



## CHAPTER 9

# METALS

*Bravely, you let go of my hand  
I can't speak, yet, you understand  
Where I go now, I go alone  
This path I walk, these days of stone  
And the angels are calling*

*I must go away  
Wait for me here  
Silently stay  
And don't ask me why  
Only believe  
This is not goodbye*

—Melissa Etheridge, *This Is Not Goodbye*

I had the great honor of surveying the records of the Gorham Manufacturing Company at the John Hay Library at Brown University. Jabez Gorham started the firm in 1831 in Providence, RI, by manufacturing silver spoons. After the Civil War, his son John increased the business exponentially by installing a steam-powered drop press that could stamp out dozens of spoons in an hour. Gorham is primarily known as a maker of silver products—flatware, hollowware, tea services, and candelabra. They also produced ecclesiastical products and had a stained-glass division. At the turn of the 20th century, Gorham was the largest manufacturer of bronze products including bronze architecture, bronze statues, memorial plaques, and small statuary. They



**Gorham Silver Tea Pot  
ca. 1860**





also produced hotel ware and a line of toilet ware products. Of note was their handwrought Martelé line that still commands high prices at auction today.

As a native Rhode Islander, I am proud of this industry that created lineage heirlooms for many families. While it is no longer common for people to receive silver tea sets upon marriage, those who already have tea sets in their family treasure them and want to ensure they are passed down to the next generation. This chapter will help you understand the special needs of metals and determine how to care for them so they will be treasured for generations to come.

Metals include silver, lead, gold, pewter, copper, bronze, and brass. You may have coins, Japanese metalwork, musical instruments, jewelry, and outdoor bronze sculptures. Humans have been creating objects from these materials for thousands of years. Gold and silver have been used since prehistoric times. Gold was possibly the first ore used decoratively by humans and was thought to have magical properties. Evidence suggests that copper was used as far back as 8000 BC. Beads made of meteoric iron were worn in Egypt as far back as 4000 BC. Ornaments, amulets, ceremonial objects, and weapons made of iron are traced back to 1900 BC. Lead has a long history of use by humans. Romans had iron pipes throughout their city and used lead for solder.

This chapter refers to historic and modern objects. If you have archaeological or ethnographic objects in your care, please contact a museum, professional conservator, or an archaeologist. The care of ancient artifacts is specialized and requires different procedures than what is outlined in this chapter.

Metals appear to be durable and lasting, but like everything else in our collections they will deteriorate, rust, green, or discolor over time. When comparing a bronze statue or a silver teapot to a photograph, an 18th-century letter, or a Victorian handkerchief, it is easy to see the metal piece as the strongest and the most durable. This may be true, but metals erode and will eventually turn to dust like everything else; it just might take a little bit longer. In the meantime, you want to do all you can to ensure their longest life and to protect them from the ravages of age. In truth, the metals in your collection may be the most valuable in terms of resale cost.

Metals begin their natural life as rock-like ores that are mined. The raw stock of metal ores is smelted into compounds or alloys through various processes. Working at high temperatures, artists and craftsmen shape and mold metals into artworks and objects that are both practical and aesthetic. Most metals found in our homes are alloys, which means they are a mixture of several metals. For example, bronze is an alloy combining mostly copper (typically 80%) and tin (typically 12%). The other 8% can be aluminum, nickel, zinc, or manganese. Silver is a very soft metal that commonly has other metals added to strengthen it. Sterling silver is an alloy containing 92.5% silver, with



copper and other metals making up the 7.5% balance. 18K yellow gold is made up of 75% gold, with copper, silver, zinc, or cobalt making up the balance.<sup>26</sup> Almost immediately after the artist has completed their work, metals begin to revert to their natural state through processes called corrosion, oxidation, and rust. We are all familiar with rust on our cars and on other metals that spend most of their time outdoors. Many of us have taken measures to keep the tarnishing demons off our silver spoons or a silver coffee pot. Sometimes a thin layer of oxidation that forms an even coloring to an object, called a patina, adds to the beauty and attractiveness of a metal object. Artists sometimes add patina to an object by using chemicals or lacquers. Do not confuse man-made patinas with patinas that form during the process of deterioration. They are quite different. In most cases we want to keep the forces of deterioration at bay.

## ENVIRONMENT

As with other parts of our collections, environment plays a key role in lengthening the life of metal objects. Establishing and maintaining the optimum environment for metals can be challenging for most homeowners. In the case of metals, humidity is the greatest enemy, followed by interior pollution. Most of us are aware that moisture is extremely damaging to metals. Metals will corrode on contact with water. RH should remain between 40% and 45% with 50% being the extreme maximum. If your metal objects are already showing evidence of deterioration, keep them in an environment with 35% humidity until a conservator can look at them and advise how to care for the pieces. Early signs of corrosion may show up as watery or powdery areas on the object. Please refer to the section called “Environment” in Chapter 1 to find the best location in your home for storing metal objects. The basement is probably not the best place. Using dehumidifiers and air conditioners will help promote dryness.

Temperature in and of itself does not affect metals. Temperature is important only in its relationship to RH, which is inverse: as temperatures rise, RH decreases; as temperatures fall, RH increases. To remember this formula, keep in mind that dew is on the grass in the early morning when temperatures have cooled, not at midday when temperatures have risen and are at their hottest. Temperature stability is vital. In a small, enclosed area, a sudden drop in temperature can cause condensation. Metal contracts and expands with increases and decreases in temperature,



### ARCHIVES TIP

**In the case of metals, humidity is the greatest enemy, followed by interior pollution**



### ARCHIVES TIP

**RH should remain between 40% and 45% with 50% being the extreme maximum.**

which stresses an object and accelerates deterioration. Keeping temperatures high to create a drier environment should be done with extreme caution. High temperatures increase the rate of corrosion in objects that have already begun to deteriorate. It is best to keep objects at a moderate temperature. The greatest challenge for the average homeowner is maintaining stability in the environment. It is not enough to reach the optimum temperature and RH goal. They must both be kept stable at that goal too. If you do not have the resources necessary to do

**ARCHIVES TIP**

**The hidden culprit that damages metals is indoor pollutants, including dust.**



this, do the best you can with what you have, or consider housing the materials with a relative who may have a better environment than you do. You could also keep them at a professional storage facility or if the objects are historically relevant, donate them to an archive, historic home, or historical society.

The hidden culprit that damages metals is indoor pollutants, including dust. Most people are aware of air pollution outside our homes caused by automobiles and industrial waste, but they are unaware of how many pollutants within our homes can be damaging to our collections. This is especially true for metals, which are highly sensitive to moisture, different gases, acids, and alkali. Dyed fabrics, wooden cabinets, plastics, glues, and products with formaldehyde can all emit harmful gases, corrosive acids, and damaging alkalis that accelerate the deterioration of different metals. Cigarette smoke causes silver and copper alloys to discolor or corrode. Rubber products can off-gas pollutants that can cause discoloration. Salts, oils, acids, and other chemicals damage metals. Even certain aggressive metal polishes can accelerate deterioration. Mishandling objects can cause breakage or scratching, and this can create sensitive areas at risk of quicker corrosion. If possible, keep metal objects covered and free from dust. Hutches with glass doors or glass frames for smaller objects provide a great place to display beautiful family heirlooms while protecting artwork from interior pollution.



