

**Conservation methods of a full leather-covered medieval rare book collected
in Ain Shams University Central Library entitled**

"ΤΟΥ ΜΕΓΑΛΟΥ ΙΠΠΟΚΡΑΤΟΥΣ ΠΑΝΤΩΝ ΤΩΝ ΙΑΤΡΩΝ ΚΡΥΦΑΙΟΥ ΤΑ
ΕΥΡΙΣΚΟΥΜΕΝΑ"

"MAGNI HIPPOCRATIS MEDICOMRUM OMNIUM FACILE PRINCIPIS OPERA OMNIA
QUAE EXTANT"

**"Complete Works of Hippocrates, the Great leader of All Physicians in the World
(the Father of Medicine)"**

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This restoration project was a fruitful collaboration between the Center for Papyrological Studies and Inscriptions (CPSI) at Ain Shams University in Egypt and Institute for Preservation and Conservation of Chinese Ancient Books (IPCCAB) at Fudan University in China during the summer in 2018. This report consists of two parts. The first part contains some historical facts about the book author, Hippocrates, the Father of Medicine, and his collective medical works which is collected in eight sections -in Greek language with Latin translation. He described in a scientific manner, many diseases and their treatments after detailed observation. The second part illustrates the major intervention steps for the restoration of this book.

Hippocrates (ca. 480 BC.- ca. 337 BC) was born in Cos, the Greek island, in the family of the Asclepiads, physicians; they were followers of the god Asclepius. Because Medicine was a common practice in his family, he learned and inherited their career and got more progress. In his books, which are more than 60, he does not rely on religious or magical beliefs, but he described in a scientific manner many diseases and their treatments after detailed observation. His biographers have determined that he was practicing in Egypt, Libya, and Asia Minor. His life was fruitful and his works were collected after his death.

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Acknowledgments to Prof. Wafika Noshay from Conservation Department at Cairo University, and to General Manager Dr. Hamdy A. Mohamed from Conservation Department of Museum of Islamic Art for their guidelines and suggestions to the conservation work.

CONTENTS OF THE BOOK

SECTION I

The first section dealt with various subjects as: The Oath of Hippocrates, the Law of Hippocrates, the Art of Medicine, the Art of Medicine in former times, the Physician, Decency, Decorum, and the Precepts of Hippocrates:

Ἱπποκράτους ὄρκος	Hippocratis Jusjurandum
Ἱπποκράτους νόμος	Hippocratis Lex
Περὶ τέχνης	De Arte
Περὶ αρχαίας ἰητρικῆς	De Prisca Medicina
Περὶ ἰητροῦ	De Medico
Περὶ εὐσχημοσύνης	De decenti Habitu, aut decoro
Παραγγελλία	Praeceptiones

The first part of this section dealt with Oath of Hippocrates, which became the famous ethical oath today for medical graduates and young practitioners who decide to devote themselves to the life-saving career. Part of Oath's text is attested in P. Oxy. XXXI 2547. (IV AD). It is also found as a manuscript entirely preserved in the Vatican Library (VII AD).

SECTION II

The second section dealt with other subjects as: (The Book of) Prognostics, (Hippocrates on) the Humours, (Hippocrates on) Crises, (Hippocrates on) Critical, days, predictions of Hippocrates and the Coan Prognostics:

Προγνωστικόν	Praenotionum
Περὶ χυμῶν	De Humoribus
Περὶ κρίσεων	De Judicationibus
Περὶ κρίσιμων	De Diebus Judicatoriis
Προρητικόν	Praedictorum Libri II.
Κωακαὶ Προγνώσεις	Coacae Praenotiones

Fracture with wounds, considered, as well as luxations fractures of the upper extremities all these minutely described, and the treatment and the machinery described for extension. He examined the eyes. Sores, both old and recent, should be noticed. If the disease is mortal, they become livid, dry, or pallid, and quite dry shortly before death.

Frequent respiration denotes pain or inflammation above the diaphragm; deep and very slow respiration announces delirium. Sweats are beneficial in all acute diseases.

