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DIRECTIONS

FOR MAKING

COLLECTIONS IN NATURAL HISTORY.

PREPARED FOR

THE NATIONAL INSTITUTION FOR THE PROMOTION OF SCIENCE,

BY

H. KING, M. D.

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These instructions being intended for those who are supposed not to have studied any branch of Natural History, the language used is intentionally divested of as much technicality as possible; whilst the descriptions are made so minutely as to leave, as far as practicable, nothing obscure or unexplained.

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DIRECTIONS.

ANIMAL KINGDOM.

I. VERTEBRAL ANIMALS, OR ANIMATED BEINGS WITH A VERTEBRA OR SPINE.

Man.—The head or skull is the only portion of man that need attract the especial attention of the collector. As it is known that there are great differences in the size and form of this organ, and that these differences serve a valuable purpose in investigating the varieties of the human species, it is very important that a good collection of them should be formed. Efforts should be made to obtain them from each of the Aboriginal nations still existing or that have existed on this continent, and especially within our own territory. Our frontier posts will present very favorable opportunities for this. Those obtained from nations still existing should be, if possible, from those persons who were well known when living.

As it is not necessary to have the bones of the head of man until they shall have had time to become freed from all fleshy covering, no instructions are necessary on this subject. The specimen should be carefully packed, and accompanied with a label, setting forth the nation to which it belonged; and, if known, the name, age, sex, &c.

The mounds of the Mississippi Valley are known to contain an abundance of human remains. Whenever practicable, the skulls at least, found therein, with such materials as may be found with them, should be preserved. These should be ac-

accompanied also with descriptive labels of the place and time of finding, and any interesting circumstance in the exhumation or country around.

Quadrupeds.—In Quadrupeds, and, indeed, nearly all of the remaining members of the vertebral animals, it is desirable to obtain the skin, the skeleton, and, in the smaller species, the entire animal.

The skinning of a quadruped is simple, and easily performed. Except for the largest animals, a pocket knife, with two blades, the largest for larger, and smallest for smaller animals, is, perhaps, the only indispensable instrument.

A longitudinal incision is made along the central line of the abdomen, from the breast bone to the pelvis; and then, as in ordinary cases, the skin is separated until arriving at the legs. These extremities are divided from the body by cutting through the flesh and disjuncting them: the thighs at the hip joint, and the fore leg at the shoulder joint. The tail bones may be cut through and removed after the carcass; or, what is better, in small animals, drawn out at once with it. Having reached the base of the skull, the neck is then divided and the carcass removed. The head is then skinned and turned out, and no other attachments left between it and the skin, than at the tip of the nose and edges of the lips, except in animals with horns; around which the skin must also remain attached. In separating the ears, care must be taken to remove them as deep in the head as possible, and not by cutting them off on a level with the surface. The whole skull is then to be freed from the flesh and other soft parts, including the eyes and tongue, and an opening made on its posterior surface, through which the entire brain must be extracted. The legs are then returned to, and, after being skinned, all the flesh, tendons, and other soft parts removed therefrom down to the feet. If the bones of the tail and its attached parts be not before removed, a few joints are now to be unskinned; and, if the animal be large, a cord secured around them. If the tail be short, the finger is then introduced, and the skin separated as far as possible; but, if it be long, a flat stick should be used for the same purpose: then, by pulling at the cord, the whole may be detached at

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once. In this condition, the skin of the animal is nearly inverted, in which condition it should be left to dry completely, if the operator have no materials with him for preserving it. If, on the contrary, he should have such material, he will proceed to anoint all the bones, and the skin covering them interiorly, or on the fleshy side, with the arsenical soap.* The bones of the extremities are then to be wrapped with so much flax, hemp, tow, or other light material, as will give the skin some distension on being drawn over it. The skin of the head is also to be brought to its natural position; the tail to have its interior well anointed with the soap, and then filled slightly by the same material; the interior of the skin of the body anointed, and slightly stuffed; the edges of the incision carefully brought together, and the operation is completed. It is well, however, to introduce some of the soap into the mouth, and to allow the skin to remain some days exposed before packing.

Common salt, powdered alum, and even wood ashes, may be used to rub upon the skin if the collector should not have the arsenical soap. If, however, he have none of these, it may be necessary, if the weather is warm, to lay the tail open to dry, rather than risk the loss of a valuable skin. When the collector has no preservative materials to aid him, he should not roll up and pack away the skin until perfectly dry.