**Gorham Coffee  
Urn, 1874;  
Silver with parcel  
gilding**

Typically, higher or “noble” metals corrode at a slower pace than base metals. Gold normally does not corrode at all. Silver is relatively stable and tarnishes less quickly than base metals such as copper, tin, and lead. Iron corrodes very easily.

Metals are said to be *electrically active* when two metals are in direct contact with each other (not to be confused with alloys that make up the metal itself). Corrugated iron is an example of an electrically active metal. The problem that occurs in electrically active metal



is that one metal can deteriorate more quickly than the other. This process is called *galvanic corrosion* or *bimetallic corrosion*. Corrugated iron is made up of a sheet of iron covered with zinc. Zinc, being the base metal, deteriorates first. The iron base does not corrode until after all the zinc has been consumed. Engineers were faced with this type of problem in the Statue of Liberty. Corrosion occurred when the insulating shellac layer between the outer copper skin and the inner iron support failed. The iron supports began to rust, while the copper exterior remained untouched.<sup>27</sup> To correct the problem, the shellac layer was replaced with a more modern synthetic compound. If you are unsure whether something in your home may be causing your metal objects to deteriorate, purchase a small piece of lead from a local hardware store and place it in the area of concern. If whitish spots form on the lead, there is something in the space that is harming your metal heirlooms.

After following the instructions in this chapter for handling, displaying, and storing metals, if you still have not identified the cause of deterioration, contact a conservator for specific advice. Metals come from many different sources, they are made through many different processes, and there are many types of materials that can damage them. Because metals have special needs, and because the value of the objects is high, it is worth having a professional conservator definitively determine the problem.

One of the best ways to stop the deterioration of metal objects is to examine them. Every now and then, take your grandmother's silver tea set out of the closet and look at it. Examine your mother's pewter candelabra. Check the backside of your uncle's bronze star. Do not forget that gold piece of your great-grandmother's. Look for tarnishing, rust, discoloration, and flaking. Remedy the situation before it becomes too extreme. Prevention is much less costly than repairing a damaged object. You do not want to open the drawer containing your ancestor's Civil War Campaign medal to find it has crumbled back to its original ore state and looks like a simple pile of dirt.

## HANDLING

Improper handling of metal objects can result in breakage, pitting, denting, or bending. Always wear clean gloves when handling metal objects. Nitrile gloves are the gloves of choice today for many archivists and conservators. Powder-free disposable nitrile gloves are safe for handling metal objects as long as they are not treated with an accelerant. Soft cotton archival gloves purchased from archival supply houses (some given out free) will also protect metals from harmful fingerprints. You should dispose of nitrile gloves after one or two uses and wash white gloves after they become visibly soiled. If you want to be extra, extra

careful, wear nitrile gloves underneath white cotton gloves. Oils and damaging salts from hands can leave marks on metals that may not show up for years. Sometimes these telltale marks can be removed, other times a fingerprint can be permanently etched into an object. This not only ruins the object for our own enjoyment, but it renders the item less valuable to a collector.

Author Photo



**Glocester Fisherman**

Looks can be deceiving with metal objects. A bronze statue may look sturdy when in actuality it is in a highly brittle state. If not handled properly, it will easily break or fall apart. When picking up metal objects, never grab or pull by a protruding part, including handles that were meant for this purpose. Solder often deteriorates faster than the metal object itself and can easily break off. Lift items with both hands, placing one hand underneath. Move slowly and place the object down gently. If a section comes apart, such as the handle of a tea pot, wrap it in acid-free tissue paper and place it inside the object. You could also wrap it in acid-free tissue paper and put

it in the same box with the tea pot. You want to wrap it in tissue paper so it does not get scratched or cause scratches, and you want to keep it with the original object so that it is not misplaced. To replace broken pieces, contact a conservator. Improper restoration by an unqualified individual may cause more harm, including discoloration, brittleness, or cracking.

When transporting an object to a conservator, place it in a sturdy box and surround it gently with either acid-free tissue paper or polyethylene foam padding such as ethafoam. Do not use wool or cotton wrapping materials because the fibers can get caught in metal fissures and textures and will be difficult or impossible to remove.

Many metal objects have inherent vice. As discussed in Chapter 7, inherent vice means that the materials used to create the object are the same materials that will cause or accelerate its destruction, such as wood pulp in paper and leaded silk in clothing. Metals have the same problem, meaning that unless you have specific knowledge about the way a piece was created, you could be deceived into thinking it is sturdier and stronger than it actually is.

When cleaning metal, do not wear rings or other items that might scratch it. Do not over clean or polish metal objects and avoid using harsh or abrasive cleaners. Excessive rubbing, chemical cleaners, and abrasive polishes will remove a thin layer of the surface each time a piece is cleaned. Important information such as maker's marks, personalized engravings, monograms, and decorative surfaces can all be worn away with cleaning methods that are too



aggressive, or too harsh. Always use mild and nonabrasive techniques. If you use metal objects such as silver flatware, a silver teapot, or gold jewelry in your daily activities, be sure to clean them gently before storing them away again. Proper storage (discussed below) helps ensure necessary cleaning is kept to a minimum. Never apply tape to a metal object; the adhesive residue may leave a permanent mark.

## DISPLAY

The best way to display metal objects is in an enclosed case such as a hutch, frame, or professional display case. When displaying metals, be mindful of environmental concerns such as temperature, humidity, and pollutants. Museum curators place a small hygrometer inside a display case to measure temperature and humidity.

Depending on the type of display you are creating, you may want to use textiles or paper to enhance the beauty of the display and highlight the attractiveness of the metal artwork. You can do this, but you need to consider a few precautionary measures. Of main concern is that the other materials in the surrounding area need to be inert, meaning they will not cause damage to the metal. Certain fabrics or fabric finishes can damage metals. Do not store wool near metals, wool contains sulfur that will eventually attack the metal. Cotton, linen, or synthetic fabrics are a better choice, but thoroughly wash and rinse them before they come in contact with your aunt's silver tea set.

Another thing to consider is that even if the cloth itself is not harmful to metal, the finishing products such as dyes, fire retardants, and sizing or soil-releasing agents may be. Testing for these products is expensive and time consuming. Unless you have unlimited resources, it is better to err on the side of caution. If you are unsure of the makeup of the fabric you are using, do not use it. Knowledgeable and experienced sales staff at your local fabric store may be able to advise you about the make-up of certain fabrics. Be cautious even with organic fabrics since they can still contain harmful finishes and dyes. Special anti-tarnish papers and cloths will absorb sulfur in the immediate area and can be used in a display case. Corrosion inhibitors, which are chemical compounds that decrease the corrosion rate of metal, are not designed for delicate metals and should not be used. Typically, a corrosion inhibitor will emit vapors that can alter the color of metals.



