Amsterdam University Press

AHM Conference 2024: 'Heritage, Memory and Material Culture: Research-Teaching-Society Nexus'
https://doi.org/10.5117/9789048567638/AHM.2024.011

Be Clean, Be Green

Perceptions of "cleanliness" in the history and reflection on the cleaning treatments of silver in modern conservation practice

Han Zhou,[1*] Maartje Stols-Witlox,[1] Loïc Bertrand[2]

[1] University of Amsterdam, Faculty of Humanities, Amsterdam, the Netherlands
[2] Université Paris-Saclay, ENS Paris-Saclay, CNRS, PPSM, 91190 Gif-sur-Yvette, France
*Corresponding author. Email: h.zhou5@uva.nl

ABSTRACT

In modern conservation practice, cleaning is a regular treatment for heritage objects. It is executed with the aim of restoring their (perceived) original aesthetics and improving their legibility, while reinforcing their physical and chemical stability. Increasing attention is being paid to the sustainability of cleaning methods and treatments, particularly with regard to their negative impact on the environment and/or the health and safety of operators. We have begun to collect and study historical cleaning methods developed in low-tech environments as a means of finding inspiration for greener alternatives to current methods. Written historical descriptions of cleaning treatments reveal a dynamic quest for "cleanliness". What was advocated as clean appears to depend on the context of application. While the history of hygiene and cleanliness of the human body has been studied, the perception and pursuit of cleanliness and hygiene of objects remains under-researched. The perception and pursuit of cleanliness may still play an invisible role in guiding modern conservation decisions, for example in defining for whom the perception of cleanliness is important. Reflecting on this interrelationship may be a step towards more sustainable and environmentally friendly treatments.

Keywords: Historical conservation methods, Sustainability, Silver tarnish removal, Cleaning, Paleo-inspiration, Perception.

1. INTRODUCTION

In the modern conservation of cultural heritage objects, cleaning is a regular treatment. For example, silver objects form a tarnish layer when exposed to sulphur-containing atmospheric pollutants, which darkens their surface colour and reduces their gloss. Tarnish removal is commonly carried out to restore their perceived original appearance (Storme et al. 2015, 1; Palomar et al. 2018, 81).

As with any intervention, cleaning poses short- and long-term risks to the object (Ormsby et al. 2024, 1). For tarnished silver objects, mechanical cleaning ("polishing") can result in loss of mass and object details. Chemicals used to dissolve tarnish layers can enhance corrosion of the underlying metal. Residues of the chemicals used can accelerate re-tarnishing (Palomar et al. 2018, 81-90).

Efforts are being made to develop suitable cleaning methods that achieve optimum cleaning efficiency while minimising risks. In recent years, increasing attention is paid to the potential health and safety hazards of conservation chemicals, both for operators and the environment. For example, acidified thiourea solutions, once widely used for silver tarnish removal, have been phased out, as thiourea is a suspected carcinogenic compound (Palomar et al. 2018, 85). Growing awareness of the

importance of sustainability has driven the search for more sustainable solutions across the conservation field. For example, the recently initiated Horizon Europe projects MOXY, GREENART and GoGreen all aim to explore greener alternatives to current conservation treatments.

The research presented in this paper investigates historical cleaning methods for silver. Over the last century, conservators have gradually replaced traditional treatments with treatments based on highly refined chemical products. This has led to the active abandonment or passive loss of empirical knowledge developed in low-tech environments (see Jouves-Hann 2024). We argue that rediscovering and reassessing these forgotten historical methods has the potential to inspire greener paths for conservation treatments, in line with what Bertrand et al. (2018, 7288) defined as paleo-inspiration. This approach has already been explored in other fields, such as speculative design (see Mitrović et al. 2021).

The argument is illustrated using our first results on silver tarnish removal. Based on a documentary study of historical sources, we give a first insight on how historical recipes can provide us with alternative systems for cleaning silver, and prompt us to reflect on the impact of perceptions of cleanliness, both past and present.

2. DOCUMENTARY STUDY APPROACH

152 recipes for cleaning silver objects from historical sources were collected through keyword searches of recipe books identified in previous art technological studies and located in digital archives (e.g. Google Books, Internet Archive, HathiTrust Digital Library, Bibliothèque Nationale de France). The year 1950 was set as the end point for this research because "scientific conservation" had become dominant by then (Muñoz Viñas 2005, 69-70). No starting point was defined beforehand. So far, our research protocol has resulted in a collection in which most of the recipes were published after 1700 (Fig. 1). Recipes were transcribed and entered into a database which was designed for systematic cross-comparison.