It should have been remarked, that before commencing the

* To make arsenical soap.

Arsenic in powder	-	-	-	-	-	1 lb.
Camphor	-	-	-	-	-	2½ ounces.
White soap	-	-	-	-	-	1 lb.
Salt of tartar	-	-	-	-	-	6 ounces.
Powdered lime	-	-	-	-	-	2 ounces.

Cut the soap into small, thin slices, place it in a crucible with a small quantity of water over a slow fire, and stir it frequently with a wooden spatula. When melted, the lime and salt of tartar must be added, and well mixed. Then remove from the fire, and add the arsenic gently, and stir. Reduce the camphor with a small quantity of spirits of wine, and add it, mixing the whole well with the wooden spatula, and whilst off the fire. It may be heated again, gently, to secure a more perfect mixture; but much care is necessary, as the camphor rapidly evaporates. It is then to be removed, and poured into earthen or leaden vessels, and carefully secured. It should be handled with care, as it is a violent poison—a brush or mop should be used in applying it. When it becomes thick, it may be thinned with water.

skinning, if the subject be recently killed, the mouth and nose, and any wound that may be upon it, should be filled up with tow, flax, or cotton, to prevent soiling the skin.

Spirits of turpentine, or creosote, should be applied, if the collector should have either, to parts upon which flies may have made a deposite.

If the animal to be skinned be very large, as a buffalo, moose deer, elk, &c., it may be necessary to make the abdominal incision to extend to the throat or chin, and cross incision corresponding with and extending down the extremities.

In rolling up a dry skin, commence with the head, and introduce straw, hay, or grass, when necessary, to prevent rubbing, and to make the whole compact.

Skeletons of existing species are not only interesting physiologically, but very important in investigating the fossil remains of those that are extinct. In preparing them for transportation to a scientific institution, where they are to undergo a further and complete preparation, it is only necessary to remove all the flesh, skin, brain, and other soft parts, cartilages excepted, that can be conveniently done, and then to expose the skeleton in this condition until the little that is left becomes completely dry, when it is ready for packing. If the animal be large, it will be better to separate the head and extremities from the back bone and pelvis, for convenience in packing. This should be done at the appropriate joints. Skeletons may also be prepared by burying the subject, and allowing it to remain sufficiently long for the destruction of the soft parts. Natural skeletons of small animals are beautifully prepared by exposing the animal to the depredations of ants and wasps.

In packing skeletons, a separate box or bag should, if possible, be made for each one.

When the entire skeleton cannot be had, the head, at least, should be attempted to be secured.

It is only the smaller animals that can be conveniently preserved entire, which is done by immersion in spirits. The facility of skinning even these, however, renders this generally unnecessary.

Birds. There is considerable similarity between the opera-

tion of skinning a bird and that of a quadruped. The skin of the former is, however, generally more tender than the latter, and therefore requires somewhat more care. As in the quadruped, the first thing to be done is to stuff up the mouth, nostrils, and any wound that may be bleeding, with some appropriate material. If the collector kills his own birds, this should be attended to immediately after the bird is shot. In this case he can be more sure of taking it home in a condition proper for skinning, if he take the further precaution of laying it upon the ground a few minutes for the blood to coagulate, and then of carefully wrapping it up in paper before depositing it in his game bag.

Before commencing the skinning, the dimensions of the bird, from the point of the beak to the point of the tail, from one to the other tip of the extended wings, and, in peculiar cases, the length of the body and weight of the whole, should be ascertained and noted down.

As in quadrupeds, the first incision is made along the abdomen, from the pelvis to the breast bone, previously separating the feathers and down carefully with the fingers of the other hand, so as to expose the skin along the line of incision. Care should be taken not to puncture the abdominal cavity, as the consequent protrusion of the viscera will incommode the operator during the rest of the operation. The incision being made, the operator, with the handle of the knife, a flat smooth stick, or, what is still better in larger birds, his finger, proceeds gently to separate the skin from the subjacent parts, until he reaches the joint of the leg, then taking the foot of the bird in the other hand, he thrusts or pushes this joint forward upon the abdomen, until the joint is seen or felt, when the knife is to be introduced into it, so as to separate it, and all the soft parts about it, from the bone and soft parts of the thigh. This being accomplished on one, the same thing is necessary on the other side. The separation of the skin is then continued along the outside of the thighs and over the back, until all the lower portion of the body of the bird is separated from the skin, except at the root of the tail. Here the knife is again necessary to divide the bone at this