GMI Companies

**Displaying metal objects safely**



Lighting is another important consideration. Metals are heat conductors and can increase and decrease their temperature quickly. Lights used in a display can rapidly increase the temperature inside a display case. Turning lights on and off daily can lead to a slight amount of condensation that can cause rust. Decorating with light can add to the beauty of the objects you are displaying, but keep in mind that the lights in your curio cabinet or antique hutch can damage the silver spoons housed inside. Use a hygrometer to measure the highs and lows of temperature and RH in a twenty-four-hour period. This will alert you to any extreme fluctuations. LED lights emit far less heat than traditional incandescent lights. If you have your metals in an area with lighting that will only be used periodically, say at the holidays, do not stress out too much. If you are concerned condensation has formed during the day, check the materials at the end of the day and remove any moisture.

If you will be mounting metal objects for display, be sure that the mounting materials will not scratch or damage them. Since metal objects can be considerably heavy, mounting materials should be sturdy and strong. Do not hang items by their protruding parts such as handles, stems, or arms. Breakage is more likely in these areas, especially if they are fastened to the main object using solder. Instead, select the area of the object that is most structurally sound. Pad the mounts with synthetic fiber, felt, or a thick layer of acrylic resin. You should be able to purchase these items at a good art supply store. Cover mounting pins with acrylic resin or plastic tubing made of polyethylene or Teflon. Plasticine and oil-based modeling clays usually contain sulfur and should not be used. Be cautious of rubber bands, as they can leave black lines that may not be removable. Archival supply stores often have specialized display cases and mounting materials that might work best for what you have in mind. For example, Hollinger Metal Edge has specialized acrylic displays for swords and rifles. So cool!

## **STORAGE**

As discussed earlier, temperature, humidity, and environmental pollutants are of greatest concern when selecting the best storage area for metals. Being mindful of any sources of moisture that may damage metals will be of top priority. Install a dehumidifier or a good air conditioner if necessary. You can use silica gels in localized areas. Archival warehouses sell certain display materials with silica gel as part of the display.

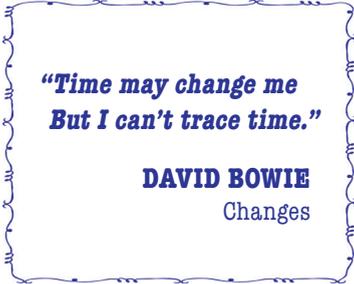
In addition to finding the best the location within your home, be sure not to use packaging materials that will hold in or trap moisture. Plastics, especially PVC, should not come in contact with metals. Even “good” plastics (i.e., archival-sound, inert plastics such as polyethylene) can trap in moisture, resulting



in rusting. As is true in all areas of your collection, PVC softens over time and can stick to materials. Most of the cheap plastic found in department stores and office supply stores for use in binders, plastic sheets, and shipping materials are made of PVC. As they deteriorate, they become soft and stick to whatever surfaces they touch. They also emit harmful gases that form acids when exposed to light and moisture. Not good. If using archival plastic like polyethylene, be sure to create some ventilation so that moisture does not get trapped between the plastic and the object. Many art supply and office supply stores do carry good polyethylene supplies today, but make sure to read the labels and be sure you are buying inert plastic.

Some practical steps to take include making sure shelves are sturdy enough to hold heavy metal objects. Do not overcrowd objects or put stress on protruding stems, arms, or handles. If an object is wobbly, lay it flat. Be sure to cover the objects so that the surface is not scratched by nearby items. If placing objects open on a shelf for storage, cover them with acid-free tissue paper. Metal should either be in an area that is dust-free or be checked regularly and dusted.

The ideal storage shelves for metal objects are metal shelves or cabinets made with powder-coated steel, which is made from thinly divided synthetic polymers fused onto steel. A second choice is anodized aluminum shelving or cabinets that are nonreactive and uncoated. Chrome plated, open-wire steel shelving is another option, as long as the objects are not placed directly on the shelves. Place objects in archival boxes before safely storing them on wire shelves. Baked enamel shelving was the preferred choice of libraries and archives until it was recently discovered that they may give off formaldehyde and other volatile gases if they are not baked long enough at high temperatures. They might be a safe option if the manufacturer or a conservator verifies their safety. Use a thin layer of polyethylene sheet foam or acid-free tissue paper for padding metal shelves to ensure objects are not scratched. Glass shelves are fine if they are strong enough to hold the object.



***"Time may change me  
But I can't trace time."***

**DAVID BOWIE**  
Changes

Housing metals in wood containers or on wood shelves is possible but poses several difficulties. All woods produce organic acids that can be damaging to metals. In particular, oak and chestnut are extremely acidic and should never be used for storing metals. Less damaging woods are true mahogany, walnut, and spruce, although like other woods they still contain a measure of acid. Particleboard, chipboard, and interior plywood often use urea formaldehyde glues in their manufacture. This substance forms acids that can damage metals. Marine-grade plywood or exterior-grade plywood are better choices.



When in doubt, consult the manufacturer about formaldehyde glue used in the construction of a piece of furniture. Newer furniture has a higher likelihood of off-gassing formaldehyde since levels reduce over time. Other concerns with wood are the varnishes, sealers, glues, paints, and stains used in most cabinetry that can release formaldehyde or acid. Oil-based paints, alkyd paints, linseed oil, and oil-borne polyurethanes should never be used. Latex is better than oil but is still problematic. Choose acrylic paints and primers for cabinetry; they tend to be safe.

All is not lost if you still want to store your sixth great-grandfather's 16th-century French sword on your third great-grandfather's beautiful mahogany bookshelves you have in your study. Treatments are available that can minimize, if not eliminate, the damaging effects of acid in woods or the problematic sealants. One option is to apply moisture-borne polyurethane varnish on woods to seal them and reduce off-gassing. Using a barrier between the wood and the object is another effective strategy. Glass, metallic laminate linings, and plexiglass all provide a layer of protection. For long-term storage, placing materials in archival boxes and folders will protect them from the damaging aspects of acidic woods. Do not place paper boxes directly on wood. Over time, wood acids will eat through paper or cardboard. Instead, place the boxes on one of the barriers mentioned above to add another level of protection. When purchasing new furniture or cabinetry, or right after refinishing them, let the cases air out for at least two weeks before enclosing objects in them.

## **PACKING AND MOVING**

So you found your dream house on a lake at the base of the Rocky Mountains, or you have decided to downsize and move to a warmer climate. Either way, you need to decide what to keep, what to let go of, what you will take with you, and what you can pawn off on your unsuspecting relatives. Purge, purge, purge, as my sister would say. After these careful decisions are made, the next task is preparing everything for packing and moving. You will want to protect metal objects from scratches, accidents, and the elements. Depending on how long the move will take, you want to ensure that temperature and RH are maintained so that condensation does not ruin your pieces before they arrive in your new home. If you have any concerns, extraordinary circumstances, or extra-large objects, as always, consult a conservator. There are many good movers who are experienced in moving libraries and archives who may offer a bit of pro bono advice or be able to move special objects for you.

The goal in packing objects is for safe arrival in the new location. This requires using packaging materials that will not cause harm from off-gassing or



moisture. They should also provide enough cushioning so that objects will not move around and break during transport and have thermal insulation against temperature changes and pollution.

