Science and conservation at the British Museum Laboratory (1919-1934)

Mariana L. Pinto

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ISBN: 978-94-6103-091-7

Cover illustration: “Report on the British Museum and its scientific problems”, by Alexander Scott. 1919. Pages 1-2 from manuscript. Courtesy of the British Museum.

Cover design by Mariana L. Pinto
Lay-out and design by Mariana L. Pinto
Printed by Ridderprint – www.ridderprint.nl

Science and conservation at the British Museum Laboratory (1919-1934)

Wetenschap en conservering
in het British Museum Laboratorium (1919-1934)
(met een samenvatting in het Nederlands)

Proefschrift

ter verkrijging van de graad van doctor aan de
Universiteit Utrecht
op gezag van de
rector magnificus, prof.dr. H.R.B.M. Kummeling,
ingevolge het besluit van het college voor promoties
in het openbaar te verdedigen op

vrijdag 26 november 2021 des middags te 4.15 uur

door

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geboren op 22 mei 1977
te Buenos Aires, Argentinië

Promotoren:

Prof. dr. S.G.M. Dupré

Prof. dr. E. Hendriks

Dit proefschrift werd (mede) mogelijk gemaakt met financiële steun van de European Research Council (ERC), binnen het European Union’s Horizon 2020 Research and Innovation Programme (grant agreement no. 648718).

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Telephone: Victoria 7940.
Telegrams: Resciendus ~~Parl~~ Vic, London.
All communications to be addressed to—
THE SECRETARY.

SCIENTIFIC AND INDUSTRIAL
RESEARCH DEPARTMENT,
16 & 18, OLD QUEEN STREET,
~~15, GREAT GEORGE STREET,~~
WESTMINSTER, LONDON, S.W. 1.

In your reply please quote :—

10/51/1.

8th May, 1920.

Dear Dr. Scott,

You will be glad to learn that the Treasury have approved the establishment of a Laboratory at the British Museum and the estimates which you discussed with Dr. Young. I enclose a copy of their letter from which you will see the conditions which they lay down.

Yours faithfully,

H. S. Lloyd

I understand that Dr Young has already been in communication with you about details.

Dr. A. Scott F.R.S.,
34, Upper Hamilton Terrace,
N.W.8.

Introduction

1. *Science and conservation*

In 2013, the ICCROM forum[1] opened its sessions with the significative question: "How can science connect with and be of greater benefit to conservation practice?" (ICCROM 2013). Two years later, several articles were published in an edited volume reflecting on the conclusions reached by this forum. To bring benefits by research and innovation was agreed on as the main responsibility of conservation science. In order to achieve this in practice and maintain such an effort, a collaborative spirit was considered essential (Heritage & Golfomitsou 2015). Today, the field of conservation has reached a consensus to understand conservation as "all measures and actions aimed at safeguarding tangible cultural heritage while ensuring its accessibility to present and future generations" (ICOM-CC 2008), and positions itself as a discipline with a strong emphasis on scientific methods. Indeed, Salvador Muñoz Viñas (2005: 71) has described the introduction of science into conservation practice as "one of the most important single factors in the development and shaping of the conservation profession".

Collaboration between science and conservation is considered standard practice in museums nowadays, while discussions about the limits and potentialities of such collaboration prevail in daily conservation work, publications, congresses and other activities within the field. However, while the treatment of artworks and archaeological objects has a long tradition, collaborative practices involving science in the conservation of cultural heritage are relatively recent. As Muñoz Viñas explains, science-based conservation became broadly accepted between 1930 and 1950, a period framed by two key events: on the one hand, the Rome conference in 1930, named the *Conférence internationale pour l'étude des méthodes scientifiques appliquées à l'examen et à la conservation des oeuvres d'art* [International conference for the study of scientific methods applied to the examination and conservation of works of art]; on the other hand, the founding in 1950 of the International Institute for the Conservation of Museum Objects (currently, the International Institute for Conservation of Historic and Artistic Works), which advocated for science-based conservation. Muñoz Viñas also mentions that many museum laboratories were established around the world during this period (Muñoz Viñas 2005: 69). But how did

[1] The acronym ICCROM stands for "International Centre for the Study of the Preservation and Restoration of Cultural Property". As an intergovernmental organisation, ICCROM coordinates training programmes, research work and other activities oriented to conserve cultural heritage worldwide, including regular *fora* (ICCROM 2020).

science become integrated as a fundamental aspect of conservation between 1930 and 1950? And what role did laboratories play?

The investigation of collaborative practices between scientists and those in charge of the care and treatment of artworks during the interbellum years, shows the processes by which science-based conservation came into place. This dissertation starts after the end of World War I, when the Trustees of the British Museum (BM) faced the deterioration of a large part of the museum´s collection, and the chemist Alexander Scott (1853–1947) was asked to supervise its treatment. The creation and first twelve years of the BM Laboratory, with Scott as its first director, is the main focus of this study. My research ends in 1934, when the first steps of the introduction of chemistry into conservation training were taken at the Courtauld Institute of Art, influenced also by the ideas generated at the BM Laboratory.

In the history of conservation, the establishment of the BM Laboratory is considered a fundamental turning point. Created in 1919 as a temporary initiative, the aim of the BM Laboratory was to help in the treatment of deteriorated objects from the museum´s collection that were stored in the London Underground system during World War I. Importantly, over the next twelve years, the laboratory transformed into a fundamental need for museum conservation, becoming a permanent department and forming one of the first examples of its kind in the world. In London, academic, government, and industrial research laboratories had already existed since the nineteenth century (Morris 2015: 269), but the BM Laboratory was the first one to be created in England in a museum. Although the first laboratory in the world established for this purpose was the Chemical Laboratory of the Royal Museums in Berlin in 1888, it never re-opened its doors after World War II (Riederer 1976: 67). Thus, the BM Laboratory, specifically created for archaeological conservation, is the oldest museum laboratory in the world that remains open today.

In the early twentieth century, other leading art institutions followed suit and created laboratories for the treatment of artworks and cultural heritage, and also to develop techniques related to scientific examination and conservation. In Paris, despite a long tradition in restoration, which has been thoroughly discussed by Noémie Étienne (2017), it was not until 1930 that the first museum laboratory was officially established in the Louvre (Vanpaemel 2010: 72). In London, the National Gallery´s (NG) Scientific Department was created in 1934 with the physicist Francis Ian Gregory Rawlins (1895–1969) as its scientific adviser (Thomson *et al.* 1977: 18), and the Courtauld Institute established a laboratory a year later, in 1935 (Plenderleith 1978: 6). Outside Europe, laboratories were also created in the early twentieth century, as in the United States, Cairo and Calcutta (Bewer 2010: 273 n.25). It was in these early museum laboratories where, for the first time, those in charge of museum collections worked together with chemists on a daily basis towards a shared goal: the care of artworks. Workers with a background in science - mostly chemists - found themselves facing the challenges related to the treatment of artworks, together with private and museum-employed restorers.

The establishment of the BM Laboratory has been referred to by several scholars concerned with the history of conservation. For instance, a brief explanation about the circumstances behind the creation of this laboratory is included in Catherine Sease´s "A short history of archaeological conservation". In the section on conservation literature in the early twentieth century, Sease (1996: 159) mentions the three editions of the BM Laboratory book *The cleaning and restoration of museum exhibits* (DSIR 1921, 1923a, 1926) and includes a brief remark about the establishment of this department. A short history of the laboratory is also included in Rutherford Gettens´ publication about teaching and research in conservation. The chemist and pioneering conservation scientist Rutherford Gettens (1900-1974), mentions the BM Laboratory among other laboratories of its kind, where he includes a few lines on the date of origin and its first directors (Gettens 1961: 1212). The BM Laboratory is also briefly listed as a milestone among other events in Francesca Bewer´s investigation of the creation of the first laboratory at the Fogg Art Museum (Bewer 2010: 271 n.1). Simon Lambert (2014: 7–10) offers a detailed introduction to the early years of the BM Laboratory to focus on the importance of this event in the history of preventive conservation. Geert Vanpaemel (2010: 72–73) brings in a short history of the BM Laboratory among other laboratories created in museums to argue that the establishment of these spaces changed the attitude of scientists towards the arts. This general claim about the role of laboratories in science-based conservation history will be further discussed in my research, as I will investigate how collaboration between scientists and those in charge of the care and treatment of artworks took place.

Although the establishment of the BM Laboratory is widely cited as a milestone in conservation history, scholars have barely addressed how this collaboration contributed to shaping science-based conservation practice. The investigation of the establishment of the BM Laboratory allows us to unpack how conservation and science worked together. This dissertation focuses on the first years of the BM Laboratory, since its pioneering status meant that collaboration between restorers and scientists had to be negotiated in this new space on a daily basis under almost unprecedented conditions. The early years of the BM Laboratory is for this reason a key moment to understand how collaboration between scientists and museum workers initially took shape.

In sum, this research will pivot on the following main question: How was collaboration between chemists and those in charge of artworks' preservation and treatment shaped during the early years of the BM Laboratory? I argue that the creation of this laboratory promoted collaboration between chemists and those in charge of museum collections on a regular basis, leading to the establishment of effective modes of exchange in the BM that came to be more broadly applied in the field of conservation, a fundamental step towards science-based conservation practice. In addition, by emphasising collaboration and openness, Scott was able to achieve a permanent status for the BM Laboratory.

2. *Artworks, texts and interviews as sources*

Literature concerning the history of conservation took off during the twentieth century. Conservators and conservation scientists wrote articles, sometimes based on their own professional experience. For example, Gettens wrote an article discussing teaching and research in conservation in the United States (US) (Gettens 1961). In England, the physicist and conservator Norman Brommelle (1915 – 1989) - first Keeper of Conservation at the Victoria & Albert Museum in London and Director of the Hamilton Kerr Institute at the University of Cambridge - (IIC 2021a) published a brief history of conservation. His article focused on the 1850 and 1853 reports from the National Gallery (NG) London and the public controversies that arose in the mid-nineteenth century related to the cleaning treatments carried out on paintings at the NG (Brommelle 1956). This topic was also discussed by Elizabeth Darrow in her 1994 article about conservation in the nineteenth century (Darrow 1994).

A doctoral dissertation about the development of easel-painting conservation in England from c.1824 to 1968, was defended in 1999 by Hero Boothroyd Brooks (1999). Boothroyd Brooks´ thesis discusses not only past conservation treatments, but also preventive measures aimed at avoiding or reducing deterioration processes in works of art. Another text focused on the history of preventive conservation is Manfred Koller´s article “Learning from the history of preventive conservation” (1994). Also, relevant books discussing historical aspects of conservation with a broader geographical scope were published in 1996, under the title *Historical and Philosophical Issues in the Conservation of Cultural Heritage* (Price *et al.* 1996) and in 2013 with *Historical Perspectives on Preventive Conservation* (Staniforth 2013). There is also literature about the history of conservation in archaeology, which is relevant to this dissertation, as the collection from the BM is formed mainly of archaeological objects. Examples of this literature are the articles by Niccolo Leo Caldararo (1987), Mark Gilberg (1987), Elizabeth Pye (1990), Catherine Sease (1996) and Mark Gilbert and Dan Vivian (2001).