point ; for it must be recollected *particularly* that a small portion of bone must always be left here attached to the tail feathers, to give support in future stuffing, and to prevent their falling out. This accomplished, the skin is detached as before as far up as the wings. It should have been stated that it is generally advantageous to fracture the wings between what may be called the shoulder joint, and the first joint of the wing, before making the first incision; this may, however, be left until the operator shall have reached the present stage of the operation. Having made the fracture: which can be easily done by laying the wing on the edge of the table or a board, and giving it a gentle blow: the finger or instrument is carefully passed around the wing, between the skin and subjacent parts, until the place of fracture is reached, when the knife is used to separate the soft parts also at this point. This done on one side, it becomes more easy, by continuing the skinning over the back and breast, to do the same with the other wing. The skin of the neck is then gradually inverted, and the neck drawn out until the base of the skull is exposed, at which point the neck is cut through and the body removed. In some instances, as in ducks, coots, woodpeckers, and other birds with large heads and small necks, the skin of the neck cannot be drawn over the head in this manner ; in these cases it is necessary to divide the neck as high up in the skin as it can be safely done, and then make an incision along the side of the head, or under the throat, sufficiently large to turn out the portion of the neck left, and finally the skull. Having cut off this portion of the neck, the operator then proceeds in both cases to separate the skin from the skull down to the bill, removes the eyes and tongue, and any flesh that may present about the head or jaws, and finally opens the skull posteriorly, and evacuates its cavities of the brain. It is then left in this position attached to the skin, and the operator proceeds to skin the extremities; when this is done, and the soft parts are removed from the bones, he anoints these and the skin on the *fleshy or inside* with the arsenical soap, if he have it, or if not he rubs them with salt, alum, or ashes, then wraps a small quantity of tow or flax around the bones, and re-

turns them into the skin. In like manner, the skin is separated in the wings from the soft parts, these removed, the bones and skin anointed or rubbed, and the former wrapped and returned into the skin. This separation of the skin on the wing should be carried only to the joint next the fracture. If there be so much flesh on the lower or outer parts of the wing as to require removal, it should be done by a distinct incision made on the under side of the wing. In which case, after anointing or rubbing the interior with the preservative, the edges of the incision should be carefully brought together.

This being accomplished, the head and skin of the neck should be anointed, or well rubbed with a preservative, and placed in their natural position. Before returning it, however, the cavity of the eye should be filled with a small ball of tow, flax, or cotton. If an incision has been made in the neck, this should be carefully stitched up. A loosely-rolled string of tow or flax should be drawn through and left in the neck. The interior of the skin of the body is then anointed with the soap or rubbed with a preservative, a roll of tow, flax, or cotton, about the size of the body introduced; and the skin drawn nicely over it. As the skin, however, is liable to be distorted or contracted in drying, it is well to take the measure of the length of the body of the bird on a light stick or reed, and introduce this into the cavity, with the last roll of tow or other material, as a guide to the stuffer.

It is not always possible to tell, from the plumage or other external characters, the sex of the bird the operator has in his hands. It is therefore necessary, in cases of doubt, to preserve the body for examination to settle the question. This examination is made by an incision across the abdomen and turning out the intestines. Beneath these, by the side of or on the back bone, a little above the pelvis, two small bodies in the male, and one in the female, will be found. At certain seasons of the year, in many birds, these bodies are so small as to be discovered with difficulty. It will be well, therefore, for the operator to make the examination frequently on birds whose sexes may be known by other indications, so as to familiarize himself with the subject. Before dismissing the remains, the operator should

look into the crop or craw, if it be a strange bird, to ascertain, if possible, the food on which it subsists.

Having thus ascertained its sex, size, food, the whole, with the time and place at which killed, its habits, if they can be known, and every thing else relating to it, in anywise interesting, should be carefully noted down, and a copy thereof, in the form of a label, attached to the specimen.