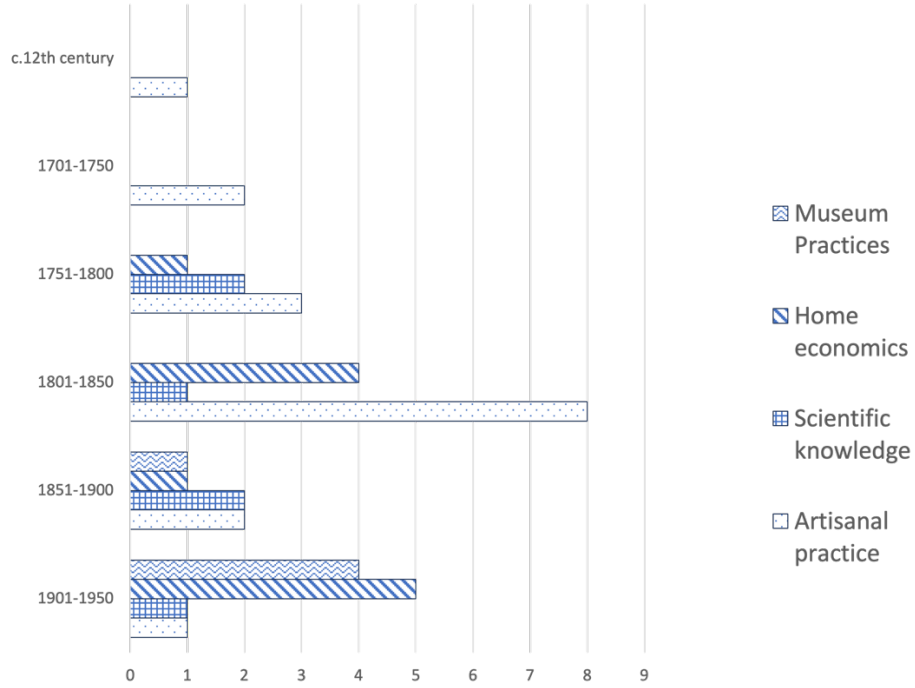

Figure 1. Chronological distribution of historical sources. The sources are categorized into four types based on their main subject, namely artisanal practice, scientific knowledge, home economics, and museum practice.

3. WISDOM FROM THE PAST: MATERIALS AND METHODS IN HISTORICAL CLEANING RECIPES

In modern conservation, silver cleaning can have two meanings: (1) the removal of unwanted external soiling materials (e.g. dirt), or (2) the removal of unwanted corrosion products (i.e. the tarnish layer) (Stone 2007). A survey by Palomar et al. (2018), focusing on the latter, identified mechanical abrasion as the dominant modern cleaning method (49%). The most commonly used mechanical method was shown to be commercial polish based on mixtures of inorganic abrasives (e.g. SiO_2, Al_2O_3, TiO_2 or $CaCO_3$) in an organic medium (50%), of which the composition was usually ambiguous. Self-made paste with calcium carbonate ($CaCO_3$) powder in water was the second most common choice (28%) according to the survey (Palomar et al. 2018, 82).

We observed that the historical recipes include a wider variety of materials (Table 1). Historical abrasives include geomaterials (such as rock powders, clay, or sand), animal bones and shells (such as powdered hartshorn and cuttlefish bone), and combustion products (such as ash and soot) (Fig. 2). While we know the properties of some of these materials is well known particularly those that are still in use, many others are far less so In fact, some of the materials, such as calcined hartshorn (deer antler) and gravelled ash (ash from burnt winemaking deposits) are largely unfamiliar to modern conservators. The discontinuation of methods using these materials may be due to various historical factors, such as decisions relating to industrial processes, the emergence of products deemed more efficient, or regulatory, supply and technical constraints. Improved understanding of these factors can reopen paths closed in the past and re-introduce some material choices for modern use (Mitrović et al. 2021).

Our archival research unearthed interesting examples of the use of waste or by-products from early manufacturing processes. For example, one of the historical polishing materials – calcined hartshorn powder – is a by-product of the production of distilled hartshorn, also called spirits of hartshorn, to which certain medicinal virtues were attributed (Gray and Porter 1830, 372). The hartshorn distillation residue, when calcined, could be used as an inexpensive silver polish (Gray and Porter 1830, 382; Cooley 1856, 1056; Beeton 1871, 151; Griffith 1874, 251). Such recipes illustrate recycling, reuse and short production cycles as early sustainable approaches.