Importantly, symposiums, conferences and other events have helped in the publication of literature about conservation history. For instance, the paper published in 1984 by Sheldon Keck about past cleaning controversies in Europe and the US (Keck 1984) was the result of a lecture presented at the AIC[2] Annual Meeting in Baltimore a year earlier. The proceedings of the Structural Conservation of Panel Paintings symposium that took place at the J. Paul Getty Museum from 24 to 28 April 1995 were printed as a book three years later (Dardes & Rothe 1998). The third part of this book focuses specifically on the history of the structural conservation of panel paintings. In 1996, during the ICOM-CC[3] 11th Triennial Conference in Edinburgh, Michael von der Goltz gave a talk about the history of restoration in Germany (von der Goltz 1996). Three years later, at the ICOM-CC 12th Triennial Conference in Lyon, Mireille te Marvelde gave a presentation about relevance and method for the history of conservation-restoration research (te Marvelde 1999). Both talks can be found in the preprints of the conferences. The English chemist and conservator Harold Plenderleith (1898–1997) shared his early professional experiences in a lecture at the British Museum (BM) in November 1978. This lecture was later published as an article in *Studies in Conservation* (Plenderleith 1998).

In the past twenty years, many more books about conservation history have been published, such as *Conservation in the nineteenth century* (Brajer 2013) and *A changing art: nineteenth-century painting practice and conservation* (Costaras *et al.* 2017). Other books include sections focused on conservation history, like *Issues in the Conservation of Paintings* (Bomford & Leonard 2004) and *The conservation of easel paintings* (Hill Stoner & Rushfield 2012). The Art of Conservation series, published by *The Burlington Magazine* since 2015 also provides a wide range of articles on the topic (Kern 2015; Avery-Quash 2015; van Duijn & Filedt Kok 2016; Massing 2016; Véliz & Aterido 2016; Blewett 2016; van Duijn & te Marvelde 2016; Bonsanti 2016; Aronson *et al.* 2017; Darrow 2017; Véliz Bomford 2017; Hill Stoner 2017; Ciatti 2017; Epley 2018; Dubois 2018; Kirby 2019).

Some researchers have focused on specific countries. A doctorate dissertation about preventive conservation in Italy was carried out by Simon Lambert (2008), whereas Michael von der Goltz (2002) investigated the Conservation of Paintings in the Weimar Republic in his doctorate thesis (Woudhuysen-Keller & Woudhuysen 2004). Ann Massing (2012) and Noémie Étienne (2017) have published about restoration in France, and the Dutch context has been investigated by Mireille te Marvelde and Esther van Duijn (te Marvelde 2013, 2015; van Duijn & te Marvelde 2016; te Marvelde *et al.* 2017; van Duijn 2017). Other studies

[2] AIC: The American Institute for Conservation

[3] ICOM-CC: Committee for Conservation from the International Council of Museums

aim to examine certain institutions, such as the Ashmolean Museum in Oxford (Norman 2001, 2020), The Metropolitan Museum of Art in New York (Becker & Schorsch 2010), the Fogg Art Museum at Harvard (Bewer 2010), or the National Portrait Gallery in London (Simon 2018).

Historical perspectives about preventive conservation have been discussed by Sarah Staniforth (2013) and Foekje Boersma (2016); while preventive conservation in England, the US and Italy has been examined by Boothroyd Brooks (2001) and Lambert (2010, 2014). Many other scholars have added important studies about the history of conservation; a few examples include research about historical restoration recipes (Stols-Witlox 2011), the emergence of conservation science as a discipline (Hill Stoner 2005; Vanpaemel 2010), conservation training (DeGhetaldi 2012; Hill Stoner 2017) and archaeological conservation (Gilbert & Vivian 2001).

But why is all this growing literature about conservation history relevant for the field of conservation? As highlighted by te Marvelde (1999), the history of conservation-restoration techniques and materials helps us understand the changes that paintings undergo over time: aging processes usually influenced by past treatments. Although te Marvelde´s main focus of discussion is on paintings, such a claim can also be extended to other artworks, such as archaeological objects and sculptures. Importantly, understanding the history, technical aspects and condition of an artwork "…is not only an important prerequisite for any decision about treatment, but is also essential for developing new and better methods of treatment" (te Marvelde 1999: 194). Because of this, objects often serve as primary research resources, as they bear physical evidence of their past trajectories, including the impact of former restoration treatments. Thus, they become documents of past restoration practices, they become "…carriers of conservation-restoration historical information" (te Marvelde 1999: 195). However, artworks are not usually readily available for study. Objects may have only partially survived or be in a highly deteriorated condition, or they may not have survived at all. Thus, while objects used as primary sources may reveal useful information about their past treatments, they may not be the most convenient sources to use. Moreover, as this dissertation focuses on the social aspects of conservation – how collaboration took place – written documents prove more revealing.

Indeed, there is increasing interest among researchers to explore archives and textual sources for more general study of the history of conservation and its institutions. Étienne´s *The restoration of paintings in Paris, 1750-1815: practice, discourse, materiality* is a representative example of this trend (Étienne 2017). Étienne investigates restoration practice in Paris during the second half of the eighteenth century and the early nineteenth century. Not intended to provide "specific information on the history of techniques"

(Étienne 2017: 2), Étienne´s study lays a strong emphasis on the social and legal context of restoration and its increasing institutionalisation during the studied period. Boothroyd Brooks´ dissertation *Practical developments in English easel-painting conservation, c.1824-1968, from written sources* - defended in 1999 - also discusses conservation practices exclusively through the study of textual sources. Her research investigates new developments in treatments for easel-paintings from 1824 (the date of the establishment of the National Gallery in London) to 1968, when *The Cleaning of Paintings: Problems and Potentialities* was published by the prominent National Gallery restorer Helmut Ruhemann (1891-1973) (Boothroyd Brooks 1999). In addition, Francesca Bewer´s *A Laboratory of Art: Harvard´s Fogg Museum and the Emergence of Conservation in America, 1900-1950* investigates the introduction of science-based conservation in the United States by discussing how practical learning and technical research took place at Harvard´s Fogg Museum during the early twentieth century (Bewer 2010). The Italian context has been largely studied by Alessandro Conti: his book *History of the Restoration and Conservation of Works of Art* was published in 2007. Despite the emphasis on the Italian context, Conti also present cases and sources from other countries, such as France and England (Conti 2007). His book discusses the history of preservation and treatment of artworks from the middle ages to the nineteenth century, and it is a good example of the use of both artworks and texts for the study of past treatments.

However, the use of textual sources is not easy or straightforward. For instance, keeping written records of treatments was not common in the past, and they rarely included information on why certain decisions for treatment were made. Therefore, the information – when present – may be scattered, limited or vague, so broader contextual research may be needed to elucidate this aspect. As te Marvelde observes, "…such information as we have, is dispersed among a wide variety of sources. Archival research in this field is enormously time consuming…" (te Marvelde 1999: 195). Another significant problem is the use of terminology and how conservation was defined in in the past. Andrew Cunningham´s discussion about the history of science points out that "when we set out to study the history of science, are we properly equipped to identify *science* in the past in order to study it?" (Cunningham 2012: 365). This is also problematic in the field of conservation, as the word choice to refer to the workers in charge of the care and treatment of artworks – and the profession itself – has changed over time, also depending on the country, language and culture. For instance, "conservator and conservation" are generally used in English nowadays to describe the profession (ICOM-CC 2008), whereas the terms "restoration and restorers", tend to be used in some European countries, such as Italy or France (Conti 2007; Étienne 2017: xiii; Muñoz Viñas 2020: xi). However, broad categories like "restoration" and "science" obscure the diverse and varied professional fields, educational backgrounds, and cultures of expertise from which present-day conservation as a hands-on and science-based practice emerged. Thus, a detailed discussion about terminology in sources and secondary literature is included in Chapter 1.

In addition, the reading of textual sources - as an act of interpretation - also calls for comparison and contrast with further sources from different origins to have a better understanding of the context. Oral history may be of great help in this regard. Although retrospective sources, such as interviews, can be reflexive and subjective about the past, this method has grown more important in conservation history. For instance, the use of interviews with conservators and artists has been advocated for contemporary art (Beerkens *et al.* 2012; Wielocha 2021). Also, the Oral History Project for the Foundation of the American Institute for Conservation of Historic and Artistic Works has created an impressive database of interviews with a growing number of conservators and conservation scientists. Established in 1975 under Joyce Hill Stoner´s leadership, The Oral History Project has become a fundamental archive for the study of conservation history (AIC-FAIC 2021).

To sum up, despite their limitations, textual and oral records are highly valuable sources which help in the interpretation of past conservation practices: while a text can inform us about the ideas and concepts of a specific period, an interview may describe past experiences and performed treatments. Thus, this research is based on the complementary analysis of both textual and oral sources from different archives that refer to the work carried out during the creation and first years of the BM Laboratory.

For the first twelve years after the creation of the laboratory, its first director, the Scottish chemist Alexander Scott (1853–1947), wrote annual reports about the activities carried out and the treatments performed on the artworks. These were requested by the Treasury Chambers, the entity officially in charge of the laboratory for the first years. Scott´s reports provide substantial information about the early years of the laboratory. They speak of the laboratory´s fundamental change of status from temporary to permanent, the limitations faced by the staff and the outcomes of the collaboration between chemists and museum workers. In his reports, Scott not only describes novel treatments of artworks, but he also includes the challenges faced during failed experiments. His thoughts about contemporary restorers and his new ideas about the profession are also found in these sources, sometimes implied in the text, other times openly stated. These annual reports can still be found in the archives of the BM Laboratory - currently known as the Department of Scientific Research – which is part of the BM buildings. Surprisingly, it was not easy to access these sources. When I found the reports - in August 2018 - they were neither listed in a catalogue nor had they any specific call number. They were located inside a box, in a folder that had the promising timeframe “1921-1924” on it. Undoubtedly, the valuable help from the staff and narrowing down of the time period were helpful. Yet, the reports were found almost by chance, by digging and searching in every box that seemed old.