Great care should be taken in skinning birds to prevent the plumage from being soiled with the blood or oil. If either should get on the specimen, it should be immediately removed with a soft rag and warm water. A little weak lie or weak solution of pearlash may be necessary to remove the oil. Be careful to wet the feathers as little as possible. When the bird being operated upon is very fat, it may be necessary to sprinkle powdered chalk, wheat bran, or other drying powder on the body occasionally during the process of skinning.*

If possible, one of each sex, full grown, and one or two of the young should be obtained.

Finally, after having partially stuffed and prepared the skin, as directed, it should be laid out on a table or board, its plumage carefully smoothed down, its wings closely approximated to its side, and several strips of paper pinned entirely around it, and thus laid away for packing.

No bird should be skinned that has lost any of its wing or tail feathers, or whose body-plumage has been seriously injured.

The directions given for preparing the skeletons of quadrupeds will suffice to enable any one to prepare those of birds for transportation.

Birds might, perhaps, be preserved in spirits, but it would be at the cost of the plumage.

In preparing the skeleton, notes should be taken and a label prepared in the same manner as in the skin.

Whenever practicable, a nest and eggs of the same species of bird as those prepared should be obtained. The eggs may be preserved by making a small hole at each end of the shell and

* There is another process of skinning birds, by making the first incision under the wing or the side. It is not deemed necessary, however, to describe it.

blowing out the contents. If they contain young, a larger hole on the side will permit its extraction. Of course, very great care will be necessary in packing the eggs.

The notes on the nest and eggs should, if possible, state the name of the bird to which they belong, where usually built, the usual number of eggs in a nest, and such other matter as may be deemed relevant or interesting.

REPTILES.

Turtles and Tortoises require, first, the separation of the breast from the back shell, which must be done by means of a knife or chisel, care being taken not to fracture the shells. Divide the other integuments, and remove the flesh and soft parts in the body, extremities, and head as clean as possible; anoint or rub with a preservative. Stuff slightly the extremities and neck, and unite the shells, by wrapping or by boring one or two small holes in each side and tying them together.

Crocodiles and Alligators are skinned much in the same manner as quadrupeds, and should be treated in the same way. *Lizards* require some care at the tail, as this member is easily separated from the body.

Serpents may be skinned: though they require care to prevent injury to the scales: by an opening along the sides. The scales should never be divided, as they are important in designating *species*. Some caution is also necessary about the head of those that are venomous, on account of their fangs. The brain is removed, and the head cleaned in the same manner as in birds. The skin should be anointed or rubbed with some preservative, and may then, or after having dried, be rolled up. There is nothing in the skin to be retained except the head.

Frogs and Toads are prepared by opening the mouth, cutting the first vertebra, removing the whole inside of the mouth, which is best done with a pair of scissors; then raising up the jaws, and drawing the whole body out at the mouth. The bones of the leg are then denuded, and anointed or rubbed, and rolled, and returned to their natural position. And the body and mouth anointed and stuffed.

The skeletons of crocodiles and alligators may be prepared much as in quadrupeds. But it is scarcely worth the labor in an ordinary collector to attempt to prepare those of smaller species or genera.

These smaller species are best preserved entire in spirits, in which condition they serve as well for the scientific naturalist to operate upon as if recently killed.

Fishes.—The fishes of our country present a highly interesting and as yet but partially explored field for the naturalist. Many species, and perhaps genera, existing in the rivers and lakes of the interior of our country, are but imperfectly, if at all, known to the scientific world.

To *skin* a fish of an ordinary form and character, an incision is made along the side, from the gills to the tail, and following the line usually seen on the side. Those with scales that easily rub off require precaution in skinning, to preserve them in their places. If the collector catches his own fish, he should either allow them to die in the water or suspended in the air. In either instance he should, soon after death, spread out the fins and tail, and keep them in this position by applying along each side of them a thin strip of wood, and securely tying the ends together. If the scales be very loose, the fish should be enveloped whilst moist in thin tissue or other absorbent paper, or thin cambric. This may be allowed to dry and remain on, even after the fish is prepared for transportation, as it will serve to protect the scales when packed up. The attachment of the muscles to the skin in fishes, makes it somewhat more difficult to remove this integument in them than in quadrupeds, but fortunately such *clean work* is not necessary in the former as the latter, as the flesh of fishes is generally easily preserved. It must, however, be removed as perfectly as possible, not only from the body but the head also, and all the fimbriated or fringe-like portions of the gills clipped with a pair of scissors from the cartilages to which they are attached. It is not necessary to dwell minutely on the various steps in the ordinary process of skinning, as the operation is very plain to one who has divested a quadruped or bird of its integuments. Some of the larger ones are opened on the belly. In

sharks and some others the incision is extended from the head to the tail fin. By dissecting back, the vertebra is reached near the head, and separated, and the whole body dissected out and removed. The skin is then drawn over the head to admit of the removal of such portions of the flesh and cartilage as may be adhering to it. The skin is then slightly stuffed, after being anointed or rubbed with a preservative, and sowed up. Eels may be skinned in the same manner as frogs.

