

## AN ILLUSTRATED GUIDE TO BOOK TERMINOLOGY

### PART TWO: CONSERVATION TREATMENT

Conservation treatment seeks to remedy the weaknesses inherent in book materials and structures, as well as damage caused by handling, by accident or disaster, or by exposure to poor environmental conditions. Although some trade binders also repair books, trained conservators are aware of both the physical and chemical natures of historic books and of the many materials available to treat them. They are able to choose stable repair materials and appropriate techniques that will not cause further harm in the future. They also reuse the original materials whenever possible, and strive to make their treatments reversible. When seeking treatment for a rare or valuable book in the United States, it is always a good idea to seek out a professional conservator who is listed through the American Institute for Conservation (AIC).

Book treatment often involves many steps and takes many hours to complete, but different condition problems create different treatment scenarios. The first step a conservator takes is to examine a book thoroughly, and then to write a **condition report and treatment proposal**. This document describes the book and its current state of repair and recommends a course of action that will repair and stabilize the book for future use. Different levels of intervention and repair may also be recommended, giving libraries or book owners a variety of options for treatment and related costs. Once the owner approves a course of treatment, the conservator documents the volume with a series of **before-treatment photographs** that illustrate its condition (Fig. 1). Only then can work begin.



**FIG. 1.** Before-treatment photograph of a bound manuscript.

The following paragraphs describe the most common conservation problems and treatment steps encountered in book conservation. Each step seeks to produce a repaired book that is not only beautiful but able to be handled and used.

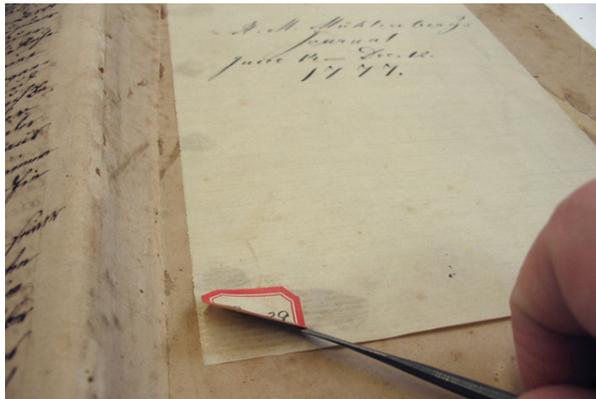
#### LEATHER CONSOLIDATION

Leather can become dried out and brittle in hot, dry storage conditions. During the Industrial Revolution, leather production methods also changed, resulting in more acidic leathers. This inherent weakness was exacerbated by exposure to airborne pollutants from gas lighting and coal fires. As a result, many books with leather covers now suffer from a condition known as **red rot**, in which the leather becomes red, powdery, and weak. Both desiccated leather and leather with red rot can benefit from **consolidation** with a solution of ethanol, hydroxypropylcellulose (Klucel G) in ethanol, and SC6000, an emulsion of acrylic polymers and wax in isopropanol. This solution, affectionately known as **red rot cocktail**, helps

to restore the leather surface by penetrating the leather and adhering the leather fibers together. Traditional leather dressings are not recommended as they can speed up leather deterioration.



**FIG. 2.** A conservator cleans a manuscript leaf with a natural rubber sponge.



**FIG. 3.** This gummed label could be easily lifted after the application of a damp poultice.

### SURFACE CLEANING

Books are often dirty, either from being stored in poorly controlled environments or from being handled with dirty hands. The tops of books are often dusty, and the **gutters**—the valleys at the spine between the open leaves—collect dirt and debris. Historic books are often sooty from open fires or gas lighting, and religious texts often have candle wax on their pages. Dust, dirt, and grime attract moisture and pests, and should be removed to prolong the life of the paper. Surface cleaning is often the first step in conservation treatment. It involves cleaning the leaves with solid or grated vinyl erasers, natural rubber sponges like those used to remove soot, and soft or stiff brushes (Fig. 2).