To begin with, wrap metal objects in acid-free tissue paper. Do not use newspapers with damaging inks and abrasive harsh pages. Soft, acid-free tissue paper provides protection and does not damage the delicate surface of metal objects. Wrap individual parts separately, such as lids, decorative attachments, or spoons. Wrapping the objects on the outside of the tissue paper with anti-tarnish cloth or paper provides another layer of protection from pollution. Include washed cotton or nylon bags of dry silica gel to prevent condensation. This is especially necessary for long moves or moves that require traveling through different temperature zones. Place the objects in a box that will provide stability and protection. Pack the box with acid-free tissue paper. Once packed, pick the box up and gently shake it from side to side to test whether you have packed it properly. A good mover will take measures to ensure the box does not move inside the van during transport. If you are transporting it yourself, you might want to secure it to the interior of your car or van with a seatbelt or bicycle belt depending on the size.

Plastic-based foams are another option for packing boxes. You can purchase them at archival stores and cut them to any size needed. Polyethylene and polystyrene foams are safe, but do not use polyurethane foam with metals as they can be damaging. Do not use polystyrene with heavier objects because it may permanently compress, allowing movement inside the package. When using foam, press the tissue-wrapped object into the foam. Foams like ethafoam are soft, and certain objects like jewelry can be pressed into them then covered with tissue paper. Larger objects may need to either have a hole dug out of the foam or have squares of foam placed on each side. Take extreme care with protruding arms, knobs, stems, and handles. Use foam to surround a particularly vulnerable section of a piece, such as a protruding handle, while covering the rest of the object with tissue paper. The next time you order a fragile object online, take note of how it is packed. Take a few lessons from professional shippers, although be aware that you are not shipping a new modern piece and everything they do is not to be copied. For example, do not use polyvinyl packaging materials that shippers sometimes use. Never use shredded newspaper or excelsior fine wood shavings as packing materials. They are both highly acidic and have a propensity for moisture retention and mold growth.



Hollinger Metal Edge

### Ethafoam



Do not use rubberized hair or other rubber products. They off-gas sulfur which, as you have already learned, is highly corrosive to metals. Never use liquid expanding polyurethane foams. These foams appear beneficial because they conform to the exact shape of the object; however, they are highly toxic and can do more harm than good.

If your objects will be traveling by airplane, be aware that they will be handled roughly and exposed to vibration and thermal changes that can cause condensation. The boxes or containers themselves should be sturdy and strong as well as waterproof. If the container is not waterproof, line the inside with polyethylene plastic sheets. Silica gel conditioned to 35% to 45% RH can be placed inside the container near the object to reduce or eliminate condensation. Place the silica gel packs inside a washed cotton or nylon bag. Write "Fragile" on the outside of the packages, and indicate which side is up. Do not depend on airport staff to handle your objects delicately or keep them right side up. Shake your finished packages around to make sure there are no moving parts. Make sure the objects are completely insulated within the package. Package them right side up, but make sure they will not be damaged if they arrive upside down. Transport will be easier for packages that have handles on the outside of them, especially if they are too large to carry in one hand. The National Institute for the Conservation of Cultural Property suggests, "Reusable molded double-walled polyethylene packing containers with water-tight gaskets are ideal for most metal objects."<sup>28</sup> Check out polypropylene records storage boxes at any archival store, or visit Uline, Rubbermaid, or other shipping products companies online.

## ADVICE ABOUT SPECIFIC METALS

### Gold

Gold in and of itself does not corrode. In its purest form, moisture, oxygen, or acids do not affect it. However, the gold we have in our collections has been alloyed or mixed with other elements that do corrode. Gold is very soft and is extremely malleable. It is very ductile, which means it can be stretched for long lengths without cracking, breaking, or shattering. In its purest form, gold does not have the material strength to be used for practical purposes. To help gauge the amount of mixing found in the various gold objects, pure gold is 24K, 18K gold is about 75% pure gold, and 14K gold is about 58% pure gold.<sup>29</sup> Silver and copper are the most common elements mixed with gold,

#### ARCHIVES TIP

**Gold in and of itself does not corrode.**





but other ores include zinc, nickel, iron, platinum or palladium, cadmium, and aluminum.

Read through the discussion of different elements to obtain a full picture of how you should care for gold. Because gold is a soft metal, you must take great care not to scratch, bend, or dent it. Remove loose dirt and dust with a soft, dry watercolor brush. To remove heavier dirt, oil, and grease, use ethyl alcohol (the antiseptic kind you buy in the drugstore) applied with soft cotton swabs or a clean cloth. If corrosion is visible, do not polish gold. Most polishes are apt to scratch the surface and can even wear away surface etchings and details. Contact a conservator or jeweler instead. They can give advice on cleaning specific objects and can be hired to do the actual cleaning depending on the condition, age, and severity of the corrosion. Err on the side of caution.



**Gold jewelry**

When storing gold objects, wrap them in acid-free tissue paper and place them in polyethylene bags. When displaying gold objects, they are best kept in airtight display cases with anti-tarnish cloth placed inside. Always wear cotton gloves when handling gold items. The chloride salts in human perspiration will tarnish gold alloys. Clean gold with precipitated chalk. Visit my website at <https://lenasalina.com/secrets-from-the-stacks-guides/> for a description of how to clean with precipitated chalk. Rub gently, being mindful not to wear away any etchings and fine details. Gold plates are very thin and can be easily worn down. Of concern is the material the plates are attached to. Depending on that material, great damage can be done to a piece with the good intentions of restoring its beauty. Again, err on the side of caution. Cleaning metal can be complicated, especially when different materials are amalgamated. Contact a conservator and get advice before ruining a 17th-century family heirloom hatpin or piece of jewelry.



**ARCHIVES TIP**

**Visit my website at <https://lenasalina.com/secrets-from-the-stacks-guides/> for a description of how to clean with precipitated chalk.**

## Silver

Silver is commonly used in many objects, and chances are most of us have something made of silver in our collections. It might not be your great-aunt's silver tea set from 1914 or your third great-grandfather's Civil War bayonet, but it could be a trophy, a winning medallion, a pin, a piece of jewelry, a belt buckle, a watch chain, or a table ornament. The discussion of silver in this section refers to



valuable silver objects that you want to preserve as a family heirloom or keep as family keepsakes and provide long-term preservation. It is not intended advice for household objects that are used regularly and are of little or no historic value.

Silver, like gold, is a soft and malleable metal. Sterling is the most common alloy, composed of 92.5% silver and 7.5% copper. Silver not labeled as sterling is most likely composed of less pure silver and more alloys. Like gold, silver needs special care to avoid scratching, denting, or deforming it. Surface tarnishing or blackening is a common problem with silver and is caused by exposure to sulfuric compounds or chloride salts. Sulfurous gases in households typically come from burning fossil fuels, coal, and industrial waste but can also come from rubber items, egg yolks, and decomposing plants.<sup>30</sup> The chloride salts and grease in human hands can be very damaging to silver and can accelerate tarnishing. Be sure to wear gloves when handling historic silver objects. Fingerprints can become permanently etched onto the surface. You do not want



**Silver Tea Set**

your descendant to demonstrate their tenth great-grandfather's war sword with their sixth great-grandfather's fingerprint permanently etched in the blade. Household synthetic detergents containing sulfur and phosphorous compounds damage silver, as can latex paints. Modern paints contain stable synthetic resins that are safer.