It is not necessary to dwell on the preparation of the skeletons of fishes. They generally require more care than might be expected from any other than a practised naturalist.

The best method of preserving fishes, of a small or even moderately large size, will be in spirits. These, even of a foot in length, may be preserved in this way, if the collector take the precaution, which should always be done, of making a small incision into the abdomen to admit the spirits into the interior. They may be packed in glass or earthen ware, but the most convenient method is the following, which may also be applied to reptiles, insects, &c.: Take a water-tight keg, remove one of the heads, and commence by covering the bottom with a layer of tow or flax wetted with spirits. On this pack a layer of fishes, then another layer of wetted tow or flax, followed by another layer of fishes, and so on until the keg is filled. The packer should also take the precaution to interpose the wetted tow or flax between the fish and the sides of the keg. The keg is then closed or headed up, a small hole bored into it, and as much more spirits introduced as it will hold or absorb. This hole then being tightly plugged, the keg and its contents may be transported any distance.

Except where *spirits of wine* is particularly mentioned, the spirits used for preservation should be as nearly colorless as possible and about the strength called fourth proof.

Fish and any other animal packed in this way, or preserved in spirits, should have a small piece of wood or lead attached to it, with a mark corresponding to one in the collector's notes. These notes should be as full as possible, giving the common name, if it have one, its locality, and time at which taken, its habits, ordinary size, uses, &c.

Heads of fishes too large to pack, with some of the scales, may be preserved in this way, when circumstances do not permit the skinning of the whole fish.

Eels, and such other fish as are covered with mucous or slime, should be carefully washed before being placed in spirits.*

INVERTEBRATE ANIMALS, OR ANIMALS WITHOUT A SPINE OR VERTEBRA.

Mollusca or Shell-fish.—The animals themselves can only be preserved in spirits. The covering or shell is the part that will more particularly attract the attention of the collector.

Shells may be naturally divided into those of land and water, and the latter sub-divided into salt and fresh water. Another arrangement, quite as natural, is into univalves, (as snails,) bivalves, (as oysters, muscles, &c.,) and multivalves, (as barnacles.)

Generally, all shells, but particularly the fresh water and land ones, should be collected with the animal in them alive. After its death, the shell is liable to lose its epidermis and internal brilliancy, and thus become lessened in beauty and value in the cabinet.

The collector will find shells of some kind in almost every considerable body of water that has a permanent existence. Rivers, creeks, lakes, and ponds, as well as the sea-shore, will repay his labors in this branch of natural history. Some of the univalves will be found floating about or attached to submerged vegetation or other material; but the bivalves will be generally found in the mud or fastened permanently to rocks or something else at the bottom. Fresh water bivalves may be found in clear shallow water very readily, generally by their tracks through the mud; but as this is a condition of things not always to be expected, they must be caught by raking or grappling with the hand. Many shells secrete them-

* Before packing fish or small animals in spirits, it is well to keep them immersed in this fluid some days. It may even be necessary to change the fluid once or oftener; this necessity can be known by ascertaining whether the spirits has lost its flavor, or the specimens begin to show indications of decay.

selves deep in the mud or sand, or under stones, timber, &c. This should be recollected in collecting. Land shells are generally found in woods and shady places, and make their appearance abroad most numerous just after a shower of rain.

Bivalves (oysters, muscles, &c.) can be easily made to open their valves by pouring upon them hot water. When opened in this manner a thin sharp knife is introduced to separate the muscle that closes the valves, and then no further difficulty presents itself to the removal of the animal. The connexion of the valves at the hinge joint should be preserved if possible. If the shell be not clean it should be made so before opening it. If it is likely to be some time before the collector can send the shell to its destination, a little sweet or linseed oil should be rubbed upon it.