SECTION III

The third section dealt with mankind and his nature as: The Nature of Man, Generation, the Foetal Nature, the Origin of Man, the Seven-Month Birth, the Eight-Month Birth, Superfoetation, Demition, the Heart, the Glands, the Nature of the Bone, Airs, Waters, Localities, Flatus and Epilepsy:

Περὶ φύσιος ἀνθρώπου	De Natura Hominis
Περὶ γονῆς	De Genitura
Περὶ φύσιος παιδίου	De Natura Pueri
Περὶ σαρκῶν	De Carnibus
Περὶ ἑπταμήνου	De Septimestri Partu
Περὶ ὀκταμήνου	De Octimestri Partu
Περὶ ἐπικυήσιος	De Superfoetatione
Περὶ ὀδοντοφυΐης	De Dentitione
Περὶ καρδίας	De Corde
Περὶ ἀδένων	De Glandulis
Περὶ οστέων φύσιος	De Ossium Natura
Περὶ ἀέρον, ὑδάτων, τόπων	De Aere, Locis, et Aquis
Περὶ φυσῶν	De Flatibus
Περὶ ἱερῆς νούσου	De Morbo Sacro

All diseases occur at all seasons of the year, but certain of them are more apt to occur and be exacerbated at certain seasons; diseases and ages, certain of them are well- or ill-adapted to different seasons, places, and kinds of diet.

SECTION IV

The fourth section dealt with other subjects as: The Healthy Diet, Regimen, Dreams, Aliment, Food in Acute Diseases, the Different Parts in Man, and the Employment of Liquids:

Περὶ διαίτης ὑγιεινῆς	De Salubri Victus Ratione
Περὶ διαίτης	De Victus Ratione Libri III
Περὶ ἐνυπνίων	De Insomniis
Περὶ τροφῆς	De Alimento
Περὶ διαίτης ὀξέων	De Victus Ratione in Morbis Acutis
Περὶ τόπων τῶν κατ' ἀνθρώπων	De Locis in Homine
Περὶ ὑγρῶν χρήσιος	De Liquidorum Usu

It included Regimen in acute diseases, using wine, honey water, squirben, cold water, and bathing. If any part of the body be in a painful state prior to the illness, there the disease fixes.

SECTION V

The fifth section dealt with the nature of woman and her diseases as: Diseases, Affections, Internal Affections, the Diseases of Virgins, the Nature of Woman, Female Diseases, Barrenness and the Vision:

Περὶ νόσων	De Morbis Libri IV
Περὶ παθῶν	De Affectionibus Libr I
Περὶ τῶν ἐντὸς παθῶν	De Internis Affectionibus
Περὶ παρθενῶν	De his quae ad Virgines spectant
Περὶ γυναικείης φύσιος	De Natura Muliebri
Περὶ γυναικείων	De Mulierum Morbis Libri II
Περὶ ἀφύρων	De his quae Uterum non gerunt
Περὶ ὄψιος	De Videndi Acie

It defined what is presented to women due to menstruation, menstrual retention and bleeding, and then mentions what is displayed during and after pregnancy, which are many of the symptoms that are frequently presented.

SECTION VI

The sixth section dealt with the other subjects as: The office of the Physician, Fractures, the Joints, the Reduction of Fractures and Luxations, Ulcers, Fistulm, Haemorrhoids, Wounds of the Head, the Extraction of the dead Faetus, and Dissections:

κατ' ἰητρείου	Medicina officina, aut de officio Medici, libr. I.
Περὶ ἀγμῶν	De Fracturis libr. I
Περὶ ἄρθρων	De Articulis
Μοχλικόν	Vectiarium
Περὶ ἐλκῶν	De Ulceribus
Περὶ συρίγγων	De Fistulis
Περὶ αἱμορροΐδων	De Haemorrhoidibus
Περὶ τῶν ἐν κεφαλῇ τραυμάτων	De Capitis Vulneribus
Περὶ ἐγκατατομῆς ἐμβρύου	De Foetus mortui exsectione
Περὶ ἀνατομῆς	De Corporum resectione

A severe wound of the bladder, of the brain, of the heart, of the diaphragm, of the small intestines, of the stomach, and of the liver, is deadly. When ulcers continue open for a year or upward, there must necessarily be exfoliation of bone, and the cicatrices are hollow. When the brain is severely wounded, fever and vomiting of bile necessarily supervene. In persons affected with chronic disease of the hip-joint, if the bone protrudes from its socket, the limb becomes wasted and maimed, unless the part be cauterized.

SECTION VII

The seventh section dealt with the other subjects as: Epidemics, the Book of Aphorisms:

τῶν ἐπιδημιῶν	De Morbis Populariter Libri VII
τῶν ἀφορισμῶν	Aphorismorum, Liber VII

This book included the Epidemia; Hippocrates used it as the title of one of his famous treatises. At that time, epidemic was the name given to a collection of clinical syndromes, such as coughs or diarrheas, occurring and propagating in a given period at a given location. The Aphorisms, they included the definition of medical phrases to be laws in which it contains the sum of what was deposited mentioned in all his other books.