Tarnishing is the gradual loss of polish leading to discoloration. Typically, silver will turn pink first, then darken to brown, then to a very dark gray or black. A slight iridescent sheen is also often present. Older objects that have not been cared for over an extended period may produce green-colored crusty deposits that are formed by the copper alloy in silver. If damage is extensive, contact a metals conservator for expert advice and professional treatment. Do not try to treat it yourself as it could result in holes, pitting, or loss of etched designs.

Before cleaning a silver object, spend some time inspecting it to determine its special needs. Objects with multiple materials, such as ivory handles or wood inlaid with silver, need to be treated differently than objects that are all silver. Try to determine whether the object is solid silver or silver-plated. Also inspect joints to determine whether solder has been used. Make sure it has structural integrity, meaning that it is strong enough to withstand the handling necessary for cleaning. Look for weak areas, cracks, missing or loose parts, or old repairs. Try to determine what, if any, surface applications have been used on the piece. Accidental removal of certain coatings could result in devaluation of the object or increased deterioration.



Determining whether an object has a coating may require using ultraviolet light or a microscope. Patina is a good example of this. Patinas are often created for decorative purposes, but can also form during the natural breakdown of silver and copper alloyed materials. Knowing whether the patina should be removed or is integral to the object's beauty and value is important information. Gilded objects that have a thin layer of gold added to the surface are best left intact.

When cleaning a silver object, use great care and caution. Experts in the field have determined that it is less damaging to clean silver with a mild abrasive over a longer time than with a more aggressive material for a shorter time.<sup>31</sup> This is good advice for newer objects and historic pieces.

You can remove surface dust and dirt from silver objects using a soft, clean, dry watercolor brush. Be aware that dust can attract moisture that will accelerate tarnishing, so keeping objects free of dust is important. Remove heavier dirt or oils and grease using ethyl alcohol and a soft cloth. The best method for cleaning historic silver is using precipitated chalk mixed with distilled water, deionized water, or ethanol. See my website at <https://lenasalina.com/secrets-from-the-stacks-guides/> for detailed instructions on removing tarnish from silver as recommended by the National Institute for the Conservation of Cultural Property.

Commercial silver cleaners use abrasion to remove dirt, meaning it scratches off a thin layer of the surface. These cleaners are not recommended since with repeated use they can remove protective coatings and destroy surface etchings. Commercial polishes contain ammonia, which dissolves copper. As stated earlier, most silver contains copper, especially sterling silver, which is 7.5% copper. Copper corrosion turns green and crusty, and once it sets in it is hard to remove. Polish trapped in etchings or crevices is especially vulnerable to ammonia residue.

Commercial silver dip solutions, chemical reduction techniques, metal granules, and foils are not recommended for cleaning silver. These methods use toxic materials, can cause disfiguring or pitting, and can result in the object looking over-cleaned. Chemical treatments such as these will



#### **ARCHIVES TIP**

**Experts in the field have determined that it is less damaging to clean silver with a mild abrasive over a longer time than with a more aggressive material for a shorter time**



**Silver Serving Utensils**



destroy silver decorated with *niello*, a black mixture of copper, silver, and lead used as an inlay on many decorative objects, particularly old swords, belt buckles, and artwork. Silver dip solutions use acid mixed with a composing agent. They will damage bronze, stainless steel, wood, and other organic materials that may be part of the object. If you decide to use this method, do not “dip” the object. Instead, dip a cloth in the solution, clean small areas of the object, and immediately rinse with distilled water. If dips are used on an object with hollow areas such as candlesticks with a hollow base, trophies with hollow feet, or teapots with hollow handles, and if the chemicals leak into the hollowed-out parts, they will be impossible to get out.

It is important to use denatured or distilled water when making a paste or rinsing silver during the cleaning process. For purification purposes, modern municipalities add chlorine to urban water, which will cause tarnishing and corrosion in silver.

Tarnish inhibitors found in most commercial silver polishes should also not be used. They slow the rate of tarnishing for a short time, but once tarnishing begins to set in they accelerate deterioration. Inhibitors also make it difficult to add a lacquer finish if that is something you might choose to do in the future.

Silver-plated, Sheffield plated, and electroplated silver should be polished as little as possible. The silver can be worn away to the base metal beneath. Not a pretty sight. If you have silver from the late-19th century onward, be aware that some “tarnishing” or darkening of the metal was done intentionally by the designer for artistic and aesthetic purposes. Be careful not to remove darkened spots that were intended to enhance the beauty and design of the artwork. Preservation of these objects requires that they are not polished. Try gentler cleaning methods that will leave the tarnish intact. If you are unsure of the artist’s intent with a particular piece in your collection, see if you can find the original design online. Many websites now list this information. You can also contact a dealer, art historian, conservator, or museum curator for advice. Sending a picture will assist others in making a professional judgment.

You can slow the tarnishing of silver by adding a coating of reversible resin or lacquer to objects that are only used for display. Most silver objects produced today are coated with lacquer before leaving the manufacturing plant and most likely will not need a second coating. A good resin coating can last for many years, but you should consider a few things before taking this step, especially with historic objects. First, this method can only be used on objects that are for display purposes only. Silver plates, cups, silver flatware, brushes, combs, and other objects that will be handled often or may be used for eating or drinking should not be coated. Second, while the coating may last many years, when it does begin to break down it will turn yellow or gray. At that time, it will need



to be removed and reapplied. Often lacquer cannot be removed completely, especially in etched spots or on uneven surfaces. Third, if the coating becomes scratched or pocked, it will need to be recoated immediately; otherwise, the exposed metal surface will corrode and may be impossible to clean. Another thing to consider is that while a lacquer coating looks natural for modern pieces, it may not be as aesthetically pleasing in older, historic objects. If you decide to go this route, you should have a professional perform the application of the resin coating. If not done properly, it will cause more problems than it was meant to aid. A bad coating job can result in severe corrosion problems. Make sure whom-ever you hire is reputable and trustworthy.

The best way to safeguard silver from environmental pollutants is to wrap it in acid-free tissue paper, then place the item in either a cloth bag made for silver storage or a polyethylene bag.

When displaying silver objects, never allow protein-based materials such as wool, silk, and leather to come in long-term contact with them. These materials contain sulfur that deteriorates silver. As mentioned earlier in this chapter, when displaying or storing silver, use anti-tarnish papers and cloths. These contain activated carbon or silver salts and provide added protection by absorbing sulfur compounds. Make sure the anti-tarnish strips do not touch the silver and change them frequently. If not changed often enough, the sulfur will re-deposit on the silver. You can purchase anti-tarnish strips from archival stores or jewelers. For more advice on displaying silver objects, review the section called “Handling” in this chapter.