Univalves (snails, &c.) should be boiled some minutes in water to harden the animal, when it can be withdrawn by a hook. Care should be taken to withdraw, if possible, the whole animal. Attached to many univalve animals is a small, flat, and somewhat circular shell, called the operculum, which just closes the mouth of the principal shell; this should always be removed from the animal and preserved with the shell. Multivalves may be generally treated as univalves.

Marine shells should be deposited an hour or two in fresh water before they are packed up.

Be careful to label every specimen, with the locality, and time at which taken, &c. If there be any thing peculiar in the temperature or otherwise of the water, it should also be noted.

Crustacea, or lobsters, crabs, &c. The flesh is extracted from the large claws of crabs and lobsters, by making a small opening in the shell. That in the body of the crab is easily removed on separating the two shells. To get at that in the body of the lobster, it is necessary to separate the body from the lower parts, and after the flesh is removed to glue or cement them together again. Preservative powders of some kind, or a solution of corrosive of sublimate, should be applied to the internal surfaces. In drying these shells be careful not to expose them to too great heat, as they have a strong tendency to become red.

The smaller species of lobster and other crustaceous animals may be preserved and transported without the removal of the fleshy matter. Great care, however, is necessary in packing all of them, to prevent the destruction of their claws and feelers. Smaller ones should be put up in cotton, wool, or other soft material.

Asterias, or star-fish, are difficult to preserve; they must be immersed in fresh water several hours, and then extended on a plank and the rays pinned down until dry. The flesh should be removed from the larger species, and some preservative introduced. Great care is necessary in packing them.

Echini and *Spataugus*, sea urchins and sea eggs. These are also difficult to preserve, in consequence of the spines, which are very difficult to retain in their natural positions. They are also very liable to fall off by their own weight whilst drying. The interior of the shell should be removed by enlarging the anal opening. It should then be immersed for fifteen or twenty minutes in fresh water, and on being taken out it should be filled with cotton, and the same material placed among the spines to support them, and then exposed to dry. The packing necessarily requires great care.

Entozoa, or worms, are best preserved in spirits, as are also *arachnides* or *spiders*. The latter, however, particularly the larger ones, are liable to shrink up in the body, to prevent which a puncture should be made, the contents squeezed out, and the cavity filled with cotton.

Insects.—The whole of the class, with a few exceptions, as butterflies, moths, and sphinges, had better be preserved in spirits. Butterflies, &c. should be preserved by having a pin run through the body and into a soft board; whilst the wings should be kept extended by strips of paper pinned across them.

Notes should be taken of such as are useful in the arts or otherwise.

The collector of insects should have constantly in his pocket a small vial, (2 ounce,) with a large mouth, and containing a small quantity of spirits, in which to secure and preserve such as he may occasionally catch. There is a long thin species of pin made especially for the purpose of securing those little

animals, called insect pins, of which the collector should also, if possible, have a supply, for such as it would not be proper to immerse in spirits. If these pins cannot be had, the ordinary dressing pin must be substituted, and for those insects that are very small the finest needle may be used. For transportation, these pins or needles should be firmly inserted or stuck into the bottom of a close sear or other box. The interior of the box should be anointed with the arsenical soap, or strongly impregnated with spirits of turpentine, whilst the crevices and cracks should be completely stopped by pasting over them paper, or by other means. Those insects that do not die at once by the insertion of the pin should be destroyed by holding under them a burning sulphur match, or by running a red-hot pin into their bodies. It is not cruelty to put a speedy termination to their torture.

Polypi, or corals, madrepores, &c., have their solid parts easily preserved. It is only necessary to immerse them a few hours in fresh water and then dry them thoroughly. They are then ready for packing.

VEGETBLE KINGDOM.

Botany.—Specimens of plants, shrubs, trees, &c., should always be obtained. The flower is the part more especially to be selected, but this should always be accompanied by more or less of the leaves, and on the same stem or twig, if possible. In herbs, it is generally necessary, if it be not too large, to collect the whole plant, root and all.