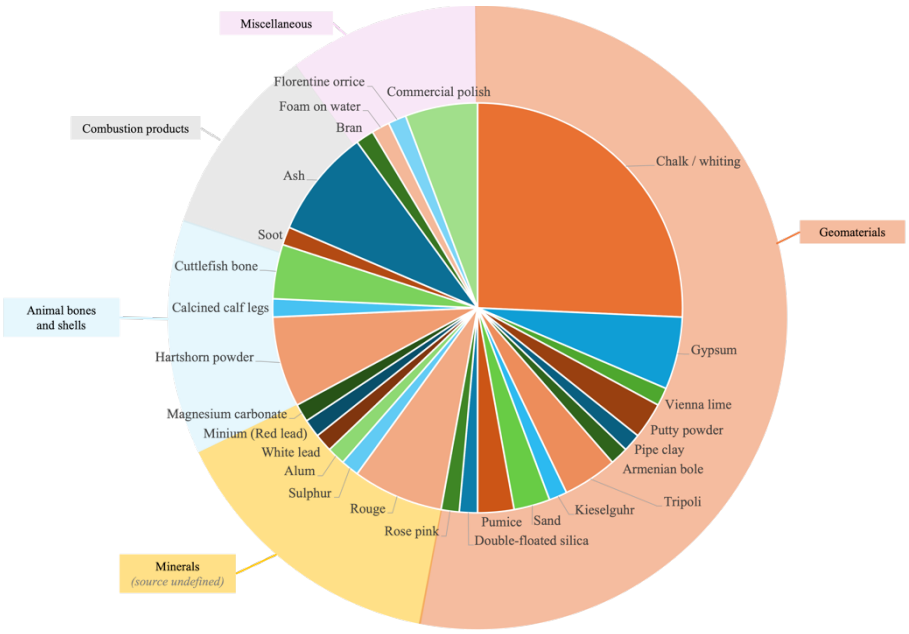

Figure 2. Abrasives mentioned in the historical recipes collected for this research (number of recipes: 152, time span: 12th c. – 1950, language of sources: English, French, German).

Table 1. Methods and materials mentioned in historical recipes for cleaning silver. Historical nomenclature used in the recipes has been re-interpreted with modern terms based on definitions and explanations in contemporary historical dictionaries where applicable. (* Chemicals that were also mentioned to be mixed with abrasive materials to form a cream or paste for polishing.)

Year			c. 12th century	1701-1750	1751-1800	1801-1850	1851-1900	1901-1950
Recipe Entry			4	9	15	50	35	38
Mechanical cleaning (abrasives)	*Geomaterial*	whiting				x	x	x
		chalk			x	x	x	x
		gypsum (CaSO4.2H2O)				x		x
		Vienna lime (high magnesium limestone, or dolomite)					x	
		putty powder (pulverized oxide of tin)				x	x	
		pipe clay					x	
		Armenian bole (earthy clay)				x		
		tripoli (rotten stone)			x		x	x
		double-floated silica						x
		kieselguhr						x
		pumice					x	x
		sand			x	x		
		rose pink (chalk and dye)				x		
	Minerals (Source unstated)	rouge (iron oxide)				x	x	x
		alum				x		
		sulphur		x				
		white lead					x	
		minium (red lead)	x					
		magnesium carbonate					x	
	Animal bones and shells	hartshorn powder				x	x	
		baked calf legs			x			
		cuttlefish bone				x	x	
	Combustion products	soot				x		
		ash		x	x	x		
	Miscellaneous	bran				x		x
		florentine orrice				x		
		foam on slow-moving waters in spring				x		
	Commercial silver polish	commercial silver polish						x
Chemical cleaning	*Acidic solutions*	cream of tartar (potassium bitartrate)*		x	x	x		x
		acetic acid (vinegar)*	x			x		x
		nitric acid			x	x	x	x
		sulphuric acid			x		x	x
		hydrochloric acid						x
		formic acid						x
		citric acid*					x	
		white wine			x			
	Bio-chemical mixture	Wine lees		x	x	x		
		wine yeast			x			
	Alkaline solutions	CaO (Ca(OH)2 in solution)				x		
		Potassium carbonate		x	x	x		x
		sodium carbonate*	x					x
		soda (sodium hydroxide)*					x	x
		Ash		x	x	x		x
		soap ley (alkalis)		x	x	x	x	
		borax					x	
		lupine cluster juice	x					
		ammonia					x	x
		ammonium carbonate*					x	
		Sal ammoniac (ammonium chloride)				x	x	
		spirits of hartshorn (sesquicarbonate of ammonia or dilute ammonia)*				x		
	Surfactants	Saponaria		x				
		soap*		x	x	x	x	x
		synthetic detergent						x
		bullock / jack's gall				x		
	Solvents	turpentine*					x	
		spirits of camphor*				x	x	
		spirit of wine*				x	x	x
		honey				x		
		sweet oil (olive oil)*				x		
		Vaseline*					x	
		nitro benzol*					x	
	Sequestring agents	common salt (sodium chloride)	x	x	x	x		
		alum	x	x	x	x		x
		potassium cyanide					x	x
		potassium oxalate					x	
		potassium permanganate						x
		sodium hyposulphite*					x	x
		silver nitrate*					x	
		Roman vitriol (copper sulphate)				x		
	Miscellaneous	sea-leek sprout	x					
		bran water				x		
		quicksilver (mercury)	x			x		
Electrolytic		Electrolytic cleaning					x	x