SECTION VIII

The eighth section dealt with some subjects as: Epistolm Hippocratis, Senate-consults of Athenians, Family and life according to Soranos, of structure of human.

Ἐπιστολαί	Epistolae aliquot
Δόγμα Ἀθηναίων	Atheniensium Senatus-Consultum
Ἐπιβώμιος	Oratio ad Aram
Πρεσβευτικός	Thessali Legati Oratio
Γένος καὶ βίος τοῦ Ἱπποκράτους	Genus et Vita Hippocratis secundum
κατὰ Σωρανόν	Soranum
Περὶ φαρμάκων	De structura Hominis

This section contains a collection of letters appears to be rather the production of a sophist than of that eminent man these letters followed by an account of life, family and writings of Hippocrates from Soranos and Vander Linden, with numerous testimonials from various sources¹.

RESTORATION OF THE BOOK

0. Introduction

The medieval medical book *Magni Hippocratis Medicorum Omnium Facile Principis, Opera Omnia Quae Extant* in Ain Shams University Central Library is among very few copies that still exist today²; in fact, it is the only copy found in Arabic

¹ John Redman Coxe, *Writings of Hippocrates and Galen* (Philadelphia: Lindsay and Blakiston, 1846), 454f.

² There are four editions of this book: the first edition presents in the Lyon Public Library in Germany; it is dated to 1595 AD. The second one presents also in Germany: Bavarian Library; it is dated to 1620 AD.

countries. This copy was published by Samuelis Chouët in Genevae in 1657 in Greek language with Latin translation – as it is mentioned- by Anutio Foesio printed on the same pages. The book title means: “The collective writing of Hippocrates, the great leader of all physicians in the world.” (Fig. 1). Hippocrates, the author of this book, was a leading medical doctor in the medieval world (Fig. 2).

This rare book is housed under special register number (610.38 over HM); and the internal left side of its hard cover bear two cards attested that this copy of the book has been registered in the Organizing and Microfilm Center, as follows:

First card			Second card		
Film no.	1138	600	Film no.	1139	600
Registered on a roll	35 mm		Registered on a roll	35 mm	
measures			measures		

The book is measured by 26.5 x 40.5 x 11 cm³, with a total of 1397 pages that form 116 fascicules. It is printed entirely in black and white, with red ink only present on the title page (Fig. 1). The pages are sewed on 6 raised single bands and are fully covered with leather gilded with golden motifs on the spine (Fig. 3). Because of its tremendous thickness (11 cm) and immense weight, this old volume suffered from many typical problems of a leather-covered heavy book, from a ruptured spine, loose binding and missing headbands to the worn and soft corners and the pale and cracked leather. Therefore, it is not only invaluable to preserve the historical and academic information in this book, but the restoration process can also be a reference for conservators to treat similar rare books with a leather cover.

The principle of “minimal intervention” was strictly performed during restoration process in order to preserve most of the historical evidence to our posterity. In addition, a clamp-shell box with a display board was tailor-made for this book to act as a buffer against the changing environment, and to minimize the stress of the spine when opening the book on the display board.

As a typical case of medieval rare book conservation, this report provides information about leather deterioration, conservation difficulties and restoration ethics for treating leather covered rare books. The intervention procedures, difficulties and effectiveness of the treatments are fully illustrated and discussed.

The third edition dated to 1624 AD is also present in the Lyon Library in Germany. The fourth one carries the same date of the new copy 1657 AD and is found in Austria.

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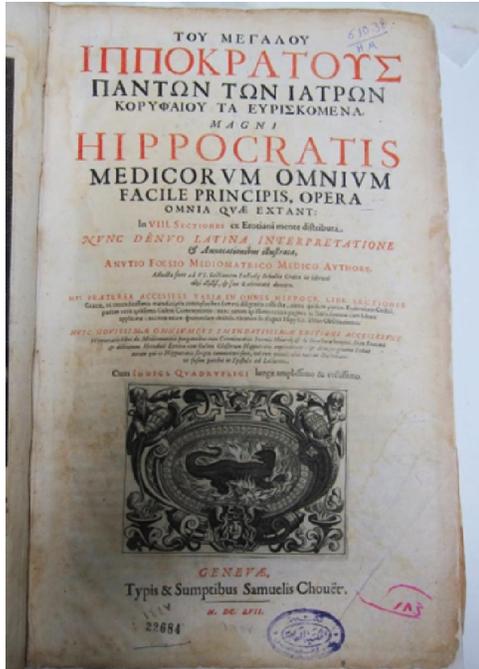


Fig. 1. The title page of the book.