### MOLD REMOVAL

If books have been stored in particularly warm, damp environments, or have been exposed to moisture in an emergency, they may be moldy. Because some types of mold are hazardous to human health, conservators generally treat moldy books in a fume hood that removes any dangerous spores. They also use a vacuum cleaner with a high-efficiency particulate air (HEPA) filter and adjustable suction to **aspirate** the mold. It is often impossible to remove the permanent staining associated with mold.

### TAPE AND ADHESIVE REMOVAL

When book leaves or covers tear, it is tempting to reach for “over-the-counter” fixes such as transparent tape, masking tape, electrical tape, or duct tape. Other tapes are marketed as “archival” paper, glassine, or linen tapes. All of these tapes are known as **pressure-sensitive tapes** because they stick with pressure alone and don’t require a solvent to activate their adhesive layer. The non-sticky paper or plastic layer of the tape is known as the **carrier**. All commercially available tapes break down over time, becoming brittle or oily. The adhesive layers stain the paper and leave residues behind. Conservators remove tape carriers using a technique that softens the adhesive: this may be heat, moisture, or a solvent. Moisture is often delivered through a **poultice** or **gel**—often a thick blend of methyl cellulose and water—which dries slowly and prevents too much water from penetrating to the surface of the paper (Fig. 3). Adhesive staining can rarely be removed entirely, but it can be treated using the correct blend of solvents.

### ATTACHMENT AND INSERTION REMOVAL

People often add materials to historic books: pressed flowers, feathers, photos, and news clippings. These may be attached using paper clips, staples, pins, rubber bands, or tape. The insertions and attachments can all damage books as they degrade. News clippings and pressed plants are acidic and cause brown stains on adjacent leaves. Pins, paper clips, and staples create dents and holes in paper and

cause rust stains. Conservators generally remove these types of attachments and insertions and place them in sleeves made of **polyester film** (Mylar) to prevent them from causing further damage.

#### DISBINDING

If a book is opened too wide, its spine may break—meaning that the spine linings, the sewing supports, the sewing thread, and the adhesive on the spine folds may fail. This causes the leaves to become loose and possibly to fall out. A book in this condition must often be **disbound**, or removed from its original sewing. The first step is to **collate** any unnumbered leaves, or to number them in graphite pencil so they can be put back in order. The conservator then snips the sewing threads holding the gatherings together. Separating them may also require removing the original spine linings and any adhesive that remains, often with the help of a methyl cellulose poultice (Fig. 4).



**FIG. 4.** Removing softened adhesive from the spine of a disbound manuscript.

#### MEDIA TESTING

Before any book can be washed, or in some cases handled, its **media**—any paints, inks, coatings, or dyes—must be examined. Some media are soluble in water or ethanol, and either cannot be bathed or must be **fixed**—physically and chemically stabilized—before being exposed to moisture. Others are friable and flaky, and must be **consolidated** or re-adhered to the paper surface with an appropriate adhesive. Before any treatment takes place, a conservator always tests the media using a fine brush and the solvents proposed for treatment (Fig. 5).



**FIG. 5.** To test the solubility of an ink, a conservator uses a fine brush to apply a droplet of solvent.

#### WASHING

Historic book leaves are often yellow and discolored due to naturally occurring acids in the paper fibers. If they have been exposed to moisture, they may display brown staining and **tide lines**, or dark rings at the edges of a stain. To reduce discoloration and acidity, conservators often **bathe** disbound leaves in deionized or filtered water, often with added calcium to help remove acids. The bathwater turns a shocking yellow color in the first bath and each successive bath is cleaner. When the water remains clear, the soluble **acidic degradation products** have been removed from the paper and bath time is over (Fig. 6). After drying, the washed sheets are often found to be brighter and more flexible than they were before washing.



