

Quills, Horn, Hair, Feathers, Claws, and Baleen

Found in such items as clothing ornaments, jewelry, and containers

Identification and General Information

These animal products, which are specialized forms of hair, come from a variety of birds and mammals, including large sea mammals. Generally, these materials have been used as decorative elements in various items rather than as structural parts or as tools. Although these materials are similar in composition, they are quite visually distinct from each other and from other materials, which aids in identification.

Quills, such as those taken from porcupines and birds, have usually been processed for use as decorations on garments, bags, and containers. They are split into strips and then colored with various pigments and vegetable dyes. The quill strips are arranged in patterns and sewn onto the item. The surface of a quill is compact and smooth. Where decorative quills have come loose from an item's surface, the ends may be slightly fibrous and can split lengthwise. Care must be taken to avoid further damage.

Horn is the outer covering of a bony outgrowth on an animal's skull. Horns are composed of very compact hair fibers that grow out of the skulls of large mammals. Unlike antlers, horns are permanent and are not seasonally shed. Horns have been used in many different ways, including being left attached to hides in headdresses, and as carved and formed utensils, such as spoons or containers. Horn has a smooth and somewhat shiny outer surface and a rough inner surface. It can be formed by heating or steaming and, once shaped, becomes rigid. Both surfaces can then be compacted and polished with an abrasive. When used in utensils, the horn has usually been prepared in that way.

Hair is found on virtually all mammals and is a specialized outgrowth of the skin. Many

mammals have an undercoat of soft, fine hairs and an outer coat of coarse, larger hairs called guard hairs. While the hairs of various animals differ greatly in size, color, and appearance, their basic structure is similar. Hairs are hollow tubes with scales on the exterior surface. The interior of the tubes may be filled with colored pigments or may be hollow. The microscopic identification of animals by their hair is relatively easy since the patterns of the scales and the interior pigments vary with the type of animal and species.

Feathers consist of a central shaft called a rachis, out of which extends the vane structures. The vanes are made up of thin barbs and barbules. These function like the hooks and loops on Velcro products and are what form the light, yet strong feather vane. When stripped of the vanes and split, the feather shaft can look similar to quills. Feathers can vary in appearance, depending on the type of bird that they come from, and where they grew on the bird. Tail and wing feathers, often called flight feathers, tend to be large relative to the size of the bird. Contour feathers are smaller vaned feathers that form the outline for the bird's body. The softer underfeathers, called downy feathers, are much smaller and more loosely structured and help insulate the bird. The color of feathers is generally due to a combination of natural dyes and the internal structure of the barbs and barbules.

Claws and talons are hard and compact outgrowths of the skin at the end of paws and feet. Claws are found on predatory mammals and birds, such as bears, wolves, eagles, and hawks. Generally, the claws are separated from the bones and are used whole. Often holes have been drilled in one end of the claw to allow for attachment as decoration to an item with a fiber, such as sinew. The surface appearance is hard, shiny, and slightly translucent. The color varies with the animal from which it was taken and with the condition of the claw.

Baleen is extracted from the mouths of humpback whales. Like horns, baleen is fused

hair. Baleen objects are processed by soaking in water, splitting, and sanding with an abrasive to a smooth, compact, and shiny surface. The color is usually dark. More recently made baleen objects may be coated with an oil or varnish to impart a more durable shine.

Quills, horn, hair, feathers, claws, and baleen are all composed of a fibrous protein called keratin. Keratin is different in structure from collagen, the protein in hide and skin, and has different properties of rigidity, compactness, and hardness. All of these materials (quills, horn, hair, etc.) are affected by water, which swells and softens them. This property can make these materials easier to work and shape when forming an object, but they should not be allowed to become wet in storage, display, or use, as they will soften, distort, and degrade over time. Excessive heat will speed up the chemical deterioration of these materials. Alkaline storage or display construction materials will cause the chemical deterioration of items made from these animal products, so it is important to use pH-neutral or unbuffered materials. Keratin is broken down over time by alkalis, or bases, such as calcium carbonate. Keratin-based items are also sensitive to chemical breakdown by ethanol and isopropynol, which may be used in cleaning. These chemicals will change the shape of the items by shrinking or swelling them. Since the surfaces of quills, horns, hair, claws, and baleen are hard and smooth, they are also susceptible to damage by abrasion.