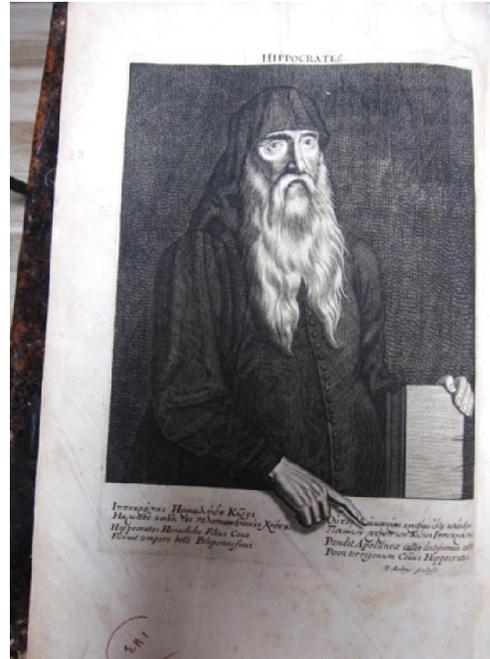


Fig. 2. Printing of Hippocrates.



Fig. 3. The spine with golden gilding.

1. Preservation status of the book

Due to the natural deterioration of leather and a lack of maintenance, the leather on the cover has become cracked, dry and stiff (Fig. 4). The problem of leather ageing is most obvious on the spine where bending and tensile forces occur whenever a reader opens and closes the book. As a result, half area of the leather is lost from the spine (Fig. 3). The stiffness of the aged leather also makes it easier to break apart during constant usage. For example, the leather on the corners of the cover is already lost due to the deformation of the cardboard inside caused by the book's own weight. Furthermore, part of the leather on the borders of the cover has fragmented (Figs. 4, 5).

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Another noticeable deterioration of the book seen on its binding. One headband is missing while the other one only has a tiny remnant attached. The upper fascicules are partially separated from the book; one has already entirely come off, possibly due to the high tensile force on the strings and cords of the binding when the thick book is opened (Fig. 6). Additionally, all the pages are covered with a thin layer of fire retardant powder when a bomb exploded in front of the book in the past! Most pages have foxing on the lower part of the paper while many pages have long tidemarks. Tears are found on the margins of many pages while insect boring holes as well as oil stains are also present (Fig. 7).



Fig. 4. The leather is dry and cracked; the corners of the cover are broken.



Fig. 5. The borders of the leather are torn.



Fig. 6. The sewing is loose; the headband is missing.

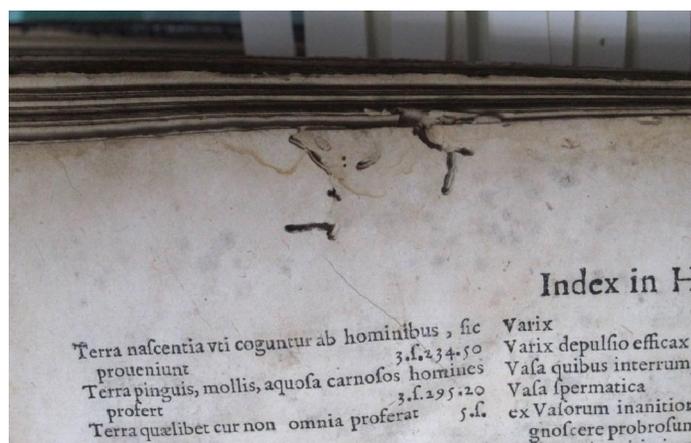


Fig. 7. Insect boring tunnels.

Fortunately, the printing and ink on the paper appear in a stable condition. Neither blur nor sign of ink corrosion occurs. The paper is generally sound and flexible; it could withstand mechanical stresses of normal use.

2. Principles of conservation

Conservation of ancient rare books has a multi-facet goal. First of all, all the text message and graphical images it bears should be safely transmitted to our posterity. Secondly, its functionality as a book should be restored to the extent that suits its future usage and storage conditions. Since this book is collected in a university library, it

should be able to withstand the normal handling of general readers after restoration. Thirdly, as the only copy still exists in Arabic world today, all the historical evidence on this book should be carefully preserved, including the original materials, ancient craftsmanship and the handwriting or timbers it bears. Finally, the aesthetic value can be increased to some extent by removing the dirt, stains, tidemarks and degradation products accumulated in the book. Nonetheless, even though a conservator can make a book look newer by cleaning it, it is not acceptable to rejuvenate the aged materials by erasing the lapse of time (Cesare Brandi 1963). Therefore, a moderate cleaning to an extent that can enhance the legibility of the text and slow down the acidic hydrolysis of fiber is usually considered adequate.