Scott´s reports are also contrasted with other contemporary and more recent sources. Contemporary publications and lectures are analysed in this research, such as articles and books written by the staff of the laboratory and public lectures describing conservation treatments. These sources not only provide insights into the work carried out at the laboratory, but they also inform us about the decisions made by the staff, on what information was made available to other colleagues and the general public, and what was supposed to be kept private. More recent interviews, with recollections of some of the main actors from the period, are also included in this dissertation (specifically, sources relating to Harold Plenderleith, who became part of the BM Laboratory in December 1924). Plenderleith was interviewed in March 1978 by Christine Leback Sitwell (Plenderleith 1978) and the transcript of this interview was made available by the Oral History Project. Ten months later, on the 23rd November 1978, Plenderleith also gave a lecture at the BM, which was published in *Studies in Conservation* in 1998 for the anniversary of the chemist´s birth (Plenderleith 1998). During both, the interview and his talk, Plenderleith recalls the first years of the establishment of the BM Laboratory. Therefore, these are essential sources to compare with Scott´s reports: on the one hand, a retrospective source can be reflexive about a period in the past; on the other hand, primary sources like Scott´s reports provide first-hand insight into a main character´s ideas.

3. *Collaboration in the early years of the British Museum Laboratory*

Conservation theory and practice lay a strong emphasis on the importance of ethics, collaboration, openness and training of the discipline. The ethical considerations towards the integrity of artworks play a fundamental role in the collaboration between conservators and scientists. Indeed, when Muñoz Viñas described the principles of science-based conservation, he stated that "scientific conservation has a fundamental need to preserve the integrity of the object" which "lies in its *physical* features and constituents" (Muñoz Viñas 2005: 81). In addition, the ICCROM Forum 2013 has highlighted the need for collaboration and openness. Under the title "Seeking sustainable solutions through collaboration and sharing", the need for "a participatory approach to research that welcomes and encourages collaboration between different actors within cultural heritage conservation, and which also looks beyond the borders of the sector, to foster interdisciplinary" was emphasised. It was also observed how "mechanisms for sharing resources and expertise between institutions are much needed to increase efficiency, knowledge exchange, and reduce inequalities. This can be realized by creating international research infrastructures to foster scholarly exchanges, share equipment and experts, provide workshops, and facilitate internships" (Heritage & Golfomitsou 2015: 4). Moreover, conservation training has also been shaped by collaboration. As DeGhetaldi explains: "The increasing number of academically trained art conservators has helped to staff museums with professionals versed in ethical issues, sophisticated examination techniques, and treatment procedures. While all of these programs and their curricula continue to evolve there remains a need to foster interdisciplinary and collaborative work" (DeGhetaldi 2012).

These concepts are so essential to the profession that we tend to take them for granted and overlook that they have taken shape gradually over centuries. Far from following an even, linear progression, they have developed differently in each country and time period. Importantly, during the early years of the BM Laboratory, the strong emphasis that Scott laid on matters of collaboration, ethics, openness and training allowed the chemist to achieve his goal of a permanent status for the laboratory as a department within the museum, contributing to the establishment of conservation as a science-based profession. Thus, each chapter will address one of these important concepts, focusing mainly on the first twelve years of the BM Laboratory, from its creation in 1919 to 1931.

Collaboration between professionals from different disciplines – such as conservation, art history, chemistry, physics - is not only common practice in conservation, but it is an essential aspect of the profession. Especially relevant is the involvement of scientists when it comes to the investigation and treatment of artworks. Chemists gradually engaged in matters concerning restoration from the end of the eighteenth century (Sease 1996: 157). During the nineteenth century, chemists were more involved in the archaeological and art worlds. For instance, they worked on materials characterisation and deterioration processes of archaeological objects (Riederer 1976; Gilberg 1987; Sease 1996), and they also offered advice about cleaning methods for paintings to The National Gallery London during public controversies (Select Committee 1853). However, such collaborations were mostly occasional or temporary (Coremans 1996: 433). During the twentieth century, the interaction between scientists and those in charge of museums´ collections became more regular. Scholarly literature has emphasised the contributions of science to the conservation field (Craddock 1991; Sease 1996), while the collaboration taking place between the scientists and museum workers has also been mentioned (Vanpaemel 2010; Lambert 2014). In this dissertation, I will demonstrate how this collaboration took place at the BM Laboratory. Through the investigation of Scott´s annual reports, my research will illustrate in Chapter 1 how the emphasis that Scott laid on matters of collaboration was of vital importance for the BM Laboratory´s change of status from a temporary aid to a permanent department. I will show how scientific expertise was not imposed upon the museum workers; on the contrary, it served to assist in collaborative decision-making processes during the treatment of artworks.

In addition, the ethics of the chemists working at the BM Laboratory are present in Scott´s reports, in contemporary publications and also in later sources. Conservation practice lays a strong emphasis on ethical considerations towards the integrity of objects. Yet, such ethics are not a static group of rules, but rather a dynamic approach to the discipline that has changed over time and also depending on the country. Thus, it is important to understand whether chemists in the past working with artworks showed any ethical considerations towards these objects. Scientists from the nineteenth century were attributed with different epistemic virtues, like humility (Kidd 2017) and persistence (Stanley 2017), but did they show any ethical considerations towards the sampled artworks when undertaking pigment analysis? Textual sources strongly suggest that an ethical attitude towards the integrity of artworks was already present before the early twentieth century. I will demonstrate in Chapter 2 that nineteenth-century chemists took an ethical perspective on preserving the integrity of artworks and how such considerations reflected a collaborative attitude towards those in charge of museum collections. Furthermore, I will discuss how certain preventive measures, designed in a collaborative context in the mid-nineteenth century, were later implemented by the keeper of the National Gallery Ralph Nicholson Wornum (1812-1877) during the second half of the century. While these two examples discuss cases of ethics and collaboration between chemists and the workers in charge of museum collections before the twentieth century, they only describe incidental practices, in comparison with museum laboratories, where collaboration took place on a regular basis. Yet, such precedents allowed Scott to build upon previous examples when he developed his strategy for the establishment of a permanent museum laboratory.

Moreover, the open attitude regarding the treatments performed on artworks and the materials used during this process was not always present in the profession. On the contrary, this is a relatively new concept that has gradually developed over time and was influenced by the introduction of science into conservation. Like artisans in the past, who shared their knowledge mainly through a master/apprenticeship system (Long 2001), restorers were also not open about the treatments performed and materials used. This secrecy remained as common practice among restorers until the twentieth century and many authors have highlighted restorers´ reticence to share information about their treatments (Darrow 2017) and the lack of documentation from the past (van Duijn & te Marvelde 2016). In Chapter 3, I will show how, during the establishment of the early museum laboratories, the thorough recording of treatments, materials and techniques and the publication of conservation methods in journals and books began to take shape as good practice. At the BM Laboratory, Scott adopted an open attitude towards sharing procedures followed for conservation treatments and analyses. Indeed, one of the first measures Scott considered when creating the laboratory, was fighting the secrecy over information that most restorers by then defended as being their own property. Scott agreed that by being open with the procedures used, treatments became safer for the objects. By contrasting Scott´s annual reports – which were meant to remain unpublished – with contemporary literature published by Scott and Plenderleith, I will demonstrate how Scott´s open attitude towards the publication of treatments also served his goal of achieving a permanent status for the BM Laboratory.

Furthermore, in Chapter 4 I will examine how this knowledge of chemistry became part of the training for conservators. Before the early twentieth century, the treatment of artworks was considered a craft activity, taught by a master to an apprentice. Most of these workers, who learned manual skills but received no formal education in chemistry, had backgrounds as painters (Koller 2000: 7) and later became restorers (Church 1890: 276; Bonsanti 2016: 970). Importantly, the rise of museum laboratories in the early twentieth century changed the ways in which people in charge of the treatment of museum collections were trained. Formal education at universities gradually replaced the apprenticeship model and chemistry became a fundamental aspect of their learning process. This chapter highlights the role of the BM Laboratory in this transition in training and education. Thus, Chapter 4 will focus on the principles taught at the BM Laboratory, mobility between the BM and other institutions, and the international exchange of workers between museum laboratories. I will argue that the training at the BM Laboratory had an impact on how conservation became institutionalised: the process of forming the Scientific Research Department at the Courtauld Institute of Art shows how the principles developed at the BM Laboratory served as a leading example during the first steps towards science-based conservation courses taught at university level.

(Illustration next page: "Report on British Museum Research for the year April 1st, 1923, to March 1924", by Alexander Scott. 1924. Page 1. Courtesy of the British Museum.)

Report
on
British Museum Research
for the year April 1st, 1923, to March 1924.

A year ago I was glad to be able to report that the Laboratory installed in 39 Russell Square had in all essential points been practically finished and equipped. The rooms as arranged have been all in continuous use and have been found well adapted for our work. At times some of the rooms have been taxed to their full extent especially when bulky objects such as furs & textiles have to be treated for moulds and moth trouble. A small vacant building (built originally as an office for the clerk of the works when the King Edward the VII Galleries ~~being~~ were erected) situated between the Laboratory & the main Museum building ~~and not at present in use~~ has been equipped with large boxes made of stout deal lined with paper & the lids made fairly airtight with felt. In these boxes furs and similar objects could be fumigated and disinfected with carbon disulphide and other agents without causing annoyance to any one as any malodourous escape was slow and was so diluted with air from the isolated position of the building. ~~and to~~ as to be quite undetectable. The smaller laboratory at the back of the building on the ground floor has been a very great convenience to myself both for writing and for experimental work.

There has not been very much that is new in objects from the Print Department itself but some excellent

Chapter 1

From temporary to permanent

The British Museum Laboratory between 1919 and 1931

1. *Introduction*

The annual reports written by the first director of the British Museum (BM) Laboratory, the Scottish chemist Alexander Scott (1853–1947), can still be found in the archives of the BM Laboratory, currently known as the Department of Scientific Research. The BM Laboratory was born in 1919 as a temporary initiative to help in the treatment of deteriorated objects from the museum´s collection that were stored in the London Underground system during World War I. By the time Scott wrote his last report in 1931, the BM Laboratory had become a permanent department in its own right within the museum. A close analysis of these reports is still lacking in the historiography of conservation practice and conservation science. This is surprising given that these documents provide valuable information shedding new light on the first years of the laboratory and the fundamental change in status it underwent.

The involvement of chemists in matters related to restoration began many years before the establishment of the BM Laboratory, it had gradually taken place at the end of the eighteenth century and during the nineteenth century (Sease 1996: 157). Scholarly literature ascribes this early involvement of scientists in museum collections to the need for a scientific approach to the treatment of highly deteriorated objects from archaeological sites (Craddock 1991: 11–12). During the nineteenth century, chemists were engaged in matters related to materials characterisation and deterioration mechanisms of archaeological objects (Riederer 1976; Gilberg 1987; Sease 1996). Also, Noémie Étienne´s study about the restoration of paintings in Paris between 1750 and 1815 mentions how the painter and chemist Jean-François Léonor Mérimée (1757-1836) proposed the creation of a committee "composed of artists, restorers, and chemists for the purpose of improving restoration methods and promoting their dissemination" (Étienne 2017: 57). In addition, chemists offered advice during the cleaning controversies that took place at the National Gallery, London.[4] By the end of the nineteenth century, chemistry had gradually begun to be considered as an aid for the treatment of objects. Yet, the involvement of chemists occurred mostly on an occasional and temporary basis (Coremans 1996: 433) and it was not until museum laboratories were established that collaboration between chemists and those in charge of the treatment of artworks became permanent.