In general, the conversion of quills, horn, antler, hair, feathers, claws, and baleen for use in items includes the following essential steps:

1. Separation from the skin or bones of the animal
2. Cleaning: removing the blood and other fluids
3. Washing: soaking in water to soften for shaping and working
4. Drying, done slowly to avoid cracking and splitting

5. Shaping: working quills, horn, claws, or baleen into the desired shape by cutting with stone or metal tools, grinding with stones (compacting), and polishing with abrasives
6. Finishing: decorating with pigments such as ochre or charcoal

The deterioration of these materials is caused by

- insect and rodent attack, especially on quills, horns, hair, and feathers;
- excess moisture, which leads to swelling, distortion, and deterioration of the materials and may promote mold growth;
- excess heat, which leads to destruction of the keratin protein and dehydration, which leads to shrinkage and cracking of the fibers;
- combination of excess heat and moisture, which can cause the keratin to be degraded, resulting in warping and cracking;
- acids and alkalies in inappropriate storage and display materials that degrade keratin;
- exposure to high light levels, which causes bleaching of the natural or dyed colors of hair, quill, and feathers and degrades all keratin materials.

Following descriptions further clarify these materials.

Quills: keratin-based specialized hair from porcupines.

Horn: keratin-based growth of compact hair; grows over a bony core on animal skulls.

Hair: keratin-based fiber that grows out of mammal skins; formed as hollow tubes with surface scales.

Feathers: keratin-based outgrowth of the skin of birds; the physical structure allows for

both low weight and strength.

Claws: keratin-based outgrowth of skin found on predatory mammals, reptiles, and birds.

Baleen: keratin-based fused hairs found in whales and used for capturing food by straining seawater through its comb-like structure.

Basic Care and Storage

A consistent temperature and humidity are particularly important for the preservation of these materials, as they are especially sensitive to moisture and heat. Follow the recommendations in

Basic Care.

To minimize temperature fluctuations, avoid storing and displaying items containing these materials in the direct line of a ventilation duct outlet. Storing items near radiators, heat pipes, outside windows, or incandescent lights can cause excessive drying.

Items with holes, straps, appendages, or other attachments must never be hung or supported by those attachments. A support can be provided under the item to hold it, and the handle or strap can be held in a natural position by additional supports.

Special Pest Concerns

Horn, baleen, and claw items are not particularly susceptible to insects. They can, however, be attacked by rodents and other small mammals that cause structural damage by gnawing on the surfaces of these items. Practicing good housekeeping, following an integrated pest management program, and employing pest control services regularly will help prevent infestations.

Vacuuming is particularly effective in keeping areas clean. Glue boards are a useful rodent monitoring and trapping device if used properly and checked regularly. Live traps are also a useful and humane control method. Consult your licensed pest control operator as to which

methods best suits your situation.

Quills, hair, and feathers are highly susceptible to insect attack and damage. All three materials are food for dermestid beetles, such as hide and carpet beetles. Dermestids are a group of beetles that scavenge and feed primarily on dried animal matter. Hair can also be attacked by clothes moths, which feed on wool and woolen products. Insect attacks on items made from these materials will leave holes, frass, and loose pieces.

Keratin-based items can also become infested with mold, particularly if the relative humidity in storage or display areas is allowed to exceed 60 percent for relatively long periods. Mold infestations can be recognized by white or greenish fuzzy growths on the surface of items. Good ventilation and air circulation in storage and display areas will help to prevent infestations. If mold growth does occur, take measures to reduce the relative humidity. Contact a conservator on how to clean the surfaces safely. Personal safety is the primary concern when dealing with mold infestations, as many types of mold can cause serious and permanent health problems.

Routine Handling

The general methods and techniques for handling all items apply to quills, horn, hair, feathers, claw, and baleen. These materials can be handled with bare hands as long as they are clean and dry. Body oils, however, can stain feathers and quills, especially those that are light colored. Wearing cotton or latex gloves is usually suggested when handling most items that include these materials.