Since this medieval rare book is of high historical value, the principle of “minimal intervention” is strictly performed. All the original materials will be preserved and reused, including the cardboard in the cover, the leather, and the guard/contra-guard papers; even the original bookbinding should be kept with only minor reinforcement in order to convey the most historical evidence it bears to the future generations.

3. Procedures of intervention

Considering both the principles of conservation described above and the actual preservation status of this book, the following restoration scheme is proposed: (1) Cleaning of all the 1397 pages; (2) Reconstruction of the 4 worn corners of the cover; (3) Mending of tears; (4) Partial reinforcement of the binding; (5) Sewing of the 2 headbands; (6) Rebacking of the spine; (7) Care of the leather; (8) Inpainting of the restoration materials on the cover; (9) Assembly of a clamp-shell box and the display board for the book.

1. Dry cleaning of the pages

Despite immersion in water can thoroughly remove the tidemarks, fire-retardant powder and paper degradation products, it needs to completely dismantle the volume. Considering that the main bookbinding is still robust and the pH test of the powder and paper is neutral, it is not recommended to rinse the totally 700 papers in water. Instead, the particles on the surface of the paper are gently brushed away and the papers are further rubbed carefully with a chemical sponge (Fig. 8). Although removing the fire-retardant powder from the pages may erase the record of bomb explosion in the past, it instead trades for the legibility and readers' health when handling the book in the library.



Fig. 8. Dry cleaning of the pages with a chemical sponge and the brush.

2. Mending the tear of paper

Thin Japanese tissue is used to mend the tears on the margin of pages. To reduce the color difference between the Japanese tissue and the old pages, black tea infusion is

used to dye the Japanese tissue to a yellow-reddish hue (Fig. 9). After drying, the dyed mending tissue is adhered onto the tear with carboxymethyl cellulose (CMC) using a small paintbrush.



Fig. 9. Dyeing the mending tissue with the black tea infusion.

3. Resewing

Since the binding of the upper fascicules of the book is very loose with one fascicule already detached, it is needed to reinforce the binding and secure the fascicules. The 2 strips of parchment on the upper and lower ends of the spine are carefully opened in order to expose the knots of sewing that tie up the strings (Fig. 10). The loose and detached fascicules are secured in the former correct position by alternately using a straight needle and a curved one that moves easier round the cords on the spine (Fig. 11).



Fig. 10. Lifting the 2 extreme strips of parchment to expose the knots.



Fig. 11. Sewing the loose upper fascicules by both a curved needle and a straight one.

4. Constructing the headbands

Although modern headbands are simply colorful fabrics glued to the spine, the traditionally handmade headbands are complex and much more than just decoration. While the base layer of traditional headband tightens the upper/lower edge of the spine, the outer layer that usually alternates with 2 bright-colored strings adorns the book. After lifting the uppermost and lowermost strips of parchment from the spine, the cotton string is sewn into the fascicules to form the base of headband (Fig. 12). Then the red and yellow strings, the same colors as the original headband remnants, are alternately wound around the core of headband in a style that creates small beads on the edge of the spine (Fig. 13).



Fig. 12. Constructing the base of the headband.



Fig. 13. Decorating the headband with 2 colorful strings.

5. Reconstructing the corners and borders of the cover

The 4 corners of the cover are either soft and bent or worn and rounded that need different treatments. In the case of bent and soft corners, high concentration of CMC is

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introduced into the fissures and pores of the deteriorated cardboard by a spatula to consolidate it, and then dried under pressure (Figs. 14, 15). If the corners of the cover are heavily worn or rounded, they need reconstruction rather than mere consolidation. Thin layers of new cardboard are firstly inserted into the rounded corner to form a rectangular new corner (Fig. 16). The new corner is then spread with the paper pulp and CMC mixture and allowed to dry to produce a flat surface (Fig. 17). Finally, several layers of Japanese paper are pasted on to produce a smooth texture (Fig. 18). The reconstructed corners need inpainting to match the color and pattern of the original leather on the cover, as detailed in session 3.8.



Fig. 14. Consolidation of the broken corner by introducing carboxyl methylcellulose (CMC).



Fig. 15. Drying the consolidated corner under pressure.

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Fig. 16. Reconstruction of the rounded corner with layers of cardboard.



Fig. 17. The corner pasted with the pulp & CMC mixture.