**FIG. 6.** The yellow water in the far tray indicates the need for more washing; the leaves in the near tray are clean.

### CALCIUM PHYTATE TREATMENT

For centuries, manuscripts were written in **iron-gall ink**, an ink made from iron sulfate or copperas, the **galls** from oak trees (knotty growths where wasps have laid their eggs under the bark), gum arabic, and water. The ink produces sulfuric acid, and if the ink recipe is not properly balanced, it also contains excess iron ions that oxidize the paper. The black or dark-brown ink etches the surface of the paper, which makes the writing permanent—but over time, it can develop dark halos, make the paper brittle, and even eat right through it. This results in the loss of information and book leaves that look more like doilies. To arrest the progress of iron-gall ink deterioration, conservators often treat inked leaves with ethanol and a solution including **phytic acid**—a natural antioxidant—and calcium bicarbonate. The resulting calcium phytate is thought to convert the damaging iron ions in the ink to a more stable form.



**FIG. 7.** A conservator mends a torn leaf with a strip of Asian mulberry paper and wheat starch paste.

### DEACIDIFICATION OR ALKALIZATION

All papers naturally become more acidic as they age. This acidity causes discoloration and brittleness. This is particularly noticeable in papers made from wood pulp, such as newsprint. Depositing an **alkaline reserve** in the paper protects the paper fibers from acid attack. After washing book leaves, conservators often bathe them in a calcium or magnesium bicarbonate solution to deposit alkaline materials in the paper fibers. If the leaves are too weak or brittle to be washed in water, they can be sprayed with an inert or solvent-based alkaline solution.

### SIZING

Historic papers were often **sized** or coated with gelatin, which contributes strength and water-resistance to the paper. Conservation treatments such as bathing can remove some of this original size. To restore strength to paper, conservators often size or re-size it with dilute solutions of gelatin or methyl cellulose.

### HUMIDIFICATION AND FLATTENING

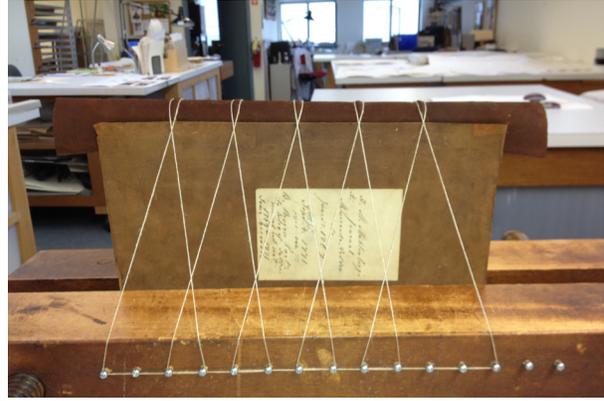
If book leaves are folded, creased, or **cockled** (warped) from exposure to moisture, they can usually be flattened successfully by introducing moisture again in a controlled way. Folds and creases can be humidified locally, using water and ethanol on a fine brush. Paper can also be humidified overall by placing it in a chamber of moist air or spraying it with a fine mist of water. Conservators choose the humidification technique that best fits the paper and its media. When the paper is limp and relaxed, it is placed between blotters or sheets of felt to dry and flatten.

### MENDING, GUARDING, AND FILLING LOSSES

Book leaves are often torn, and over time, the spine folds of the gatherings can also become worn or torn. The hinges of books often split as well. Conservators use physically and chemically stable materials to mend these tears, including wheat starch paste, methyl cellulose, and long-fibered Asian papers made from the inner bark of mulberry trees (Fig. 7). Often, the mending papers are **toned** with dilute acrylic paints to match the original paper. Mending the spine folds or creating folios from separated leaves is known as **guarding**. Single leaves can also be attached to the text block with strips of paper (**hinging**) or by direct adhesion along the spine edge (**tipping**). If leaves have holes or large areas of loss, these can be **filled** with mending paper to match the original dimensions of the leaf. Moisture-sensitive papers may be mended with **heat-set tissues** made from mulberry paper and acrylic-based adhesives that can be activated with heat or solvents.