[4] See Chapter 2 for further discussions on the topic of pigment analysis in the nineteenth century and the cleaning controversies in the National Gallery, London in the 1850s.

Whereas academic, government, and industrial research and development laboratories had existed in the nineteenth century in London (Morris 2015: 269), the BM Laboratory was the first one to be established in England in the context of a museum; it is also the oldest museum laboratory in the world that remains open today. Yet, it was not the first of its kind: the Chemical Laboratory of the Royal Museums had been created in Berlin as early as 1888, with the German chemist Friedrich Rathgen (1862–1942) as its first Director. This laboratory, however, never re-opened its doors after World War II (Riederer 1976: 67). A few decades later, in the early twentieth century, growing concerns over the preservation of deteriorated artworks after World War I led to the creation of museum laboratories in some countries (Bewer 2010: 78), with the aim of developing scientific methods for research into, and the treatment of, artworks. In France, the *Laboratoire microradiographique* was set up at the *Musée des Beaux-Arts de Dijon* in 1920 by the art historian, medievalist and curator of the museum, Fernand Mercier. Founded and directed by Mercier, the laboratory was closed in 1929 due to a conflict between the curator and the authorities of the museum (Cardinali 2017: 228–29, 2019: 71).[5] After the BM Laboratory was created, more institutions also opened laboratories for the treatment of museum collections and the development of techniques related to the technical examination of artworks. For instance, a museum laboratory was officially established in Paris at the Louvre in 1930 (Lécuyer 1930, 1934; Vanpaemel 2010: 72). The Fogg Art Museum was the first institution in the US to create a museum laboratory for the study of artworks; it gradually took shape during the 1920s and was established as the Research Department around 1930 (Bewer 2010). In London, The National Gallery´s Scientific Department was created in 1934 with the physicist Francis Ian Gregory Rawlins (1895–1969) assigned as its scientific adviser (Thomson *et al.* 1977: 18). The Courtauld Institute of Art also opened a Scientific Research Department at the end of 1934.[6]

The establishment of these early museum laboratories is considered as a milestone in the history of conservation and the contribution of science to the world of art, is highlighted by many scholars. For example, Paul Craddock (1991: 11–12) claimed that scientific conservation was established with the opening of the first laboratory in Berlin in 1888. Catherine Sease (1996: 158) described Rathgen´s contributions during his work at the

[5] Cardinali´s mention of the Dijon laboratory is based on the publication written by the laboratory founder and director, Fernand Mercier (1929). The text is originally written in French and has no translation into English.

[6] The establishment of the Courtauld Institute of Art and its Scientific Research Department is investigated in Chapter 4.

museum laboratory in Berlin as systematic and scientific: "He made a systematic, scientific approach the basis of his study of the problems and determination of their solutions." Also, Geert Vanpaemel (2010: 69) has emphasised that "the creation of museum laboratories proved to be decisive in making space for science in the world of art."

Still, disproportionate attention has been paid by some scholars to the contributions of science to the treatment of artworks, whereas the collaboration that took place between the scientists working at the laboratories and the workers from the museums, has been overlooked. This omission suggests a view in the literature that considers scientific knowledge to be imposed upon those in charge of the care and treatment of museum collections. For instance, while Sease (1996: 157) insists on the contributions of scientists in the formation of "modern archaeological conservation", collaboration between chemists and restorers is not acknowledged. A short explanation about the circumstances behind the creation of the BM Laboratory is included in Sease´s section about conservation literature: here, the influence of Scott and Plenderleith´s publications describing treatments of objects are mentioned, but no external collaboration is considered (Sease 1996: 159–60). Similarly, Craddock (1991: 12) alleges that the permanent status of the BM Laboratory was obtained because the "general applicability and usefulness of the work was appreciated" without discussing any possible collaboration with the workers from the BM.

More recent publications have approached the topic acknowledging collaboration between chemists and museum workers. Simon Lambert´s publication about the history of preventive conservation considers collaboration as an important factor for the involvement of science in the art world. Lambert points out that "the early history of preventive conservation is characterized by the progressive integration of science into the museum world and the strengthening of collaboration between curators, conservators and scientists" (Lambert 2014: 1). However, Lambert does not discuss collaboration when referring to the BM Laboratory: in his section about "Archaeological collections in Britain" (Lambert 2014: 7–10) he claims that "Building on Scott´s approach, Plenderleith developed new preventive conservation guidance…" (Lambert 2014: 9) without mentioning any engagement by the BM employees. Vanpaemel also recognises collaboration between the staff from laboratories and museum workers. According to him, "…the role of science was not to teach and to decide, but to add and to interpret" (Vanpaemel 2010: 73), pointing out that scientists hired to work in museum laboratories "…were framed in a continuous debate with restorers, curators and art critics" (Vanpaemel 2010: 72–73). The change of status of the BM Laboratory - from a temporary initiative to a permanent department - illustrates how this collaboration took place, between the staff of the BM Laboratory with chemical knowledge, and the workers from the museum: keepers with a theoretical background in art history and restorers with practical experience.[7] Scientific expertise was not imposed upon the museum workers, but served to advise and assist in collaborative decision-making processes oriented to the care and treatment of artworks.

Scott´s annual reports illustrate the establishment of the oldest museum laboratory that remains functioning to the present day and testify to the strong emphasis on collaboration on equal ground that the chemist envisioned from the very beginning. Moreover, these valuable sources not only demonstrate Scott´s main ideas about collaboration, they also reveal how the chemist used the annual reports as a tool to advocate for the permanent status of the laboratory within the BM. As Scott himself recalls in a lecture in 1932: "These reports on the work actually carried out and indications of what still remained to be done, however, led to the definite prolongation on a more or less permanent footing…" (Scott 1932: 488).

While scholars have focused on the role of science, I argue that the emphasis that Scott laid on matters of collaboration was of vital importance for the BM Laboratory to be able to develop from a temporary aid after World War I to a permanent museum department in its own right. In this context of collaboration, the annual reports as strategic documents were used by Scott to advocate for the permanent status of the laboratory.

2. *Brief history of the establishment of the British Museum Laboratory*

The British Museum (BM) Laboratory was originally conceived as a temporary aid for the treatment of an extensive part of the museum collection that was severely deteriorated (Plenderleith 1998: 130). This situation was a direct consequence of World War I. During the conflict, several artworks were removed from their place in the museum as a preventive measure, to avoid damage in case of attack. The board minutes mention a recurrent concern for potential damage in the building caused by air-raids. In June 1917, the Director of the Museum Sir Frederic Kenyon[8] "reported that warnings of air-raids were received during the night of May 23-24 and the evening of June 5, and that the usual precautions were taken on each occasion" (Board of Trustees 1918: 3510). Although initially these

[7] See a detailed discussion about all actors in the "Terminology" section in this chapter.

[8] Sir Frederic George Kenyon (1863–1952) was the Director and Principal Librarian of the British Museum between 1909 and 1931 (The British Museum 2019a; b).

precautions related to the shelter of London citizens, the notes about air-raids become more frequent[9] until the safety of the museum´s collection also grew into an issue to consider. In the meeting of 8th December 1917 it is reported that "in view of official warnings of increasing danger from air-raids in the future, the Director was instructed to go into the question of removing portions of the collections to places of greater safety" (Board of Trustees 1918: 3563).

The instructions for evacuating museums of collections were recommended by the War Cabinet and communicated to the Director by the Office of Works.[10] After visiting the station below the West Central District Post Office from London´s underground railway system (the Tube), the Director considered the space sufficiently safe for the accommodation of valuable artworks from the Department of Antiquities (Board of Trustees 1918: 3566). Marjorie Caygill (1992: 31–32) offers a brief description of how some of the BM items were moved to safer places, and the minutes of the Board of Trustees provide a detailed record of the evacuation: most of the removal of the collection to the Tube station was carried out during the first two weeks of April 1918 (Board of Trustees 1918: 3581), but objects continued to be relocated for several months (Board of Trustees 1918: 3586, 3591, 3595, 1922: 3602). The objects left in the museum were protected with sandbags as far as possible (Board of Trustees 1918: 3566, 1922: 3602).

When the Museum building was considered safe again, the objects were returned to their original space in order to re-open the galleries to the public. The sandbags used for the collection that had remained in the building were removed in November 1918 (Board of Trustees 1922: 3614) and the transportation of antiquities stored in the Tube station began two months later, in December (Board of Trustees 1922: 3614). While it took until 10th February 1919 before all the objects were back in the BM (Board of Trustees 1922: 3623, 3630), as early as January 1919 the Director had asked the Department of Scientific and

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9 Early remarks on air-raids date from 9th June 1917 (Board of Trustees 1918: 3510). A month later, on 14th July, another air-raid is reported, together with the mention of an offer from the librarian of the National Library of Wales, Aberystwyth, to accommodate valuable books and manuscripts from the BM collection (Board of Trustees 1918: 3546). Although the Trustees declined the offer at the time, Aberystwyth later became the main destination of most books relocated during the war (Board of Trustees 1918: 3566, 3572, 3575, 3581, 3591). Further air-raids were reported on 13th October (Board of Trustees 1918: 3552) and 10th November (Board of Trustees 1918: 3557) of the same year.

10 The instructions were communicated by "His Majesty´s Government through the Office of Works", and it was informed that a sub-committee was appointed for this task, formed by Viscount Dillon, Viscount Morley, Lt. Colonel Morley Knight and Professor Gilbert Murray (Board of Trustees 1918: 3563).

Industrial Research (DSIR)[11] for assistance "in problems of a scientific nature, such as […] the methods of preserving and restoring antique objects." (Board of Trustees 1922: 3674). This initiative was conceived after finding that a large part of the collection that had been stored in the Tube was in an advanced state of deterioration due to unsuitable environmental conditions, mostly high temperatures and levels of humidity. Although by that time most departments in the museum had restorers (Thomson 1970: 134; Plenderleith 1998: 129–30), the management of the museum considered the existing expertise to be inadequate; the nature and extent of the problem caused the Director and Trustees of the museum to seek scientific advice (Plenderleith 1998: 130). Scott was asked "to conduct an inquiry into the subject and submit proposals" (Board of Trustees 1922: 3674). Not only was Scott an experienced and eminent scientist, as a member of the Royal and Chemical Societies, with his own private laboratory (Roberts 1995), but he was also interested in art and botany (Plenderleith 1978: 5), so he appeared to be the ideal candidate. Scott elaborated a report informing about the general situation of the collection in October 1919 (Scott 1919) and the DSIR supported the creation of a laboratory under their own management (Board of Trustees 1922: 3683).