## Copper and Copper Alloys – Bronze and Brass

Like gold and silver, copper is a soft metal that is easily scratched or dented. Different alloys have been added to copper throughout the ages to lower its melting point for easier casting, to make it more resistant to corrosion, to alter its color, or to make it harder and sturdier. Bronze is a mixture of tin and copper, and brass mixes zinc with copper. Other copper alloys include gunmetal, bell metal, German or nickel silver, and paktong (an alloy of copper, zinc, and nickel resembling silver).

Copper, bronze, and brass will all corrode over time. They are highly sensitive to ammonia, acids, strong alkalis, chlorides, and sulfide gases, which means



**Copper Kettle**



that most cleaning solutions will not be good for these metals. Oils and salts from hands can lead to corrosion or leave permanently etched fingerprints. Zinc in brass can become weakened or discolored by contact with acidic or alkaline substances. Brass is also sensitive to heat (think light bulbs), which can vaporize the zinc, changing the surface color from yellow to a coppery red.

### Bronze Disease

Bronze disease is a problem particular to copper alloy objects. It occurs when copper alloyed metals contact chloride, oxygen, and water. Bronze disease is a significant problem for archaeological metals that have been buried in the earth and have suffered significant corrosion. These objects are often exposed to chloride salts in the ground. Typically, historical or modern copper alloy items are not subject to this level of corrosion, but it is possible. Chloride contamination can come from the salts on our hands, salt-laden air (particularly if you live near the ocean), or from certain cleaning solutions that contain chloride. Perhaps you have found a metal object buried outside your house, or objects in your collection were stored in a dirt cellar, buried in a dusty attic, or stashed in an exposed barn. All these environments can cause bronze disease on copper alloy objects. To tell if your object has bronze disease, look for powdery, light-green spots. If you have any concerns, contact a local



**Bronze Disease**

conservator, museum, or archaeological conservator and get professional advice. Once bronze disease sets in, it is difficult to cure.

Since bronze disease develops in the presence of copper chloride, oxygen, and water, keep bronze in a low humidity environment. For objects that are in good condition, stick to the 55% RH rule. Objects that have been exposed to bronze disease should ideally be kept in an environment below 35% humidity. It may be impossible or impractical for a homeowner to achieve this level of dryness. The key is to keep moisture away from the object. If you can maintain a steady 55%, check the object periodically. If it continues to deteriorate and keeping it boxed and wrapped is not helping, consider donating the object to a museum, archive, or historical society. They have the resources to keep it safe.

Before cleaning a copper alloy product, identify any artificial patinas, colored lacquers, waxes, or paints that have been applied decoratively to create special effects. These thin layers are very delicate and easily removed or altered using abrasive cleaners or chemical solvents. Some 19th-century bronzes were darkened using chemicals during production to give them an antique look popular at the time. Military instruments such as bugles and candle lanterns were



treated with a dark matte finish so they would not reflect dangerous sunlight in the field. Clear varnishes or bituminous finishes were applied to navigational instruments as weather protection at sea. Removal of these finishes would alter the object and devalue it to collectors or curators.

Dry cleaning is a safer bet. Use a soft, clean brush to remove loose dirt and dust. Ethyl alcohol applied with a soft cloth or cotton swab will remove fingerprints and grease. Be sure to test an inconspicuous area first to make sure discoloration will not occur and the original coating will not be removed. Rinse and dry thoroughly.

Simple oxidation characterized by a dull reddish or brownish film can be cleaned using the precipitated chalk method described on my website at <https://lenasalina.com/secrets-from-the-stacks-guides/>. Only use this method on copper, brass, or bronze objects that do not have a desired patina, delicate coating, or specialized surface treatment. Be sure to remove all polish residue after cleaning. To remove grime, oil, and scum, use alcohol, mineral spirits, or detergents with a soft cotton cloth or cotton swab.

Do not use commercial brass cleaners. Their formulations can change without notice, rendering safe usage subjective. Dips and pastes contain acids or chloride and will not only remove surface finishes but can cause pitting, scratching, discoloration, and further corrosion. Do not use abrasive papers, steel wool, or bronze wool on copper alloys, and do not use salt, lemon juice, or vinegar treatments. The chlorides in the salt can cause more corrosion. Regular cleaning will remove a small amount of metal each time, so less is better when it comes to cleaning metal, especially when it comes to historical objects.

If applying lacquer to protect the surface and keep it bright, use a professional. Lacquer is very tough and durable, but keep in mind that when lacquer film breaks down it will discolor and will need to be replaced. Oxidation will occur in any spot where the lacquer becomes scratched or cracked. Removing lacquer is difficult to impossible. An alternative to lacquer is *microcrystalline wax*. It does not offer as much protection as lacquer, but it can be easily removed with mineral spirits and replaced without damaging the object. Wax also dulls the shine of copper and brass, which may or may not be desirable. Synthetic lacquer is another option and can be found specially formulated for copper and brass. It can be easily removed with mild solvents and will provide good protection for the surface. Look to conservation suppliers for specific products. When storing copper alloy objects, use anti-tarnish cloth or paper.

### **Outdoor Bronze Sculptures**

Bronze sculptures add beauty to any garden and can mark a significant event, act as a memorial, or decorate decks, porches, and yards. Bronze is a strong, sturdy metal that can withstand the ravages of weather and air pollution.



But even the public displays in our neighborhoods and national museums deteriorate and discolor over time. Finding the best location for a bronze statue or plaque is the best preventative medicine against future damage. Choose a spot that is clear of overhanging trees and away from nearby shrubs that can scratch bronze surfaces and add moisture, sap, leaf, and bird droppings, all of which can corrode or disfigure the surface. Do not place bronze directly on the ground where groundwater salts, fertilizers, snow removal products, or animal urine can cause corrosion.

With a stable reversible coating, outdoor sculptures can be protected from the elements as well as air gases, salts, and acid rain. Reversible synthetic resins and waxes are the product of choice for most conservators. Often wax is applied over an initial resin coating to give it added protection. Wax coatings can be easily and economically maintained. Resin coatings are more vulnerable to breakage. Once the coating is broken, corrosion can set in and is usually more severe than if no coating had ever been applied. It is important to periodically inspect your piece for areas of discoloration or coating breakage. Once a coating is applied, it will need to be maintained.

Coatings should always be applied by a conservator. If you have an expensive object, a large object, or an old or historically relevant object (like a grave marker), you should probably seek the advice of a good conservator. They will be able to advise you on how best to care for that particular object and teach you how to maintain it properly.

Try to clean your outdoor sculpture once a year. Pick a day that is moderate—not too hot, not too cold. Cleaning in springtime after a long harsh winter would be ideal for anyone living in the north. For those in southern climates, you might want to choose the autumn after the harsh sun and high humidity has potentially damaged bronze items. Wash the sculpture with water containing a few drops of a nonionic detergent, rinse, and allow to air dry. If a wax coating has been applied, this is the time to recoat.