**FIG. 8.** A conservator sews mended manuscript folios over linen tapes using unbleached linen thread.



**FIG. 9.** The new leather spine on this rebacked manuscript is tied down over the raised bands.

### SEWING AND LINING THE SPINE

When a book has been disbound, the text block is treated and then reassembled. Conservators often add new endleaves to a historic text block in order to protect it from the cover. The book is then sewn again, usually following the original sewing pattern. If the original sewing structure was damaging, a more stable sewing structure may be chosen. Conservators usually use unbleached linen thread and sew through the fold. The sewing supports may be linen cord, woven linen tapes, parchment strips, or **Ramieband** (nonwoven strips of ramie fiber). After sewing, the spine is consolidated with wheat starch paste, rounded and backed as appropriate, and lined. Two or more linings of thin mulberry paper are put down first and adhered with wheat starch paste. These create a chemically stable **barrier layer** that allows any additional linings to be removed easily later on. Additional layers of linen or cotton cloth and Western paper may be adhered with **PVA**, or poly(vinyl acetate), a strong and flexible synthetic adhesive. The textile lining is often extended beyond the shoulders and used to attach the book cover. Conservators can also reattach old endbands or affix new ones.

### BOARD REATTACHMENT

Because the joints of a book must flex repeatedly, they often break. If the sewing supports and hinges also break, the boards become detached. This common treatment problem can be corrected in a number of ways. The original sewing supports can be extended and used to attach the boards. Loops of thread known as **tackets** can be passed through the shoulder of the book and used to attach the boards. In lightweight books, new hinges and joints of toned long-fibered mulberry paper may be sufficient. If the book has been resealed, the new sewing support slips and an extended spine lining are often used to reattach the original book boards.

### REBACKING

The spines of book covers are particularly vulnerable to light damage and mishandling. Pulling a book from a bookshelf by hooking a finger into its headcap often causes the headcap to tear away. If the joints split, the spine often flaps free or becomes loose entirely in hollow-back books and case bindings. The constant flexing of the leather spine in a tightback book also causes the leather to deteriorate. If the original spine is lost or cannot be reused, a book must be **rebacked** or given a new spine (Fig. 9). Conservators often use cotton or linen cloth, paper, or new leather to replace a missing spine. The cloth or paper may be toned with acrylic paints to match the original covering material. The new spine may also be tooled to match the original, or provided with a new spine label that matches the old. If the old spine can be reused, it may be adhered on top of the new one.



**FIG. 10.** After-treatment photograph of the bound manuscript from Figure 1.

#### CORNER CONSOLIDATION

The corners of paper boards often become bent and crushed, with **delaminated** or separated layers. These can be consolidated with wheat starch paste, flattened, and dried under weight to restore their original shape.

#### COVER MENDING

Book covers are also prone to wear and tear, particularly over the joints, corners, and edges. Splits and abraded areas are often mended with layers of mulberry paper toned with acrylic paints. The toning may be fine-tuned with chalk pastels or colored pencils.

#### REBINDING AND CASE BINDING

If a book's old cover is too deteriorated for further use, the text block may be **rebound** in a new one. The book's owner may choose a binding that duplicates the book's original format or a sturdy case binding. The old cover is always returned to the owner as a record of the book's history.

#### HOUSING

Sturdy boxes of chemically stable materials are perfect for protecting a valuable book from light, dust, excessive handling, and pests. A wide variety of options are available, including four-flap enclosures of alkaline board, clamshell boxes of corrugated alkaline board, and attractive cloth-covered clamshell boxes with leather spine labels.

#### PRESERVATION REFORMATTING AND DIGITIZATION

Some books are too brittle to be handled. Other books are so sensitive or valuable that their handling should be minimized. In the case of brittle books whose information is more valuable than their structure, conservators often create **preservation photocopies** for use. Each leaf is copied onto alkaline paper and the leaves are then bound in a new cloth case. Non-brittle books may also be easily digitized while disbound for conservation treatment. The resulting digital images may be served directly to researchers in place of the original book, or they may be used to produce a physical **facsimile** (copy) for research or display.

When treatment is complete, conservators write a **treatment report** that describes all the steps taken to repair the book, along with a rationale for the techniques chosen. Often these reports include a list of the materials used during treatment. Conservators also take **after-treatment photographs** that document the changes in the book (Fig. 10). The photographs and written documentation become an important part of the history of the volume, and can help the book's owners care for it appropriately in years to come. If the book should ever need conservation treatment again, the documentation can also help future conservators determine the best course of action.

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