First condition: a temporary arrangement

The letter from the Treasury Chambers, officially sanctioning the establishment of the laboratory from 1st January 1920 subject to certain conditions, mentions the temporary aspect of the laboratory as the first one of these:

> *…My Lords sanction the establishment, as from the 1st of January, 1920 of the Laboratory as proposed, subject to the following conditions. -*
>
> *(a) that the experiment for the establishment of this Laboratory must be regarded as a purely temporary arrangement, which will come to an end within three years, and will only be continued after the current year with further Treasury sanction. (Barstow 1920).*

[11] The DSIR was an initiative by the President of the Board of Education to coordinate all governmental bodies with a specialised scientific focus. It was formally established in 1916 as a separate department and remained in its functions until the 1950s. The aim of the DSIR was "the organisation, development and encouragement of scientific and industrial research and the dissemination of its results". It created several scientific laboratories, among which was the one at the BM (The National Archives 2019).

The temporary character of the laboratory persisted for several years, as mentioned by the chemist Harold Plenderleith (1898-1997). With a PhD in chemistry from University College Dundee, Plenderleith was hired by the DSIR in December 1924 to work at the BM Laboratory, where he carried out conservation work under the direction of Scott (Plenderleith 1978: 2–5). Plenderleith became Assistant Keeper of the BM from 1927 to 1938, and he retired from the museum in 1959 as Keeper of the British Museum Research Laboratory (Oddy 1997). Much later, in 1978, Plenderleith recalls the temporary circumstances during the early years of the laboratory, when he asked about the stability of his job, after a few months of being hired: "The reply from the authorities was oh, well in a year or two you´ll get all this finished. Well, what happens after that? Well, replied a facetious colleague, you just hang up your key and go home. But it didn´t quite happen that way" (Plenderleith 1978: 5). Indeed, this was not the case and, according to Plenderleith, the laboratory had gained its permanent status by the end of 1925, when the DSIR handed over the responsibility to the Trustees of the BM[12] (Plenderleith 1978: 5).

Second condition: annual reports

The second condition imposed for the creation of the laboratory was that "Dr. Scott will submit an annual report giving the results of his investigations…" (Barstow 1920). Starting in 1919, for a period of twelve years, Scott would closely supervise the laboratory work and write annual reports about the progress of scientific analysis and conservation treatments.[13] These reports were addressed to the Treasury Chambers (Scott 1932: 488) and the DSIR, to meet the requirements of those formally in charge of the newly established laboratory.

Interestingly, the BM Department of Scientific Research kept Scott´s reports, and some of them remain as drafts written by the chemist himself (unfortunately, the reports for 1920 and 1921 seem to be missing). The report from 1922 is preserved only in handwritten form.

[12] This change in the management of the BM Laboratory must have been a long process; Scott highlights in his last report that the laboratory would come under the control of the Trustees of the BM from March 1931 (Scott 1931: 3). In a lecture Scott gives in 1932, he confirms that the formal date was April 1st 1931 (Scott 1932: 489). Plenderleith also recalls this lapse of time: "…when we were eventually handed over from the Department of Scientific and Industrial Research to the museum, as a ledger transfer, the laboratory wasn´t moved at all. We became a part of the museum staff and years were to pass before we could qualify as a museum department in our own right" (Plenderleith 1978: 15).

[13] See Tables 1 to 6 in Appendix for an overview of the textual sources.

For the rest, a typewriter was used, although an original manuscript version was also kept in a few cases. Each text is between five and twenty pages long and includes general information on the activities of the laboratory and records of the treatments performed on the objects. The treatment records are usually divided by material and, in some cases, added as appendices.

These reports provide insight into the main ideas sparking the creation of an establishment of such magnitude. Not only Scott´s attitude towards the treatment of artworks can be inferred from these texts, but the reports also include valuable information to help explain the changes in staff and management that the laboratory underwent during its first years and its transformation from a temporary facility to a permanent department in its own right. Scott's reports are an invaluable contemporary source, documenting changes year by year. However, a note of caution is warranted here, as Scott´s reports are addressed to the departments that were financing and supporting his project. On the one hand, the Treasury was the entity that had sanctioned and approved the creation of the BM Laboratory and financed its costs, including Scott´s salary (Barstow 1920). On the other hand, the DSIR was the department that had requested the establishment of the laboratory - together with the consent of the Trustees of the BM- and remained in charge of it until 1931. Thus, these textual sources must also be read as strategic documents, used by the chemist to advocate for a permanent status of the recently created laboratory.

In contrast, Plenderleith´s sources offer a retrospective view. As one of the key actors during the first years of the laboratory, the chemist adds a first-hand description of the challenges faced during the creation of the laboratory. A transcription of his lecture given at the BM in November 1978, was published twenty years later in the journal *Studies in Conservation* (Plenderleith 1998) to commemorate the centenary of his birth. Plenderleith had also referred to this subject more extensively in an interview conducted by Christine Leback Sitwell in March 1978, eight months before his lecture (Plenderleith 1978). In contrast to Scott´s sources, Plenderleith recalls these early years from the perspective of a professional still active in the second half of the twentieth century, when the scientific base of conservation practice had been firmly established. His observations about the first years of the BM Laboratory are far more critical than those of Scott.[14] This is interesting, but perhaps not surprising, if we consider that he gave his interview and conference lecture from an independent position that allowed him to be more outspoken, while Scott was still

[14] Plenderleith´s tone during his conference of 1978 seems to be a bit more approving and positive towards the first years of the lab, but he is especially critical during the interview he gives in the same year.

on the payroll of the institution. Therefore, Plenderleith's sources are especially important for assessing the validity of Scott´s reports and unravelling Scott´s strategies.

3. *Terminology challenges and main actors*

In order to discuss Scott's and Plenderleith's textual sources for the present investigation, certain terms related to conservation must be addressed, as words and meanings have changed as quickly as the profession itself.[15] Even today the terms "conservation" and "restoration" remain problematic. The use and meaning of these terms vary for each country, with its own traditions and language.[16] The Italian theorist Cesare Brandi (1906–1988) formulated his ideas when he was the director of the *Istituto Centrale del Restauro* in Rome from 1939 to 1961 (Gardner 1988; Muñoz Viñas 2005: 6) and in his *Teoria del Restauro*, he defined restoration as "the methodological moment in which the work of art is appreciated in its material form and in its historical and aesthetic duality, with a view to transmitting it to the future" (reprinted from Brandi 1963; Price *et al.* 1996: 231). Five years later, the German Helmut Ruhemann (1891–1973) described his profession as both, "restoration" or "conservation", alleging that these terms were "almost synonymous" (Ruhemann 1968: 59). Ruhemann observed that the word "conservator" was favoured in the United States (US) on the basis that an object can never be restored to its original state, whereas the term restoration had remained in use in some European countries (Ruhemann 1968: 59–60).

Nowadays, conservation is the most commonly accepted word in English to describe the profession of those who are in charge of the care and treatment of artworks. The Committee for Conservation from the International Council of Museums (ICOM-CC) describes conservation as "…all measures and actions aimed at safeguarding tangible

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[15] This section does not intend to be an exhaustive study about terminology, categories in conservation and translation challenges in all languages, which is a whole topic by itself. It aims to provide a general context to introduce the complexities of the uses, meanings and limitations of the terms used in the field of conservation, that will also appear in the sources analysed in the present research. For a more detailed study of the subject, see the publication by Muñoz Viñas (2005).

[16] Working spaces where treatments of artworks are carried out, can also be given different names, such as studios, laboratories, ateliers or workshops, depending on the countries, languages and traditions. See Noémie Étienne (2017: xii–xiii) for a brief discussion of this specific topic.

cultural heritage while ensuring its accessibility to present and future generations”[17] (ICOM-CC 2008). ICOM-CC describes conservation as an umbrella-term that includes: 1) Preventive conservation: all indirect measures carried out in the surroundings of the object to avoid or reduce deterioration; 2) Remedial conservation: the actions carried out directly on fragile or deteriorated objects to prevent or reduce damaging processes; and 3) Restoration: the actions carried out on an object to facilitate aesthetic appreciation (ICOM-CC 2008). These three categories within conservation seem to be based on how interventive the treatment is, from preventive conservation (in which the object is not treated, but the environment is controlled), to remedial conservation (with only the necessary intervention to safeguard the safety of the object) and restoration, with the highest degree of intervention for aesthetical reasons.

As clear as the above definitions may appear, these terms may not be mutually exclusive and there could be overlap between categories. In his *Contemporary Theory of Conservation*, Salvador Muñoz Viñas (2005: 15–18) discusses conservation as preservation, and conservation as restoration; the former oriented to preserving the object by avoiding any possible changes, the latter aiming to restore the artwork to its supposedly original state. Moreover, the term “conservation” may also refer to the practical activity of the conservator who is in direct contact with the object, or it may entail a broader definition of the profession itself, even when the people involved are not treating objects, such as scientists or heritage managers (Muñoz Viñas 2005: 9–13).

Additionally, terminology becomes more problematic if other languages are considered (Muñoz Viñas 2020: xi). Italian terms seem to present different meanings, and the categories are not comparable with those from the English language. Helen Glanville, the translator of Alessandro Conti´s (2007) book *History of the restoration and conservation of works of art*, encountered this challenge when translating the original Italian text into English: “Restoration vocabulary and terminology in Italian are much richer, and have more shades of meaning than in English, reflecting the long tradition which, like its art, lies at the foundations of restoration practice and theory in the West” (Glanville 2007: xxvii). According to Glanville, Conti distinguishes three different approaches: 1) *Restauro di conservazione o di tutela*: translated as “restoration as conservation”, these actions aim to

[17] The term “conservation” will be used in the present research with the meaning provided by ICOM-CC, to describe the profession as we understand it today. Furthermore, the word “conservator” will refer to those professionals in charge of the treatment of artworks after the establishment of museum laboratories; people with chemical knowledge, practical experience and a university degree in conservation studies.

treat the existent material with no intention of reintegrating the missing parts; 2) *Restauro amatoriale*: translated as “aesthetic restoration”, it entails reconstruction and retouching in a way that the intervention would not be distinguishable from the rest of the object by the naked eye; and 3) *di accompagnamento*: translated as “visible restoration”, this approach seeks harmony with the object, but remains recognisable as an intervention by the naked eye.

