants. Many seeds and fruits cannot be put in the herbarium, particularly if of a succulent nature, causing mouldiness, and others form irregularities and inequalities in the papers, thus breaking specimens and causing small ones and seeds to drop out. Fruits of this kind should be numbered to correspond with the specimen, and kept in the saddle-bag or some such place. It is necessary, in order to make good specimens, to avoid heavy pressure and keep the papers well dried, otherwise they get mouldy, turn black, or decay.

On board ship, it is all-important to keep the collections from getting wet with salt-water. The papers can generally be dried at the galley. The whole herbarium should be exposed to the sun as often as possible, and frequently examined and the mould brushed off with a feather or camel's-hair pencil.

‡ VIII. MINERALS AND FOSSILS.

The collections in mineralogy and palæontology are amongst all, those which are most easily made; whilst, on the other hand, their weight, especially when on a march, will prevent many from making such upon an extensive scale.

All the preparation usually needed for preserving minerals and fossils consists in wrapping the specimens separately in paper, with a label inside for the locality, and packing so as to prevent rubbing. Crumbling fossils may be soaked to advantage in a solution of glue.

Any fossil, whatever it be, should be collected. Minerals and samples of rocks are also desirable. The latter should be properly selected, and cut to five by three inches of surface and one to two inches thick.

Specimens ought to be tightly packed up in boxes, taking care that each one is wrapped up separately, in order that the angles or crystalline surfaces should not be destroyed by transportation; their value depending upon their good condition. The same precautions will be required for corals. The interstices between the specimens, in the box or cask, may be occupied by sawdust, sand, shavings, hay, cotton, or other soft substance. It is absolutely essential, for land carriage, that no cavity be left in the vessel, or box.

‡ IX. DESIDERATA.

As comparatively little is known of the animals and plants of the country west of the Mississippi and Gulf of Mexico, the attention of officers of the army, and others, is especially invited to this region. Of the fresh water fishes, trout, grayling, minnows, &c., little or nothing is on record; and the same may be said of the marine species. The reptiles, birds, smaller mammalia (squirrels, marmots, gophers, pouched rats, hares, &c.), and all other animals, should also be carefully collected.

This region likewise abounds in fossil bones, teeth, &c. of the greatest interest, especially in those portions known as "Mauvais

Terres," or "Bad Lands," and occurring along the Missouri and its tributaries, White River, Milk River, Platte, Eau qui Court, &c. The banks and beds of these and other streams likewise contain rich treasures of fossil bones. Similar remains are to be looked for in all caves, peat bogs, alluvial soil, marl pits, fissures in rocks and other localities throughout North America.

A list of the principal species of large North American animals is subjoined, with reference to the collection of skins, skulls, horns, and skeletons. For the purpose of having complete series in the different stages of age and sex, and for supplying other museums, it is desirable to have a considerable number of the skulls of each species. When possible, at least one skeleton should be procured. It must, however, be remembered, that a single tooth or bone of an animal, in the absence of anything more, will be of importance. Each specimen should, as far as practicable, have the approximate age, sex, and locality distinctly marked on the bone in pen or pencil.

HUMAN RACES, civilized and uncivilized.	LARGE WOLF, black, white, or gray.
BUFFALO.	LOBOS WOLF.
MUSK OX.	PRAIRIE WOLF.
MOUNTAIN SHEEP, or BIGHORN.	COYOTE.
CALIFORNIA WILD SHEEP.	MEDICINE WOLF.
MOUNTAIN GOAT.	INDIAN DOG.
ANTELOPE.	FOXES, all species.
ELK.	SEA OTTER.
LITTLE ELK.	COMMON OTTER.
MOOSE.	GRIZZLY BEAR.
REINDEER, or CARABOU.	WHITE BEAR.
BLACK TAIL DEER, of Rocky Mountains.	BEARS, other species.
BLACK TAIL DEER, of the Pacific.	RACCOON, especially from California.
MULE DEER.	BADGER.
WHITE TAIL DEER.	WOLVERINE, or CARCAJOU.
DEER, other species.	FISHER.
BEAVER.	MARTEN.
PRAIRIE DOG.	PANTHER.
MARMOTS.	JAGUAR.
SEWELLEL.	OCELOT.
HARES.	OUNCE.
	TIGER CAT.

WILD CAT.	DOLPHINS.
LYNX.	WHALES.
CIVET CAT, or BASSARIS.	MANATEE, or SEA COW.
ARMADILLO.	—————
PECCARY, or MEXICAN HOG.	ALLIGATOR.
WALRUS, or MORSE.	SHARKS, STINGREES, RAYS,
SEALS.	DEVIL FISH; teeth, jaws, and
PORPOISES.	vertebræ.

Specimens of the following kinds, preserved in spirits, from all parts of North America, are particularly desired: SMALL QUADRUPEDS, as field mice, shrews, moles, bats, squirrels, weasels. REPTILES, as snakes, lizards, scorpions (so-called), frogs, toads, tree-frogs, and, above all, the salamanders, or lizards without scales, found in water, or under logs and stones, known by the various names of hellbender, young alligator, ground puppy, water puppy, &c. FISH of all kinds, such as the gars, perch, pike, sunfish, chubs, suckers, minnows, and other species.

INVERTEBRATES in general, as crabs, crawfish, and crustacea in general, insects, worms, starfishes, shells, &c.

In addition to dried plants, it will be well always to gather seeds, acorns, nuts, pine cones, &c., which when sent in may be planted, and thus furnish important additions to Horticulture, as well as to Botany. They should be put up perfectly dry.

We have called especial attention to the country west of the Mississippi. Much is still to be done, however, in the east, and collections of any kind will be acceptable from all parts of the Continent.

‡ X. GENERAL LIST OF APPARATUS.

We shall here present at one view a list of the principal apparatus and outfit required for collecting on the simplest scale, in the different kingdoms of nature. Fuller explanations of all will be found under their appropriate heads.

I. FOR COLLECTING.

Gun, with shot of various sizes, from buck to No. 10, as also the proper equipment of powder, percussion caps and wads. Rifle for large game.

Fishing rod and lines. The latter should be of different sizes, with a supply of extra hooks, and snoods.

Nets of various kinds; a seine of about seven feet long with a bag in the middle, will be found most useful for fish. Also a small pocket net for insects, &c., but strong enough for fishes. Some gauze nets for insects.

A casting net will be found useful in fishing.

Pocket vial for collecting insects when on a land exploration, and for small invertebrata when on the sea shore, or on the bank of a river or lake.

Pocket box lined with cork, for collecting insects which cannot well be immersed in spirits.

Larger boxes into which the contents of the preceding may be transferred.

A vial of ether, and

A few ounces of camphor, for killing insects, ether being used in the pocket vial and camphor in the box.

Insect pins of assorted sizes.

Blank labels of paper with strings, for plants and skins of animals.

Unsize paper for plants; a ream or more.

Portfolio with straps.

Labels of parchment for animals in liquids.

Hundred or more lino bags of various sizes, p. 14.

Ten or more yards of lino.

India rubber bag, p. 14.

2. FOR PRESERVING.

Knives, p. 5.

Two pairs of scissors, p. 5.

Needles and threads of various numbers.

Twine.

Hook with loop, p. 5.

Arsenic (powdered), five or ten pounds put up in several tin canisters.

Corrosive sublimate (powdered), about half a pound.

Alcohol in a small keg or tin can.

Tartar emetic or ipecacuanha.

Alum.

Saltpetre.

Common salt. (The three latter substances will hardly be required with plenty of alcohol and arsenic.)

Cotton or tow.



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