Fig. 18. Insertion of Japanese paper to produce a smooth surface.

The old leather has partly peeled off from the borders of the cover where the wear and tear is most frequent. The missing areas of the leather are filled with the paper pulp and CMC mixture with a spatula, allowed to dry, and then pasted with several layers of Japanese paper that will be further inpainted to resemble the appearance of leather, as described in session 3.8.

6. Rebacking the spine

Since half area of the leather is lost from the spine, the 2 boards of covers are connected to the body of the book by only the guard papers and the cords, which are largely exposed. It is necessary to restore both the functionality and the appearance of the spine. To restore its function, a piece of new leather is used. A rectangular piece of leather large enough to wrap the entire spine is cut from the vegetable-tanned goat skin (Fig. 19). Meanwhile, to reduce the thickness of overlapping between the new leather and the original, the periphery of the new leather is trimmed off from the flesh side by a leather knife (Fig. 20). On the other hand, to restore the appearance of the spine, the original leather remnants are carefully peeled off from the spine by a spatula (Fig. 21). The trimmed leather piece is then evenly distributed with the glue mixture of starch paste and CMC (4:1) before its borders are inserted into the fissures between the original leather and the cardboard of the cover (Figs. 22, 23). The upper and lower ends of the leather are folded round the edge of the spine and fixed by the glue mixture. The book is then tied with ropes and bandage on a rack overnight to secure the spine, with the raised bands exposed from the gaps between two ropes to make the raised bands eminent (Fig. 24). The new leather is finally inpainted with acrylate colors to the same shade of the old leather (Refer to session 3.8). Lastly, the original leather remnants are pasted back to their former position on the spine to restore its appearance (Fig. 25).



Fig. 19. Cutting a square of leather from the vegetable-tanned skin.

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Fig. 20. Trimming off the edges of leather from the flesh side.



Fig. 21. Peeling off the remaining leather from the spine.

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Fig. 22. Distributing the starch and CMC mixture (4:1) on the leather.



Fig. 23. Inserting the periphery of the new leather beneath the original leather.

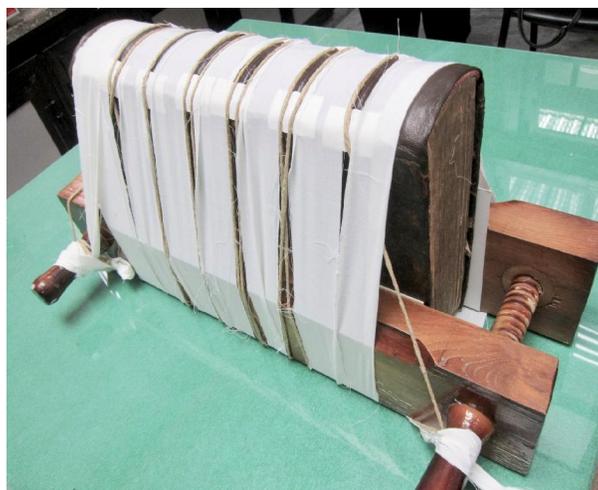


Fig. 24. Securing the new leather and evidencing the raised bands on the spine.



Fig. 25. Pasting the original leather back onto the new leather.

7. Leather conditioning

During the natural ageing process of acid hydrolysis and oxidation over the past 360 years, the leather cover of this book has become cracked, rough and pale (Dirken 1997). It is necessary to restore both the strength and aesthetic properties of the leather. To consolidate the cracked leather, 5% Klucel-G in ethanol is applied by gentle rubbing with a cotton fabric. After drying, 40% castor oil in water is firstly applied with a small

paintbrush, and then rubbed and polished with a lint-free cloth to create a brownish sheen and a smooth texture.

8. Inpainting of the cover

The covers reconstructed with paper, cardboard and pulp appear white that is incompatible with the dark brown leather cover. Inpainting is the final step after the leather is completely dried from consolidation and oil conditioning treatments that may alter the color of leather. Small amount of water colors that resemble the basic hue of the original leather is firstly applied to the restored corners of the cover with an ultra-fine paintbrush. Tiny dots with varied shades of color are then painted on to mimic the texture of the real leather (Fig. 26). The new leather on the spine also has a different color from the original leather and thus needs inpainting. Multiple layers of acrylate colors are applied one by one to the new leather to create the effect of a dark brownish basic tone with purple and orange sheen (Fig. 27).



Fig. 26. Inpainting the paper-based new corner with water colors.



Fig. 27. Inpainting the new leather spine with acrylate colors.