4. "AS BRIGHT AS NEW" (HISCOX 1916, 201): THE PERCEPTION AND CONSTRUCTION OF CLEANLINESS

As expected, inspiration for greener solutions comes not only from materials, but also from the application process itself (Bertrand et al. 2018, 7292). Of particular interest in this context are descriptions of the *expected* visual change. We found that these descriptions focused on either colour or gloss. For example, Hiscox (1916, 201) stated that the cleaning should be continued "till the articles are quite bright". Kendall (1947, 299-300) preferred a satin finish to a high brightness, as for her, a soft lustre was a quality of "old and cherished silver". Hopkins (1893, 449) described "a beautiful white appearance" as the goal of the cleaning operation, and the article should be subsequently burnished, while Norman (1814, 118) suggested that the user "will see it [the silver] changing colour directly".

These historical annotations not only provide us with a more varied perspective on the purpose of cleaning, but also lead us to question what should be considered clean for silver objects displayed in modern museum contexts, and how this notion of cleanliness could or should relate to historical perceptions of cleanliness in the original contexts of the objects.

While the history of hygiene and the cleanliness of the human body has been studied (see, for example, Vigarello 1988), the cleanliness of objects in everyday life remains under-researched. Ward argued in *The Clean Body: A Modern History* (2019, 4) that "the concept of the clean body is a construct, one that has evolved slowly over time … hygienic customs inevitably reflect the sensibilities of their era." We suggest that the same argument can be applied to the concept of cleanliness of objects. Indeed, actions of cleaning and perception of *clean objects* are part of human interaction with the surrounding world. In future research, we would like to step back and examine the evolution of the concepts of object cleanliness and hygiene over time and in different social contexts, as briefly outlined below.

5. FROM PAST TO PRESENT: RECONSTRUCTING HISTORICAL CLEANING METHODS

To understand the actual cleaning effects of historical methods, we propose to bring the past into the present through reconstruction.

Material reconstructions are widely use in art technological and conservation studies. The "Historically Accurate Reconstruction Techniques (HART)" model is one of the most widely recognized and discussed approaches in conservation studies and serves as the theoretical framework of our research (see Carlyle 2020). Adjustments were necessary for our purposes. Art technological studies typically take a specific object (e.g. a painting) as physical reference, which is available for comparison with the reconstruction results. As our subject is historical methods rather than objects, there is no such material reference. Instead, our evaluation method inter-compares the results of the distinct selected methods. The evaluation is benchmarked based on cleaning capacity, ease of application, and short- and long-term impacts (such as residue-induced degradation), with an emphasis on sustainability in terms of safety and environmental impact.

Mock-up systems subjected to silver tarnish removal methods, were prepared with coupons of two different qualities of silver (sterling silver and pure silver). Both were artificially tarnished. Cleaning methods were tested using materials and application processes found in the historical recipes.