The collector must have with him a quire or more of brown or other absorbing paper; old newspapers answer very well. Immediately on collecting a plant and cleansing the root, if that part be taken, it must be laid carefully between the folds of the paper, with the leaves and flowers well extended. Too many specimens must not be collected together in one bundle of paper. As soon as the collector arrives at home, he should transfer the specimens to fresh paper, and a much larger quantity, say 12 or 15 sheets, should be interposed between the specimens. Stems, or other parts that are very thick, should be split, whilst the bulbs of bulbous plants should

be immersed in boiling water for a minute or two before putting up in this way. When packed, the whole should be deposited between two boards, and considerable weight or pressure applied upon them. They should not be allowed to remain in this way more than twenty-four, and, if the plants be very succulent, not more than twelve hours; at the end of which time, they should be removed from this paper to other that is fresh and dry, and again submitted to the same pressure. After a few days, the change may be at greater intervals, until the specimens become perfectly dry. Then they are to be removed to the paper in which they are to be permanently kept, in which condition, an interval of one sheet is sufficient between each specimen. If this care be not taken, the specimens are liable to turn black and be ruined.

As soon as a specimen is collected, a label should be prepared and placed with it, and constantly kept with it in all its transfers. This label should state the place and time of collection; whether the plant be of land or water; if the latter, fresh or salt, the kind of soil in which it grows; its name, where found; its uses, if any; its mode of manufacture, if converted to useful or other purposes; the color and odor of its flowers, and any thing else interesting or important connected with it.

The collector must not refuse to collect a specimen because he thinks it common at the place to which he wishes to send his collections. It is an important question to determine the geographical distribution of the vegetable kingdom, and this can only be done by knowing the various localities in which a plant may be found.

Sea weeds should be immersed a few hours in fresh water before they are put up.

If possible, the collector should obtain the fruit or seed, not only of the specimens collected, but of any other vegetable. These should be wrapped up carefully with a label. They should be retained in or accompanied by the pod, capsule, or other covering in which they have grown, if this be not of a perishable nature. De Candolle recommends that seeds from a moist country should be packed in charcoal pulverized.

Seeds of an oily nature may be packed in sand, if they have to undergo long transportation. Fruits must be preserved in spirits.

A section of the trunk of any rare or interesting tree should be obtained. If the tree be not more than a foot in diameter, a section of the whole trunk may be preserved; if the diameter be greater, then the fourth or less quantity will be sufficient, being careful, however, always to embrace the pith, and to preserve the bark attached to the specimen. Its height or thickness may be about four inches. Labels should accompany each, as full in description as for the specimens of plants.

MINERAL KINGDOM.

Geology.—The object of a geological specimen is to show the general character of the rock, clay, sand, or marl of some particular spot, bed, or formation. It should, therefore, have the very reverse of a curious or anomalous character, at the place where obtained. In other words, it should represent the most common characters in the formation to which it belongs, and should always be selected from rocks, clay, &c., *in situ* or fixed position. Specimens of geology that are solid should be of as uniform a size as possible; not too large, as their weight will be objectionable for transportation, nor too small to show the general character of the formation. They should be as near as possible as follows: six inches long, four wide, and one thick.

It should be recollected that a mere collection of specimens is of very limited importance, if unaccompanied with other information necessary to elucidate the condition under which the formation exists. The collector should, therefore, ascertain, as far as possible, the thickness of the formation represented by each specimen; whether it is horizontal, twisted, or inclined. The latter is called *dip*, and can only be properly judged of by seeing the bed on several of its edges, as in the bluffs of a crooked river or creek. This dip should be stated in degrees, counting from the horizontal, and the *direction* given by the compass. He should ascertain if there be any fossils, as shells impression of vegetables, fishes, or the like, in any of the strata; and, if so, obtain as many of them as possible, and be careful

to refer the fossil to its proper specimen or formation. He should be careful to ascertain if it contains any mineral, in veins, beds, or otherwise, connected with it; whether it has been subject to any thing like a fracture; and if so, whether there has been a displacement of the beds, that is, if the beds on one side of the fracture are higher than the same beds on the other side; and whether the fracture be simple or filled up by a rock different from any composing the beds or the earth above; if different, specimens of it should be obtained.