## **Lead, Pewter, and Tin**

### **Lead**

Lead has been used in many cultures for centuries. Famous are the lead pipes used in ancient Rome that some believe resulted in the fall of the Roman Empire. Lead and lead alloys, particularly pewter, have been used in architecture and construction, coins, vessels and kitchenware, sculptures and statues, and weapons and bullets. In the modern age, we have learned to respect the dangers of lead and no longer use lead pipes, lead paint, or lead cooking and eating materials, but



many artists still work in this medium and find its beauty to be incomparable. Old pewter is a mixture of lead and tin. Leaded bronze, as the name implies, also has lead in it.

If you have lead, tin, or pewter in your collection, you will want to care for it properly. Lead and leaded pewter are soft metals that are easily scratched and dented. Be sure to wear soft gloves when cleaning or moving them. Lead and its alloys are sensitive to organic acids found in wood and paper products, paints, varnishes, fabrics, and many other materials. Since so many materials can damage lead, doing the simple test outlined earlier in this chapter will determine whether the environment in which you are storing or displaying lead alloy items is safe. Examine lead objects regularly. Look for white powdery spots that may be the beginnings of a corrosion problem. A conservator can advise you on how best to remedy the situation.



**Pewter Mug**

### **Old Pewter**

Old pewter had lead added to make it more malleable. The lead makes pewter turn a darker, bluish color. It often develops an even oxide-gray film on its surface that is protective and that most collectors find desirable. You do not want to remove this protective, aesthetic layer when cleaning or polishing. Lead in pewter is a concern in objects used for food consumption. But pewter candlesticks, vases, or tableware used for decorative purposes are not dangerous. Traditional pewter with high lead contents were less costly than those made with pure pewter. They are also considered less valuable. Keep in mind that even “pure” pewter could have high levels of lead in them. Tin ore can be contaminated with lead, which may or may not have been known to the smelter. Unscrupulous craftspeople were also known to sell leaded or “ley” metal as “pure” pewter. If in doubt, you may be able to have your piece tested.

In the mid-18th century, Britannia metal came into common use as a substitute for leaded pewter. Britannia metal is a mixture of tin, antimony, and copper and is harder and more corrosion-resistant than leaded pewter. It is usually a brighter color and is easily cleaned with either a soft brush for dusting or ethyl alcohol to remove greasy deposits.

Keep pewter in an environment with 40% to 50% humidity. Keep the area as free of household and exterior pollutants as possible. When displaying pewter objects, keep materials that contain sulfur compounds away from them. This



includes adhesives and certain felts. When storing pewter, wrap it in acid-free tissue paper and enclose it in polyethylene bags.

As with other metals, always wear white cotton gloves or powder-free nitrile gloves when handling pewter. Pewter bends easily, so treat it delicately and with care. Be careful not to heat pewter objects. Dents, gouges, and bent areas can be fixed by a trained individual; either a conservator or some jewelers may have this ability. Trying to do it yourself could lead to more damage.

When cleaning pewter, remember that most collectors consider the gray patina formed on old pewter desirable. You will not want to polish it away. It is a protective layer and can be an indication of the age of the object. Cleaning pewter can be laborious. Also, a small amount of the metal will be removed during the process. Do not use harsh abrasives, steel or bronze wool, or commercial cleaners that contain acids or alkalis. Remove surface dirt by using a soft artist brush. Try mixing rottenstone or jeweler's rouge mixed with mineral oil or alcohol, and use a soft cloth. Test the item in an inconspicuous spot for discoloration or scratching. Cleaning a small area will let you know how much time and energy will need to be expended to clean the entire piece. Remember, it is better to rub gently for a longer period of time than harder for a shorter period of time.

Electrochemical reduction is a method that is known to remove certain types of heavy corrosion. However, this method may also smear lines, inscriptions, and stamp marks—essential parts of a piece's history—which lowers the aesthetic and monetary value of the piece.

Like tin, pewter that is made with tin as a base is subject to *tin pest* or *tin disease*. (See below for further explanation.) Tin pest is a powdery, crystalline condition that is caused by exposure to intense cold. Once tin pest has set in, it cannot be reversed. You will need to consult a conservator for advice on how to proceed.

## Tin

Tin is allotropic, meaning it can occur in two or more forms that differ in molecular structure. In temperatures above 55°F, it appears in the form we are most familiar with. Below 55°F, pure tin can disintegrate into a gray powder called **tin pest** or **tin disease**. Tin cannot be reclaimed once this occurs. Commercial grades of tin are 99.8% tin alloyed with other elements added such as copper, antimony, bismuth, cadmium, or silver to prevent tin disease and to increase the hardness of the material.

Tin is quite resilient and stable, and it does not rust as easily as you might think. Tin is often used as a protective coating on top of iron found in such



objects as tin cans and tinware. Iron is the softer metal in this case and will corrode more quickly than the tin. Not until all the iron is disintegrated will the tin begin to degrade. Most often when we see rusted tin cans, it is the iron that has rusted, not the tin.

With that said, tin will corrode with prolonged exposure to air, moisture, and certain acids. While durable, it is also a soft metal and should be cleaned using the finest polishes and the gentlest methods, such as those used for silver. Remember, every time a metal piece is cleaned, a surface layer is worn away. So clean lightly and infrequently.

## Iron

Iron is a common site on the lawns of many New England homes, especially those along the coastline where great old iron anchors with big, linked chains lean against an iron flagpole or a large boulder. That is a lot of iron. Many people paint these old artifacts white, black, or silver depending on their preference. Other iron artifacts in our collections may include old firearms, swords, weaponry, and bullets. Fencing, outdoor metalwork, gratings, and decorative hollowware may all be made of iron or have iron in them. Iron is highly susceptible to rusting and needs special care and attention.

As with other metals, water is the greatest enemy of iron and will cause rusting or oxidation. Salt mixed with water, as found in the air and sea near coastlines and present in road salts, acid rain, and human perspiration, will also accelerate deterioration. It is impossible to control the environment for outdoor iron works. But for iron work within your home, keep RH at 40% if possible. If you are unable to do this, 50% is acceptable, but the room should be kept stable. Sometimes fluctuations in humidity can be more damaging than a high number in and of itself. Portable dehumidifiers help keep moisture levels down and clean the air of pollutants, just be sure to keep the filters clean. Air conditioners are more expensive to run but are another option for stabilizing humidity and filtering the air.

Silica gel can be used safely around iron objects, but only in closed containers. It is essential that the area in which you place silica gel is completely sealed. Any leakage will reduce the gel's effectiveness. If you are displaying objects such as iron flasks or ferrous guns in an enclosed display case, you can use silica gel to help keep the interior environment at a low moisture level. Silica gel is "conditioned" to a particular RH. Follow package instructions and test the amount



Author Photo

**Iron anchor**



needed by placing the gel in a bag with a hygrometer for twenty-four hours. The silica gel will buffer humidity changes. The amount of silica gel to use is roughly equal to half the weight of the object it is enclosed with.

For objects stored or displayed where a clean environment with low humidity is impossible to attain, you can use protective coatings. However, there are many things to consider before using a protective coating. Review the following section on coatings and learn as much as you can. If you are still unsure how a particular coating may affect your unique object, consult with a conservator.