9. Assembling the clamp-shell box and the display board for the book

Clamp-shell box is a type of preservation containers that keep the book in horizontal position to avoid the collapse of the cover and binding caused by the book's own weight. The box can reduce the risk of biological attack, such as fungi and insects. Additionally, the semi-tight space can serve as a buffer against fluctuating humidity and temperature. The acid-free lining also provides a neutral preservation micro-environment. The tailor-made clamp-shell box with the display board is an ideal equipment for storage, transportation and display of the book. When placing the book on the display board, the book is opened to only approximate 110-degree angle so that the bending and compression forces on the binding and the spine are reduced.

The general steps to assemble the clamp-shell box with a display board is as follows:
(Fig. 28 a-g)

(1) Measuring the precise dimension of the book; (2) Cutting the cardboard into rectangular plates; (3) Assembling the boards into 2 vessels using PVAc; (4) Cutting the fabric into the shape that wraps both the outer and inner surfaces of the 2 vessels; (5) Placing a strip of cardboard between the 2 vessels, and then wrapping them with the fabric spread with PVAc; (6) Lining the inner side of the box with acid-free paper using CMC; (7) Repeating the steps described above to make the display board. Instead of making the 2 vessels for the box, making 2 triangles by joining 2 cardboards for each triangle; (8) Inserting a loop of cotton strip into each side of the display board before lining up the surface.

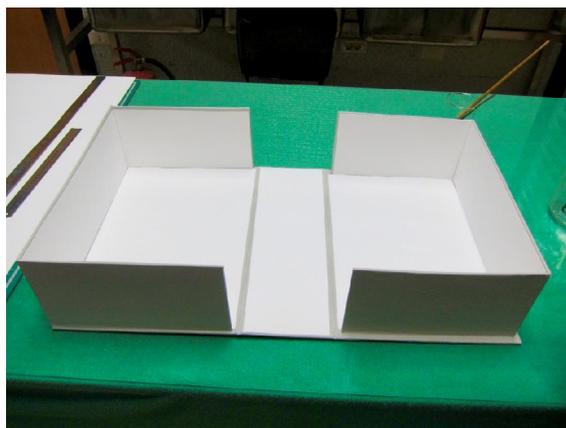


Fig. 28 (a) Assembling 4 pieces of plate into a vessel by PVAc.

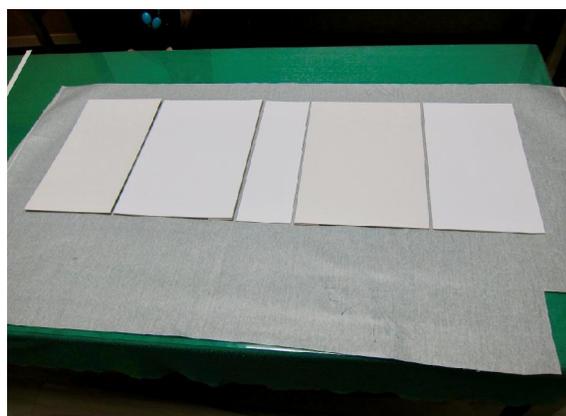
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(b) Wrapping the fabric over the 2 vessels.

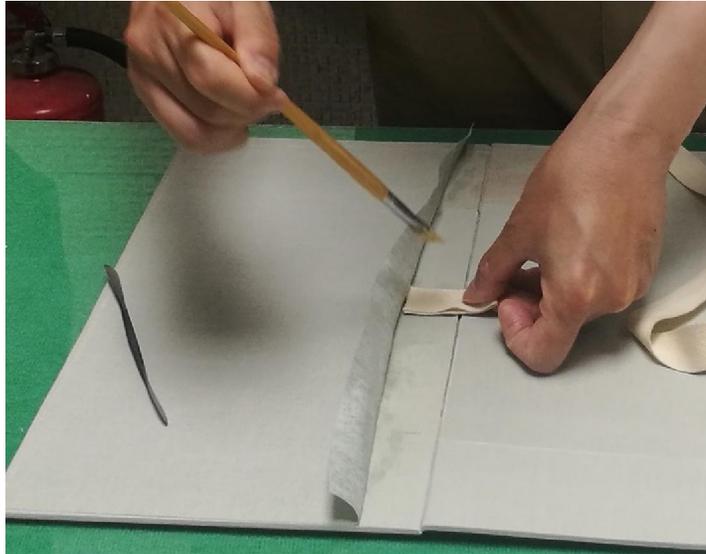


(c) Inner surfaces lined with acid-free paper.