The collector should have with him one or two hammers, weighing one or two pounds, and should make his specimens into the proper size and form on the spot. Care should be taken to make all the fractures from the edges, as no hammer-marks should appear on the faces of the specimens. Clays and marls may be cut into proper size, and sands should be collected in quantities equivalent to the solid specimens. Each specimen should be carefully wrapped in sufficient paper, and accompanied with a label setting forth the locality, thickness, relation to other beds, dip, and all other matters, including reference to fossils, that may appear to relate to it. Where the beds or strata present any differences, and particularly where these differences are remarkable, as between sandstone and limestone, gneiss and marble, or where there is a diversity in the dip of neighboring strata, care should be taken to obtain specimens for each. If the collector is familiar with drawing, a sketch of the bluff or *section*, as it is called, with numbers on the strata corresponding with the numbers of the specimens, will produce more distinct conception than the most lengthy description. This thing of numbering each of the strata on the specimen that the bluff or section presents is very important, even when not accompanied by a sketch. Always state on the number whether it counts from the top or bottom of the bluff.

If the region in which collections are being made produce metal of any kind, ascertain, if possible, the kind, and condition in which found, and obtain specimens. If this mineral or metal presents itself in regular beds or veins, ascertain the general thickness and direction of the vein. If the bed or vein has been opened; collect specimens from each one of the

strata through which it has passed, and number and label them regularly. If the vein should be generally more productive in one stratum or set of strata than another, note the fact, collect all statistical and historical matter that can be had in relation to the mine and neighboring country. If there should exist in the same region any igneous rocks, as they are called, that is granite, porphyry, trap, basalt, or lava, ascertain if possible their extent and appearance, and obtain specimens.

In coal regions, ascertain the extent, if possible, of the basin; that is the various places at which what appears to be the same bed of coal presents itself or is worked. Note the thickness of the bed, or beds, if there be several, collect specimens of each. Examine carefully for fossils. In the shale or slaty matter connected with the coal, vegetable impressions are often very abundant. Fail not to avail yourself of them. Where wells or borings are made to any considerable depth, ascertain the various strata passed through and collect any fossils that may thus be thrown out. If salt or other water has been sought for, ascertain the depth at which it was reached.

Where rolled masses of rock present themselves on or near the surface, ascertain whether they are similar to the rocks in bed in the same vicinity; if not, collect specimens of them.

If in excavating canals, railroads, sand-pits or marshes, fossils of any kind should be found, endeavor to obtain and preserve them. Instances are constantly occurring of the discovery of *mastodon* and other fossil bones in various parts of our country; if opportunities present for collecting them, the collector should avail himself of them. These bones are sometimes in such a condition that, on exposure to the air, they fall to pieces; in that case, the collector must prepare himself with some coarse varnish, or size made of common glue, and as soon as they are dry enough to admit of it, give them a coating of this varnish or size.

In Europe valuable deposits of fossil bones have been found in caves and crevices of rocks, by digging into the soil or loose earth commonly found in them. This has not been the case as yet to any considerable extent in this country; but it is a subject worthy the notice of the collector.

Shells, corals, &c. are found extensively in most of the limestone, &c. of our country, and generally in a state of petrification. The rule given for the size of geological specimens, strictly so called, of course does not embrace these fossils, even when smaller than the geological specimen: if they be imbedded in the rock: for no effort should be made to reduce the size of the containing rock that will endanger a valuable fossil.

The importance of collecting fossil remains cannot be too strongly impressed on the mind of the collector. To the geologist they are nature's hieroglyphics, by the study of which he is enabled to realize the various conditions in which animate and inanimate matters have existed on this earth, and the many revolutions to which it and they have been subject.

Mineralogy.—Mineralogical specimens should be carefully wrapped up with an accompanying label, and where the crystals are delicate or easily broken, they should be enveloped in cotton or other soft substance. Great care should always be taken to preserve crystals unfractured or unrubbed, and the faces of compact specimens unscratched. The size of mineralogical specimens must necessarily be very various: suitable labels should accompany each specimen.

CONCLUDING REMARKS.

The collector should be careful in packing to have his boxes tight and strong. The angles and cracks should be carefully caulked up and pitched internally and externally. Specimens of all kinds should not be indiscriminately packed together, as destruction must be the inevitable consequence in such a case to some of the more frail and tender. Geological, mineralogical, and other heavy specimens should be put up in separate boxes, even if these are subsequently introduced into the general or great box. Skins may be securely packed in tight whiskey or other spirit barrels. Snuff, tobacco, camphor, or small balls of cotton immersed in spirits of turpentine, should be always introduced with these skins to prevent the attack of bugs and worms. Injunctions should be given to those who transport these collections not to expose them to wet or rain, nor to pack them away in the damp part of a vessel, or in a damp cellar.