Conti´s classification cannot be directly translated into the English categories provided by ICOM-CC. Admittedly, the Italian *Restauro di conservazione* could be comparable with the English category “remedial conservation”, but preventive conservation - as understood by ICOM-CC - is missing in Glanville´s translation. In addition, Conti´s visible and aesthetic restorations could probably fall under the same “restoration” category described by ICOM-CC. The English divisions seem to describe the level of intervention carried out on the object, but are also more focused on defining the profession in a broader sense, whereas the approaches described in Conti´s book are based on the aesthetic result of the artwork after treatment (e.g. reintegrating areas of loss) and discuss the specific work carried out directly on an object. Étienne (2017: xii–xiii) also refers to the translation issue in her book *The restoration of paintings in Paris, 1750-1815: practice, discourse, materiality*, which was translated from French to English. Although the term “conservation”, opposed to “restoration”, first appeared in France in the eighteenth century (Nadolny 2012a: 574), Étienne acknowledges that these terms are somehow difficult to define and their translation becomes challenging as well. For instance, “*conservateur*” is the name used in France for curators, whereas conservators prefer to be called “*conservateurs-restaurateurs*” (Étienne 2017: xii–xiii).

Furthermore, trying to define certain terms becomes more challenging when they are observed through a historical lens, as words and meanings change with the times. It is impossible to use a universal term that covers all meanings; the profession itself has changed in the last centuries and the terms that are associated with it have changed as well - not only the terms describing the specific treatments of artworks, but also the titles given to the persons who carry out these treatments. This is even more evident during the early twentieth century, when the still emerging profession changed quickly and professionals with diverse backgrounds, training and experience were working on the treatment of artworks. Should all these workers be considered under the same title? What were the practical activities involved? And which were the terms used at certain times?

If we turn to the sources, we find that English terminology was already problematic by the early twentieth century. As I will discuss below, there was not a single title to refer to those workers who were in charge of the care and treatment of artworks; the terms are also generic sometimes or seem elusive in their meaning and delimitations. An analysis of the terminology used in Scott´s reports can help in the identification of the different actors that were part of the collaboration that took place in the BM Laboratory and identify the people in charge of the treatment of artworks, their backgrounds and by which titles they were referred to. These workers belonged to three groups: 1) The keepers from the different departments of the museum; 2) The workers in charge of the treatment of artworks who were also part of the departments of the museum; and 3) The staff who worked at the BM Laboratory. I will discuss the three groups in the sections below.

Keepers: the "classical experts"

Scott refers to the keepers or heads of department as staff educated in Classical Art History, the "classical experts" (Scott 1919: 3) or "classical workers" (Scott 1919: 4). Their education was perceived by Scott as purely theoretical and focused on the historical, aesthetical and cultural aspects of objects, but not on the technical issues. The chemist delimits both practices by highlighting this difference in education between scientists and keepers: "Those at the head of the various Departments are primarily and naturally more directly interested in the artistic, ethnographic, linguistic and historical problems […] As a rule all have had a literary and classical training as distinguished from a scientific one…". Although the chemist acknowledges that keepers may have a certain insight into the restorers work, he states that "they cannot be expected to devise new and more scientific methods or even to decide whether a new process is likely to be perfectly safe[18] from the ´Museum´ point of view" (Scott 1919: 2). These workers with theoretical knowledge of art history and focused on the historical and aesthetical aspects of the artworks, will be referred to as heads of department or keepers throughout all chapters.

Restorers: the "artificers"

The people who were in charge of the care and treatment of artworks at the time the BM Laboratory was established, were salaried men, who were part of the staff of the museum and worked in the different departments (Thomson 1970: 134). These people were craftsmen who had no formal education in chemistry, but had practical experience in the treatment of artworks and had been trained in workshops under an apprentice/master

[18] Underlined is in the original text. This underlining is exceptional in his texts, which also shows how strongly Scott is advocating for safe treatments.

system.[19] This traditional craftsman model was already present in the mid-nineteenth century in England, and the cleaning controversies that took place at the National Gallery (NG) in London during 1850-53 reveal the use of different terms to refer to the workers from this background who undertook treatments of artworks. Reports were created to document the discussions about the care and management of the NG collection as a consequence of the controversies about the safety of the treatments carried out on the artworks.[20] These reports provide fruitful material for understanding, on the one hand, the different titles used to refer to the workers performing treatments on museum collections, and on the other hand, the specific practical work they carried out.

A generic phrase, “the treatment of the pictures” (Select Committee 1853: x), was used to describe all the actions carried out on an artwork, but treatments may have required different steps: cleaning, lining or other repairs (Select Committee 1853: xiii). The cleaning of paintings involved different operations, mostly the removal of accumulated dirt and deteriorated varnishes, by chemical or mechanical methods (Select Committee 1853: vi–vii) and the people who performed these actions were called “professional picture-cleaner”, “gallery cleaner” or simply “picture cleaner” (Select Committee 1853: viii, xi, xiii). Relining was sometimes carried out if the painting was not stable, and it was performed before cleaning. Understood today as a transfer (removal of the original support), the term “relining” entailed “the removal of the damaged canvas, or other material on which the picture is painted, and the substitution of a fresh canvas” (Select Committee 1853: vii). This operation was undertaken by the cleaner if he was experienced, or by a professional who specialised in this specific job. “Other repairs” involved further work on the surface of the painting, such as colour integration for areas where the paint was damaged or missing. These are mentioned as “repairs or repaints” (Select Committee 1853: xi) in order “to improve or repair the surface of the pictures” (Select Committee 1853: ix) and were carried out by painters or experienced cleaners who were also painters by training.

The word “restoration” was used in the NG reports to describe the process of re-varnishing a painting after cleaning, a process that was also called “re-toning” (Select Committee 1853: xi) because of the use of a toned “gallery varnish”. Interestingly, Scott also uses the word “restore” in his report from 1919, but his use of the word seems to cover a broader meaning. When the chemist mentions the steps performed by the workers in charge of the

[19] See Chapter 4 for further discussion about the education and training of workers undertaking treatments of artworks.

[20] See Chapter 2 for further discussion about the cleaning controversies in the mid-nineteenth century at the National Gallery, London.

care and treatment of the museum collections before the BM Laboratory was created, he describes the steps followed by these "artificers" and mentions restoration as one of the steps: "…those whom we may call the artificers employed to clean, restore and mount for exhibition the specimens…" (Scott 1919: 2). This enumeration of steps shows that "restore" was understood as any treatment undertaken on an artwork after cleaning and before mounting. Therefore, this includes the nineteenth-century meaning of "restoration" (or "re-toning" in the case of paintings), but it is not limited to it; other treatments may be involved as well, such as retouching of deteriorated surfaces or missing areas. The meaning with which Scott uses the word restoration remains unchanged for years, as in 1927 he applies the term in the same context. In this case, the chemist describes the treatment undertaken on a metal object and describes restoration as the treatment carried out after stabilisation of the artwork (Scott 1927: 2).

Importantly, Scott never mentions the terms "restorer" when referring either to workers at the museum who conducted treatments on objects, or those who worked privately by commission. Instead, the chemist uses the words "artificers" (Scott 1919: 2, 1927: 2), "workers", "assistants from the Museum" (Scott 1924: 1) or "assistants from different departments" (Scott 1925: 1) indiscriminately throughout his texts, with no change over time. Therefore, it remains challenging to select a single title that would describe these workers according to the connotations and standards of the 1920s. Generally, scholarly literature has mostly referred to these workers as "restorers", a word used with a historical perspective (Conti 2007; Simon 2017; Étienne 2017). This term will be used throughout the chapters to refer to this type of worker: traditional craftsmen specialists with no formal education in chemistry, who learned by practical experience and were trained by a master/apprenticeship model, as no formal training for restorers existed at that time at the university level.[21] In addition, the generic term "restoration" will be used throughout to refer to all practices carried out by these workers.

The staff of the BM Laboratory: chemists and lab boys

The staff who treated artworks in the laboratory established at the BM were not a uniform group; they had different backgrounds.[22] On the one hand, the laboratory assistants were acknowledged as "laboratory attendant" (Scott 1919: 5), or "laboratory boy" (Scott 1929: 14). These were workers who had experience from previous laboratories; they had no

[21] Chapter 4 discusses the early steps of the establishment of conservation courses at universities.

[22] Chapter 4 investigates some of these workers by following their education and trajectories.

formal education, but had experience in assisting chemists in their work and therefore had a basic knowledge of chemistry. These assistants resemble the description offered by Caitlin O´Grady (2017) of an "invisible force" treating archaeological objects after excavations. In contrast to the assumption that in the late nineteenth century, most of the field work on objects was carried out by archaeologists (Sease 1996: 159), O´Grady´s research highlights a group of "technicians" and "repairers" who were the first ones to assist in the treatment of objects during excavations undertaken in the late nineteenth and early twentieth centuries. O´Grady describes them as mostly unknown workers who had no formal academic training, but were trained in laboratories or museums and acquired technical skills by learning through practice; their identities are mostly unknown and their contributions were not generally acknowledged. The invisibility of technicians working in laboratories has also been highlighted by Steven Shapin (1989), who investigated the transparency of the staff in seventeenth-century English laboratories and their roles in the production of knowledge. Shapin (1989: 554–55) observes that the work carried out by these invisible technicians or assistants usually involved manual skills. Their position being relatively stable, depending on a salary, and following orders from the person in charge, they were trained in their jobs. Although Shapin´s study is focused on the seventeenth century, these characteristics are similar to the laboratory boys operating in the BM Laboratory.

On the other hand, chemists were in charge of the treatment of artworks in the laboratory. Both Scott and Plenderleith were chemists, and the workers who temporarily volunteered during the first years of the establishment of the BM Laboratory also held a chemistry degree. Scott calls these volunteers "voluntary workers" (Scott 1928: 2) or "research assistants" (Scott 1927: 2).

This distinction between assistants with a degree in chemistry and theoretical background (the volunteers) and assistants with no degree, but with practical experience in a chemical laboratory (the lab boys), has been pointed out by Sacha Tomic (2018: 232–36) in her research about the *École de pharmacie* in Paris during the first three decades of the nineteenth century. Tomic mentions the existence of two groups of assistants: the lab assistants or demonstrators, and the lab boys. The former workers were assistants to the chemistry professors; they were chosen from among the best pupils -thus were educated workers - and carried out both practical and theoretical work: performing experiments, teaching, research and publishing in scientific journals. The latter group was constituted of those who helped the laboratory assistants: lab boys who carried out office work, cleaning of the laboratory and tools and making purchases, among other duties. As there is no mention in Tomic´s research about the qualifications held by these lab boys, it seems that no university degree was required of them.

However, while Tomic illustrates how laboratory assistants had social mobility and could therefore ascend to better job positions, the mobility options for the lab boys are not mentioned in her study and appear to be more limited. In comparison, all the staff of the BM Laboratory - volunteers and lab boys - could carry out the same types of work (performing treatment of artworks) once they had sufficient experience and were considered ready for it.