Some recipes produce results that would not be considered sufficiently effective from a modern conservation perspective. For example, polishing a heavily tarnished surface with straw ash according to the recipes provided by Kunckel (1705, 165) and Lémery (1711, 172) increases gloss, but does not significantly lighten the colour (Figs. 3a and 3b). However, even when a cleaning test cannot be considered satisfactory, it may have been deemed effective in its historical context. When testing the same recipes on a lightly tarnished surface, the changes in colour and gloss were more obvious, suggesting that the method can *clean* lightly tarnished surfaces more effectively (Fig. 3c).

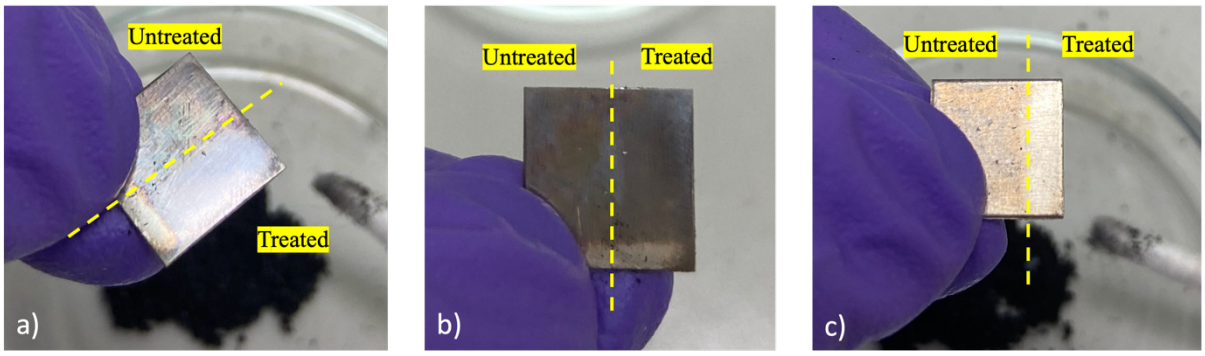

Figure 3. Observation of the on-going polishing of a heavily tarnished sterling silver surface under (a) and without (b) raking light. Observation of the on-going polishing of a slightly tarnished sterling silver surface (c). Photos taken on September 28th 2023 by Han Zhou.

Such visual observations feed our reflections about dynamic perceptions of cleanliness over time and bring into question the historical accuracy of current notion(s) of cleanliness. For example, if 18th century methods do not clean as thoroughly as modern methods, what should 18th century objects look like? In a museum, objects are usually staged with fixed lighting conditions and at pre-determined distance from the audience, which leads to a vastly different perception of the objects from their historical settings. Under these modern environmental settings, who decides how clean the objects should be when displayed? Reflecting on these questions creates room to explore alternative treatment choices and may itself be a step towards more sustainable and environmentally friendly practices.

6. CONCLUSION

This article presents the framework of our research into historical cleaning methods. We share our initial observations on the development of paleo-inspired conservation methods for the removal of tarnish from silver. In museums, many silver objects are displayed not just for their artistic value, but also as material evidence of past life, and the current treatment results of these objects might not always reflect their original appearance. Analysis of historical cleaning methods encourages us to question modern treatments. While the search for sustainable cleaning methods may involve developing greener chemical solutions, our work obliges us to reflect on the changing meaning of the word "clean" and questioning current expectations of cleanliness.

AUTHORS' CONTRIBUTIONS

Han Zhou: conceptualization, methodology, investigation, recipe collection and analysis, drafting, editing. Maartje Stols-Witlox: conceptualization, methodology, advice on source collection, editing. Loïc Bertrand: conceptualization, methodology, advice on source collection, editing.

ACKNOWLEDGMENTS

The PhD research of Han Zhou at University of Amsterdam is funded by the European Union's Horizon Europe Research and innovation action HORIZON-RIA under the grant agreement no. 101060768 (GoGreen project). We would like to thank Joosje van Bennekom (senior metals conservator, Rijksmuseum Amsterdam) and Ellen van Bork (metals conservator, Rijksmuseum Amsterdam) for their advice on silver cleaning treatments in conservation.

REFERENCES

Beeton, Samuel Orchart. 1871. *Beeton's Dictionary of Practical Recipes and Every-day Information*. London: Ward, Lock, and Tyler.

Bertrand, L., C. Gervais, A. Masic, and L. Robbiola. 2018. "Paleo-inspired Systems: Durability, Sustainability, and Remarkable Properties." *Angewandte Chemie International Edition* 57, no. 25: 7288-7298. https://doi.org/10.1002/anie.201709303.