Overtreatment of metal is the second greatest cause of iron destruction. If iron is kept in an environment that is low in humidity, atmospheric acids, and salts, corrosion will occur slowly. This means your iron objects will need little to no attention for longer intervals. Over cleaning or using the wrong cleaning products can do more damage than not cleaning at all. As with other objects, a little inspection goes a long way. Here are a few other things to consider before attempting to clean iron:

How deep does the rusting go? Is there a stable core that will be present once the outer rust is removed? Test your object by placing a magnet next to it. If the magnet does not stick, the interior is rusted as well. Removing rust on an object rusted through will result in a pile of orange dust and nothing more. Consult a conservator, museum curator, or archaeologist.

Look at the exterior coating. Many iron objects were coated as part of the manufacturing process and removal of these patinas could cause damage. Removing protective coatings exposes objects to corrosive air and can cause immediate, quick rusting. Also, since certain patinas add to the beauty or aesthetic value of iron objects, removing them may result in devaluation.

Many ironwork tools, utensils, and firearms were never originally shiny and were not meant to be. Polishing an object down to a shiny surface will be immediately noticeable to a collector or curator and will lessen its value. Know your piece. Ask yourself what the original look and intention of the creator was. For example, many gunlocks and gun barrels were purposefully given blue or brown finishes when manufactured, so removing these finishes renders them less valuable and exposes them to corrosion.

A good rule of thumb is, unless you know what you are doing, do not do it.



## COATINGS

The decision to add a protective coating to your metal pieces needs much consideration. Depending on the age and historical value of your pieces, you may want to bring them to an expert in the field and discuss all your options.

Historically, boiled linseed oil or oil-resin varnishes were used as waterproofing agents. Recent research has revealed that moisture can penetrate these types of coating, so they are not recommended. These oils can also cause corrosion and are difficult to remove. Dips or sprays with synthetic resins provide more protection, but only if they are applied uniformly with no breaks so that moisture or salts cannot become trapped below the coating. Synthetic resin coatings tend to be shiny and may alter the original look of the object or be less desirable aesthetically.

Wax coatings do not have the shine of synthetic resin coatings, but they also offer less mechanical protection. Wax coatings are usually easier to apply and easy to remove if necessary. If you choose a wax coating, microcrystalline wax is the better choice. You can purchase it at conservation supply stores. Waxes such as candelilla, carnauba, or beeswax are also acceptable. Heating an object before waxing it will help the wax penetrate rough or intricate surfaces. Coat the object when it is warm, then remove any excess wax when it cools. Only place pure iron objects in an oven. Heating other materials in this way can destroy them or cause a fire. Also, do not put metal in a microwave. Know your objects! Be sure to test the wax in a small area before applying it to the entire surface and look for discoloration or other undesirable effects. Wax coating build-up can result in loss of transparency or an unnatural appearance over time.

Traditionally, oil or grease coatings were used on objects that were going to be stored away for a long time or in potentially damaging environments. These include gun grease, penetrating oil, petroleum jelly, and mixtures of each. You can use these methods, but they may not be practical for objects that will be displayed or used periodically. Before using them, you will need to degrease and clean them.

Silicone spray is another option but is not recommended for historical artifacts or objects of high value. Once applied, silicone cannot be removed. Contact between silicone and nonmetal areas of a piece, such as wooden handles or decorative

***“You don’t think of the details because you don’t have them. So you can’t think of...but this strange connection it gives me. It just makes you feel like you are part of something so much bigger.”***

**MAYA RUDOLPH**  
Finding Your Roots S3.E3



materials, can cause permanent damage during treatment. Silicone spray provides an invisible protective coating and lubricant, but it is a light-bodied fluid that can get into threads, delicate etchings, and hard-to-reach places. However, it does resist handling and high temperatures and typically does not change the appearance of the objects to which it is applied. Silicone might be the right coating depending on the piece, its value, and its artistic importance. A good conservator can provide specific advice about this.

Heavy coatings or paint are sometimes used for outdoor metal objects that are exposed to the elements and need more substantial protection. These methods might be preferable for those great anchors and cast-iron cannonballs people display in their yards. Grill work, chains, and forged objects also fall into this category. Before painting, the object should be cleaned, dried, and be free of loose rust, scale, and chloride salts. Traditional primers such as calcium plumbate and red lead are effective but not recommended since they both contain lead. Instead, zinc chromate is a good primer. Pieces with galvanized metals may require special primers. You can purchase epoxy-resin paints used for boating from marine supply houses. Epoxy paints need to be mixed and are difficult to apply, so they may not be the best choice for beginners. Epoxies form a tough protective surface, but only if there are no cracks or breaks. Moisture can and will get in where any breaks appear. Epoxy is also impossible to remove for repair or recoating, so it is not recommended for use on historical objects.

Old farm machinery, carriages, wagons, steam-powered machines, and other large objects were often painted in their original form. Rust-inhibiting paints purchased at most hardware or paint stores provide a good option for retreatment. They are inexpensive and come in a variety of colors. Choose paint in cans over spray paints that tend to become clogged and are difficult to apply. But do not think it is necessary to paint a historical object just to spruce it up. It may be more valuable in its original condition with the original paint. Cleaning and protecting a metal object may be preferable to blindly painting the entire piece. Sometimes the least treatment is the best treatment.

## **CLEANING**

To clean a lightly rusted object, use fine bronze wool and mineral spirits. Rub gently. This process will remove rust without removing patinas or bluing. Do not use abrasive paper or abrasive chemicals on historical objects. Keep in mind that once the surface rusts, and possibly when the patina is removed, the metal will be vulnerable to the formation of new rust and should be coated immediately. Even a few hours of unprotected exposure could result in a new layer of corrosion. Never use sulfuric acid or nitric acid on historical metal objects as pitting would be inevitable and disfigurement of fine detail would be



likely. Use commercial rust removers with extreme caution. Like acid removers, they can cause pitting, discoloration, and loss of fine detail. Phosphoric acid is the least damaging of chemical rust removers but should also not be used on historical artifacts. The damage resulting from over cleaning cannot be undone. If you are unsure, use caution and consult a conservator.

Electrochemical and electrolytic methods can be effective but should be done by a professional. These methods require expensive equipment, advanced treatment, and expert knowledge of metals.

Do not scrape rust off manually using a dental pick or other metal object. This method is time consuming and dangerous because tiny pieces of rusted metal can shoot off in different directions and become lodged in eyes and skin. If not done properly, scraping with a dental pick can also result in surface scratching.

Removing rust requires the use of an abrasive that is softer than the material being treated. The finest steel wool *may* be safe to use, but always test a small area first. Bristle or nylon brushes are other possible options. Do not use glass fiber, steel brushes, coarse abrasives, or steel tools. Never use a hammer, power grinding wheels, wire wheels, or other forceful tools. All of these could scratch, scar, and permanently damage a metal piece. Hopefully I do not need to say this, but do not use a blowtorch. Using such high heat can result in undesirable fusing. Severely rusted objects that do not respond to the magnetic pull of a magnet require professional care. Handle gently and call a conservator.