All these workers who had a background in chemistry - either by previous experience in a laboratory or by formal education at university - were trained to treat artworks during their time in the laboratory. Yet, given the diversity of these workers, it seems problematic to group them together under one title. Not surprisingly, Scott did not refer to his staff with the same title either, and he never used the word “restorer” to refer to them. Thus, “chemists”, “volunteers” and “lab assistants” will be used throughout the chapters - according to their background upon joining the laboratory - to refer to the staff working at the BM Laboratory under Scott´s guidance.

4. *Collaboration in the British Museum Laboratory*

Collaboration in context: external and trans-national collaboration

Despite the pioneering status of the BM Laboratory, Scott and Plenderleith did not start from scratch: the experience of the Chemical Laboratory of the Royal Museums in Berlin was used by the staff of the BM Laboratory. Although short-lived, the Royal Museums’ laboratory had left a valuable legacy, namely the book published by its first director Friedrich Rathgen, which was initially used by Plenderleith to deal with treatments performed on the museum collection. Rathgen's text was a manual for the treatment of objects made of different materials, initially published in German in 1898 as *Die Konservierung von Altertumsfunden* and translated into English in 1905 under the name *The Preservation of Antiquities: A Handbook for Curators* (Sease 1996: 158). Plenderleith mentions having used this “handbook” in his first years working at the BM Laboratory as a way to build his own knowledge based on another chemist´s experience:

> *…in the early stages I found it useful to begin by checking through some of the methods of Rathgen. […] We checked the methods he advocated and as a matter of fact this was of interest to me because many years*

> *previously in Dundee I had come across an idea of reducing an oxidized metallic surface by treating it with zinc and caustic soda… […] So I tried all the reduction methods on that and came to the conclusion that the safest was to use granulated zinc with formic acid.*

Also, from the very beginning, connections were created with other institutions by collaboration, and after a few years, an international network was established with newly created laboratories (Vanpaemel 2010: 72). These connections were also cultivated by the movement of staff working at the BM Laboratory. For instance, Margaret Binyon, a volunteer who worked at the BM for a year, went to the US to work at the Fogg Museum and later returned to the UK to work again at the BM Laboratory.[23] Another example is Plenderleith himself, who became a founding member of the Honorary Scientific Advisory Committee in the National Gallery, London in 1935, while he was still working at the BM Laboratory (Thomson *et al.* 1977: 19). In addition, the Rome conference that took place in 1930 acted as a catalyst for the creation of museum laboratories in several countries (Nadolny 2012b: 340). As one of the first international conferences at which topics related to the care and treatment of artworks were discussed among professionals from different countries, it connected museum workers from around the world. When Plenderleith was asked if there was any contact with European conservators, the chemist answered affirmatively and recalls the Rome conference: "now it was possible to meet picture restorers from all over Europe; USA and beyond."

Moreover, the BM Laboratory was open to requests from other public institutions, private collectors and archaeologists. A growing interest in what science had to offer to those in charge of archaeological and art collections can be observed in Scott´s reports. For instance, in 1923, when explaining the work carried out by the laboratory during the previous year, the chemist mentions that "most of this work has been of a very interesting nature and indicates the great necessity for authorititative [sic] guidance which has been felt both by private collectors and curators of Museums as well as by public bodies having valuable works of art in their custody" (Scott 1923: 5). The following year the demand for scientific advice seems to have increased: "During the year we have had numerous applications for advice and for practical assistance both from Museums and Public Institutions as well as from private collectors" (Scott 1924: 5). Moreover, after twelve years of being head of the laboratory, Scott proudly claimed:

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[23] The work carried out by volunteer assistant Margaret Binyon at the BM Laboratory and her trip to the US is discussed in detail in Chapter 4.

> *Throughout our career we have been in constant touch with other Museums and Institutions interested in museum and preservation problems of all kinds so that my ideal that the British museum Laboratory should become the world centre of Museum research and problems has been in a large measure fulfilled. We have had many enquiries from India, Australia and even The Panama Canal Zone. With the Victoria and Albert Museum we have had a more or less definite arrangement since 1924, and with the National Gallery, The National Portrait Gallery and H.M. Office of Works we are constantly conferring on their scientific problems as they arise. (Scott 1931: 4)*

Such a statement can be read as a recapitulation of the chemist´s years as the Director of the BM Laboratory. The above quotes can also be understood as a strategical statement to advertise the prestige the laboratory had brought to the museum. They illustrate how, throughout the first years of his directorship, Scott consistently highlighted the fruitful collaboration that took place with different external institutions and private collectors. The chemist repeatedly insists on the benefits of this collaboration to argue for the need for a permanent laboratory at the BM.

Nonetheless, the claim does not seem to have been far from the truth, as the comments by workers from the Victoria & Albert Museum (V&A) and the National Portrait Gallery (NPG) suggest. After Scott´s lecture about his work at the BM Laboratory in February 1932, the director of the V&A, Eric Maclagan,[24] expressed his gratitude to Scott during the discussions. The chair of the lecture reports: "[Maclagan] would like to express the great debt of gratitude which the Victoria and Albert Museum owed to the lecturer for the work he had done for them" (Scott 1932: 495). The chair also transcribes the acknowledgements for the great assistance Scott provided to the NPG:

> *[Adams]*[25] *said the lecturer had been of great assistance to the National Portrait Gallery just after the War, when the drawings came back from the Post Office tube, where they had been housed for safety, and where they had developed various diseases. Dr. Scott´s advice was sought and the drawings had been put straight by the methods he had*

[24] Sir Eric Maclagan (1879–1951) was the Director and Secretary of the V&A between 1924 and 1944 (The Victoria and Albert Museum 2019).

[25] Charles Kingsley Adams (1899-1971) was the Director of the NPG (National Portrait Gallery 2020a).

> *described that evening; they had remained in a perfect state ever since. (Scott 1932: 496)*

Collaboration with archaeologists was also strongly encouraged at the laboratory. During the excavations of remote archaeological sites (e.g. Tutankhamun's tomb and Ur), several pieces were brought to the BM for examination. Just like the restorers from the museum, the archaeologists were able to work in the laboratory and benefit from scientific advice: "It has also been a great pleasure to assist in this way the actual excavators themselves" (Scott 1925: 1).

Also, in this case, Scott made sure that the benefits of collaboration between archaeologists and the laboratory staff were clearly stated in the annual reports sent to the DSIR. In 1928 the chemist remarks:

> *It is not too much to claim that by the work being done in a well equipped laboratory and by the excavator himself with the laboratory staff, much valuable detail with regard to the objects themselves and the processes by which they were made has been acquired which could only be discovered during the cleaning and restoration of the objects, and without such a combination would have been inevitably lost. (Scott 1928: 1)*

Two years later, Scott was still emphasising how collaboration had been highly favourable for all parties:

> *The antiquities from Ur of the Chaldees excavated during 1928-29 presented a range of materials for experiment and renovation in no way inferior in interest to that of previous years, and the success of the reconstructions was made possible by the usual close cooperation in the laboratory with the excavator, Mr Leonard Woolley." (Scott 1930b: 8)*

Moreover, collaboration with private collections helped the laboratory in the development of new methods. Contrary to museum collections, working on privately-owned objects allowed the laboratory staff more freedom to carry out treatments. For instance, in his first report, the chemist is cautious about recommending new treatments for museum objects and suggests further experimentation for safer results: "At this early period of the Research Work it would be premature to recommend the processes which have been tried as being the best for with further experience all may be notably improved" (Scott 1919: 1 Appendix). Nine years later, Scott rememorates the early beginnings in the laboratory and remains consistent with his early ideals:

> *During these earlier years the most obvious examples of decay were tackled and the processes of restoration and preservation were being evolved and their stability and probable permanence were being tested as far as possible. These processes are now being steadily improved and in many cases simplified. (Scott 1928: 1)*

Also, in 1929, the chemist insists on the same approach:

> *Ten years ago one of the first problems we had to tackle was to find the safest methods of cleaning and restoring as well as of rendering safe from further deterioration […] The problem has presented itself in many forms since and our methods and reagents have been notably improved both in efficiency and safety. (Scott 1929: 2)*

This experience was partly deepened by the treatment of artworks from private collections. As soon as the laboratory became known in the art world, other public institutions started to request advice, but public workers were not the only ones recognising the advantages of scientific research. Scott mentions several times the requests received from private collectors for scientific advice. The chemist took great advantage of the treatment of such objects, as they were allowed to experiment on them with much more freedom than the objects from the BM collection: "The experience obtained with the specimens brought by the latter class [private collectors] is of great value as we are usually allowed to make experiments with them which we would hardly risk trying on catalogued specimens belonging to the Museum itself." (Scott 1924: 5). Interestingly, this opportunity for experimentation was not only some secondary outcome, it seems to have been a main factor in Scott´s decision-making process when accepting objects from private ownership:

> *In another way and in different directions the examination and restoration of objects for other National Museums, and for private collectors have provided, in the latter cases especially, not only new scientific problems of great interest but opportunities for experiment which one might possibly hesitate to apply for the first time to objects in National Collections. One of the conditions insisted on in accepting specimens from private collectors is that we shall be allowed to make any experiments we deem necessary and only such objects are accepted for experiment when they seem to present some new problems waiting for scientific observation and solution. (Scott 1929: 1)*

Likewise, the laboratory also sought external advice. For instance, when Scott was investigating the composition and manufacturing techniques of iron spear heads from the Bronze Period from the Department of Medieval Antiquities, he suggested asking a knowledgeable person about the topic. After experiments had failed, the chemist humbly requested expert opinion:

> *Experiments with etching agents on many specimens failed in every case to give in our hands the [illegible] evidence of any carbon content in the iron which behaved in every respect as pure malleable iron. As the discussion had really been initiated by a professor in Metallurgy I suggested that Professor Carpenter should be asked to give his opinion. (Scott 1929: 8)*

A collaborative scientific laboratory at the British Museum

Collaboration between the laboratory staff and the BM workers was encouraged as well during the early beginnings of the BM Laboratory. Scott insisted on the benefits of this collaboration in his annual reports to achieve his goal of establishing the laboratory as a permanent department. This can be observed even from the very first years, before the laboratory was up and running. In 1919, Scott was requested to investigate the condition of the BM collection that had deteriorated while stored underground in the Tube system during World War I. Between April and October of that year, Scott paid several visits to the different departments of the BM "in order to obtain as clear an understanding of the problems constantly arising in the normal work there as well as of these which have arisen from circumstances due to war conditions" (Scott 1919: 1). The first page of his report highlights the advantages that a close collaboration with scientists would bring to the BM:

> *Without casting the slightest reflection on any one it may safely be said that cach [sic] and every one of the Departments of the Museum stands much in need of expert scientific assistance and advice in order to carry out its aims and to utilise to the full the possibilities afforded by the specimens stored in or sent to the Museum. (Scott 1919: 1)*