Carlyle, Leslie. 2020. "Reconstructions of Oil Painting Materials and Techniques: the HART Model for Approaching Historical Accuracy." In *Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences*, edited by Sven Dupré, Anna Harris, Julia Kursell, Patricia Lulof, and Maartje Stols-Witlox. 141-167. Amsterdam: Amsterdam Unversity Press.

Cooley, Arnold James. 1856. *A Cyclopaedia of Practical Receipts and Collateral Information in the Arts, Manufactures, Professions, and Trades*. London: J. Churchill.

de Andrade Bulos, R.B., F. da Gama Paz, C.G. Machado, P. P. L. G. Tavares, C. O. de Souza and M. A. Umsza-Guez. 2023. "Scientific and Technological Research on the Use of Wine Lees." *Food Production, Processing and Nutrition* 5, 25. https://doi.org/10.1186/s43014-023-00137-0.

GoGreen. n.d. "GoGreen Project." Accessed May 2nd 2024, https://gogreenconservation.eu/.

Gray, Samuel Frederick. and Porter, Arthur Livermore. 1830. *The Chemistry of the Arts: Being a Practical Display of the Arts and Manufactures which Depend on Chemical Principles.* Philadelphia: Carey & Lea.

GREENART. n.d. "GREen Endeavor in Art ResToration." Accessed May 2nd 2024, https://www.greenart-project.eu/.

Griffith, Robert Eglesfeld. 1874. *A Universal Formulary: Containing the Methods of Preparing and Administering Officinal and Other Medicines*. Philadelphia: H.C. Lea.

Hiscox, G. Dexter, ed. 1916. *Henley's Twentieth Century Formulas, Recipes and Processes*. New York: Norman W. Henley.

Hopkins, Albert A., ed. 1893. *The Scientific American Cyclopedia of Receipts, Notes and Queries.* New York: Munn & Company.

Jouves-Hann, Barbara. 2024. *Amateurs et Restaurateurs de Tableaux à Paris (1789-1870).* Paris: Éditions de la Sorbonne.

Kendall, H. W. 1947. *The Good Housekeeping Book*. Philadelphia: David McKay company.

Kunckel von Loewenstern, Johannes. 1705. *Wieder Neu aufgerichtete und vergrösserte in zwey Theilen angewiesene curieusen Kunst- und Werck-Schul*. Volume 1 of 2. Nünberg: Johann Ziegern.

Lémery, N. 1711. *New Curiosities in Art and Nature*. London: John King.

Mitrović, I., J. Auger, J. Hanna., & I. Helgason, eds. 2021. *Beyond Speculative Design: Past – Present – Future*. Split: University of Split.

MOXY. 2022. "The MOXY Project: Green Atmospheric Plasma-generated Atomic Oxygen Technology for Restoration of Works of Art." Accessed May 2nd 2024, https://www.moxyproject.eu/.

Muñoz Viñas, Salvador. 2005. *Contemporary Theory of Conservation*. Oxford: Elsevier Butterworth-Heinemann.

Norman, J. 1814. *The Artist's Companion, and Manufacturer's Guide*. Boston: Published by J. Norman.

Ormsby, B., A. Bartoletti, K. J. van den Berg, and C. Stavroudis. 2024. "Cleaning and Conservation: Recent Successes and Challenges." *Heritage Science* 12, no. 10: 1-4. https://doi.org/10.1186/s40494-023-01113-0

Palomar, T., B. Ramírez Barat, and E. Cano. 2018. "Evaluation of Cleaning Treatments for Tarnished Silver: The Conservator's Perspective." *International Journal of Conservation Science* 9, no. 1: 81-90.

Stone, Tom. 2007. "Basic Care of Coins, Medals and Medallic Art – Canadian Conservation Institute (CCI) Notes 9/4." Last modified January 8th, 2020. https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/care-coins-medals-medallic-art.html.

Storme, Patrick, Olivier Schalm, and Rita Wiesinger. 2015. "The Sulfidation Process of Sterling Silver in Different Corrosive Environments: Impact of the Process on the Surface Films Formed and Consequences for the Conservation-restoration Community." *Heritage Science* 3, no. 25. DOI 10.1186/s40494-015-0054-1.

Vigarello, Georges, and Jean Birrell. 1988. *Concepts of Cleanliness: Changing Attitudes in France since the Middle Ages*. Cambridge: Cambridge University Press.

Ward, W. Peter. 2019. *The Clean Body : A Modern History*. Montreal: McGill-Queen's University Press.