When lifting and moving an item composed of or including these materials, make certain that it is supported well and that no stress is put on weak areas or attachment points. Use a tray or other support if necessary. This can be made from a piece of acid-free corrugated board that is cut to the standard sizes of drawers or other storage units.

Display Issues

The temperature and relative humidity ranges mentioned above in the Basic Care and Storage section also apply to display conditions. When displayed, items with quill, horn, hair, feather, claw, and baleen should be protected from high light levels, ultraviolet radiation, and heat from incandescent lights; inspected regularly for rodent, insect, and mold infestation and damage; and inspected regularly for changes in overall condition.

If items containing these materials are going to be displayed for an extended period, such as longer than one year, it is best to “rotate” them. Do not leave items colored with light-sensitive components, like natural or artificial dyes, on exhibit indefinitely, or irreparable fading and physical damage will occur. Incandescent floodlights inside cases and dioramas will generate heat and dry out the display items. The length of time that an item should be used for display depends on the particular item itself and the amount of light to which it will be exposed. Never display these items using natural light from windows or skylights. Both the visible and ultraviolet types of light in sunlight will fade and destroy these items in a relatively short time. By the time that you notice that dyes have faded, other more serious invisible damage may have been done. See *Display* for other general display concerns.

Mounts and Supports

External supports can be fabricated from acrylic plastic sheeting, such as Plexiglas, and shaped with heat to conform to an item’s surface shape. Avoid the use of unpadded wires and attaching items through existing holes with fasteners such as screws, as these will cause abrasion damage or corrosive stains. Adhesive mounts should also be avoided. These can cause irreversible damage as the adhesive breaks down, and may result in staining and loss of surface texture. In addition, if the adhesive bond fails, the item can fall from its mount. It is best to attach items to

mounts with padded wires or flat acrylic plastic clips.

Cleaning and Minor Repairs

Periodic inspection and maintenance is the best way to assure the long-term preservation of quills, horn, hair, feathers, claws, and baleen items.

Surface dust can be removed from quill, horn, claw, and baleen items with a variable speed vacuum, brushes, and micro-attachments. Distilled or deionized water with two to three drops of mild detergent, such as an unscented dish-washing soap, added to approximately a quart of water, can be used sparingly to remove dirt and finger marks. Follow this with the sparing use of plain water to rinse. Be careful when wet cleaning materials that are attached to skin, textiles, or basketry, which can stain easily. Care must also be taken to inspect the item before cleaning for loose attachments and fragile decorations such as flaking paint layers. Quills that are attached to an item, such as a hide shirt or woven fiber basket, may be loose at the ends. Do not vacuum quills that are in this condition, as the suction will cause the loose ends to break off. In this case, use a soft natural-bristle brush to remove dust.

Hair can be gently brushed and vacuumed to remove dust. If it is particularly stiff and brittle, do not continue cleaning. To remove surface dirt, some conservators wipe the hair in the direction it grows with water on a soft, lint-free cloth.

Feathers usually need surface cleaning and realignment of the barbules onto the barbs. This can be done by placing the feather on a smooth, hard surface, such as a piece of flat glass. The surfaces of the feather can be cleaned with a low-power vacuum with micro-attachments. The barbules can be reattached to the barbs by gently “preening” the feather with a soft natural-bristle brush or by fingers wearing cotton gloves. Some barbs may be permanently distorted or broken. In these cases, the barbules will not line up completely, and there will still be gaps

visible in the feather vanes, which is acceptable. If the feather shaft is broken, consult a conservator for further advice.

Avoid using liquid-based cleaners, detergents, or alcohol on keratin-based items, except as described above. If a greater level of cleaning is required, contact a conservator for further advice.

Using over-the-counter adhesives to repair cracks and breaks is discouraged, as these repairs are difficult to do and may result in staining and further deterioration. In addition, breaks and cracks can be evidence of use and may provide historical information. Unnecessary repair of such damage can obscure historical evidence. Consult a conservator if major repairs are needed or for advice on other alternatives.