(d) Wrapping the fabric round the display board.

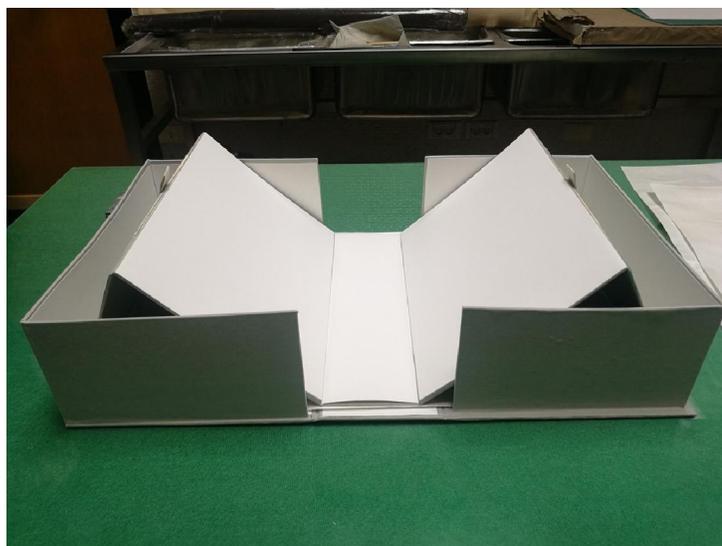
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(e) Inserting the loop that opens the display board.



(f) Lining up the inner surface of the display board with acid-free paper.



(g) Clamp-shell box with the display board in open position.

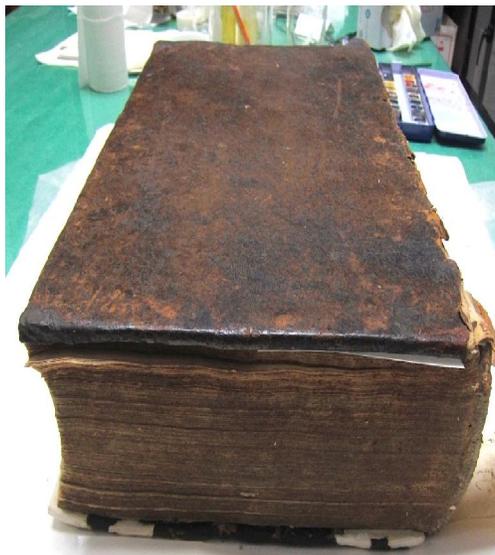
4. Assessment of the treatment

The main effort of restoration of this full-leather covered medieval rare book is focused on its cover and spine. The pale and cracked leather has been consolidated and oil dressed; it has a brownish sheen and smooth texture after the treatment (Fig. 29). The soft and worn corners of the cover have been consolidated and restored, and become strong enough to withstand the book's own weight (Fig. 30). The two headbands on the spine are restored to its original structure and style with both mechanical and aesthetic functions (Fig. 31). The ruined spine is reconstructed with new leather to ensure its flexibility and endurance against the bending and tensile forces when opening and closing the book. The original leather remnants are pasted back onto the new spine to restore its appearance (Fig. 32). Although it is possible to further increase the aesthetic value of the spine by restoring the golden gilding, it requires the same motifs of gilding tools and skilled gilding techniques. Thus, the gilding is left untouched to future experts to fully restore it. Finally, the construction of a tailor-made clamp-shell box provides a buffered environment that can lower the impact of biological attacks, fluctuating humidity and temperature, and mechanical stresses. The display board stands at a restricted angle to reduce the bending force of the spine when the book is opened (Fig. 28 g).

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Fig. 29 (a) The leather before restoration appears pale and cracked.



(b) After restoration, the leather is smooth with a brownish sheen.

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Fig. 30 (a) The corners of the cover before restoration are soft and broken.



(b) After restoration, the corners become solid and robust.

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Fig. 31 (a) One headband is missing; the other has only tiny remnants.



(b) Headbands restored.

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Fig. 32 (a) Before restoration, half of the leather is lost from the spine, exposing the cords and the parchment strips.



(b) The spine restored with the new leather.

References

1. Coxe, John Redman, *Writings of Hippocrates and Galen*, Philadelphia: Lindsay and Blakiston, 1846.
2. Dirksen V., "The degradation and conservation of leather", *Journal of Conservation and Museum Studies* 3 (1997): 6-10.
3. Cesare Brandi (1963) Chapter 4 Il tempo riguardo all'opera d'arte e al restauro. *In: Teoria del Restauro*. Torino: Piccola Biblioteca Einaudi, 2016.