In terms of collaboration, Scott´s rhetoric did not change over time. After eleven years of work, the founder and head of the laboratory still advocated for science as beneficial to the museum, not only for conservation treatments, but also for scientific research and the detection of previous interventions in artworks:

> *Analytical work often forms part of the larger issue, the scientific examination of a specimen of suspicious manufacture or doubtful*

> *patina. […] Cooperation with the Laboratory in these matters has admittedly greatly strengthened the hands of those responsible for advising collectors or purchasing specimens for the Museum. (Scott 1930b: 11)*

Scott´s intentions of a close collaboration across disciplines between the scientific laboratory and the different departments of the museum can be found throughout his texts, from his first report to the very last one. The earliest example is apparent when the chemist suggests a structure for the laboratory and he specifies the staff needed for its proper functioning. When the chemist mentions the functions of the Director, the collaborative aspect of this position is clearly stated: “The staff at first need only consist of [a] Director, who would discuss the various problems with the Heads of the various Departments, and who would direct all the experimental work in the Laboratory” (Scott 1919: 5). Scott deeply believed that the staff from the museum would benefit from the laboratory´s scientific work, but he also considered that the laboratory would benefit from the museum workers with a more theoretical education in art history, as he openly stated himself: “For the satisfactory solution of many of the problems involved the harmonious co-operation of the classical expert with the scientific man is absolutely essential” (Scott 1919: 3). In the following page of the same report, Scott not only emphasises this idea, but he also strategically promotes the value of his laboratory and its methods:

> *By the introduction of scientific knowledge and methods to reinforce those employed by the most prominent classical workers of the present time it is not too much to expect that many of the unsolved problems which have arisen from a study of ancient civilisations will be satisfactorily elucidated. (Scott 1919: 4)*

This concept of collaboration was also reproduced in the working space, as restorers from the different departments seem to have worked in the laboratory space, at least when considered necessary. In the early stages and due to the large number of objects that needed conservation treatment, the deterioration issues seem to have been identified at first by groups of objects with similar characteristics (for example, collections of similar provenance, kind or material). After investigating and concluding on the best treatment, the restorers from the departments where the objects belonged were accommodated in the laboratory to have their work supervised. Although the lack of textual sources written by BM restorers makes it impossible to determine to what extent they agreed with Scott, the chemist ensured that the benefits of this collaboration between the restorers and chemists was clearly stated in his reports:

> *We shall thus be able to supervise the cleaning and restoration of the remainder and to suggest modifications in treatment necessary for those objects which differ from the typical specimens in each group. A beginning has been made in this direction already and this side of our work will doubtless extend and prove of great use to the Museum as a whole. (Scott 1923: 1)*

Indeed, the space shared with restorers from the departments proved to be beneficial, as this approach continued in the following years. In 1924 Scott mentions "the room above this which is fitted as a laboratory of a simpler type has been a good deal used by assistants from the Museum working under our supervision" (Scott 1924: 1). A year later, this arrangement was still effective: "At various times assistants from different departments have been accommodated when working on problems where our appliances and advice were of assistance to them" (Scott 1925: 1). This practice seems to have been carried out when the complexity of the conservation treatment represented a new challenge. The treatment, once learned, was performed in each department by the restorer that had been previously supervised in the laboratory: "The stucco block method of applying hydrogen peroxide continues to be used with success in the Print Department and it is only in a few cases presenting special difficulties that prints are now treated in the laboratory" (Scott 1923: 3). This way, the restorers from the museum also gained experience of treatments based on scientific methods.

This collaboration strengthened over time, as during the last years of Scott´s directorship, the laboratory received further assistance from young museum workers: "About 1930 the group of assistants was reinforced by junior members of the British Museum staff wishing to have some scientific training…"[26] (Plenderleith 1978: 6). This suggests that the knowledge generated in the laboratory as a result of the collaboration between workers with different backgrounds did not remain within the laboratory, but was transferred to the different departments of the museum.

[26] Although Plenderleith explicitly mentions the addition of these "junior members" from the BM, there is no corroboration of this in Scott´s reports. The only incorporation of new staff mentioned by Scott is the appointment of a new laboratory boy named L. W. Walker on the 21st May 1929 (Scott 1929: 14, 1930b: 11, 1931: 4), but it is uncertain whether Walker was externally hired or had already been working at the BM.

Additionally, further actions were taken to introduce workers from other museums to conservation practices based on scientific research. In 1931, the year that Scott retired as head of the laboratory, he describes an initiative by the Museums Association:

> *An interesting and important movement of the Museums Association in a direction which is certain to prove of great value and in which we had great pleasure in taking part was made in October. A short course of training (Oct. 6th to 11th, 1930) was arranged for the Curators of Museums in which visits were paid to various Museums in London where lectures and demonstrations were given by the various Keepers of Departments and their Assistants. On Friday October 10th the party numbering about 30 came to the Laboratory in the forenoon and demonstrations were given on the various types of work in progress. (Scott 1931: 12)*

As described by Scott, treatments and other activities taking place in the laboratory were shown to this group of curators. While Plenderleith explained procedures related to resins and fats, two laboratory assistants demonstrated metal treatments and presented procedures carried out to remove salts from porous stones and earthenware. Scott also participated by giving a lecture about treatments performed on objects from Egyptian archaeological sites (Scott 1931: 12).

Tensions and negotiations of expertise

Such innovative practices of collaboration between the long-established museum departments and the newly created scientific laboratory did not come without tensions. The boundaries between what work was supposed to be carried out by the laboratory staff and what was the restorers' job remained a grey area during the first years. This is a challenge that Scott addresses in his reports; the text from 1927 contains a detailed explanation of the chemist´s thoughts on this matter:

> *This raises again the question […] as to how much was to be done by my research assistants and how much assistance in this work should be provided by the Museum. That the problem is somewhat involved and seems to call for an almost new type of Museum workman cannot be better illustrated than by the accompanying photographs A and B, (Merovingian silver on iron) which require the constant watching of the chemist and the skill of an artificer who possesses infinite patience and manual dexterity. The removal of the rust from the silver and the*

> *extraction of the agents provoking the formation of rust must belong to the chemist, but the careful replacement of the thin silver and its fixation in a satisfactory manner are rather outside his province although even in this his advice may be of value. There is no doubt whatever that had these objects been treated so as to remove the salts which they contained when found, the energetic action of these deleterious reagents would have been arrested and the specimens would have been in a much finer condition than that now obtainable by the most skilful restoration. (Scott 1927: 2)*

Importantly, Scott seems to foresee the need for a “new type of museum workman” with competencies covering both areas, i.e. the understanding and treatment of deterioration processes linked to the knowledge held by the chemist, and the “manual dexterity” required to perform restorations. But despite his reflections, there is no mention in Scott´s reports of any tensions between the laboratory staff and the BM departments about boundaries and limitations of each other´s work. This is not surprising, as Scott´s main tool to promote the benefits of collaboration with the scientific laboratory were his annual reports, so it is only natural that he would have tried to avoid the mention of any tensions across and between the departments of the museum.

On the contrary, the later Plenderleith sources offer a more critical view of the situation, with a description of the tensions arising, and the changes in them over time. Whereas the emphasis on collaboration is consistently maintained over the years as Scott wrote his annual reports, the tensions as a result of cooperation seem to have emerged at an early stage and decreased over time. The origins of these tensions were mainly distrust based on the prejudices held towards each other´s knowledge and expertise, such as secretive attitudes versus transparent methods, or cautious approaches compared with supposedly dangerous treatments. For instance, Plenderleith mentions the early issues creating antagonism between scientists and the staff from the museum:

> *…departments had their own technicians, their own people who did technical jobs for them […] But how they did it was their business. We had to stop that. […] There was often active antagonism to begin with between that type of person and our approach. They had their private methods. By our being there and exposing this we were undermining their importance. Tact and diplomacy were called for! (Plenderleith 1978: 15)*

The “type of person” that Plenderleith refers to, were the restorers working at the BM. According to him, they used secret methods that were considered unsafe for the objects.

However, Plenderleith also explains how such contradictory points of view were negotiated and eventually valued after a certain period of working together. In this case, the distrust that was overcome existed between himself - as a scientist - and the “frightfully impractical” keepers from the museum:

> *The British Museum had had no scientific advisors. I was the only trained scientist working at the British museum at first.*[27] *There were of course the world renowned classical scholars who were the cream of specialists but not in sculpture or necessarily technical matters. Awfully nice people but it took me some years to discover that because I was a chemist by training they very naturally suspected me of wanting to dip things in acid and watch them fizz. A scientist was a dangerous person to them – that´s the truth, just as they were in their way, frightfully impractical people to me. It took some time for us to get to know each other but in the end we became the closest of friends and I learned everything from them as it seems now in retrospect. (Plenderleith 1978: 4)*

This change of attitude can be observed also in how Scott describes the increasing demands from the different departments. About five years after the creation of the laboratory, Scott reports that “the work of the past year has been of a very varied kind and there seems to be no falling off in the number of new problems for solution and investigation” (Scott 1925: 1). Two years later, Scott still insists on the work that had to be carried out: “Much of what was done in the earlier years of our work was devoted to studying various causes of decay and corrosion and in devising means of arresting them. There will always be abundant work in this direction…” (Scott 1927: 1). Although Scott´s comments can be understood as a statement actively geared at claiming a permanent position for the laboratory at the museum, Plenderleith´s view coincides with Scott´s report about the increasing amount of work requested by the departments:

> *[The museum authorities] had never had this facility before. Of course they loved that for their reports. Altogether they found it useful to have a dog´s body about to do the scientific work, and for that reason alone*

[27] Plenderleith does not include Scott in his statement because whereas Plenderleith was a museum employee performing conservation work, he considered Scott as a research scientist and an external museum advisor: “…he wasn´t a museum servant at all. I was the only one who was a museum man. He was the experienced scientist who had undertaken to help and to advise me” (Plenderleith 1978: 4).

> *the lab was worth keeping. Everybody wanted to keep it. By that time, I had got to know them all pretty well, you know and they trusted me. (Plenderleith 1978: 5)*

Scott and Plenderleith´s statements are also confirmed by Robert Hobson, the Keeper of Ceramics at the BM.[28] After the lecture given by Scott in 1932, Hobson expresses his gratitude to the chemists from the laboratory publicly and acknowledges their work. The chair of the lecture reports:

> *[Hobson] said it gave him great pleasure to pay a tribute to Dr. Scott not only for his fascinating paper, but also for the invaluable assistance he had rendered to the Department of Ceramics of the British Museum. Dr. Scott and his clever assistant, Dr. Plenderleith, had been staunch and valuable allies of the Departments concerned with antiquities. There were certain problems which faced them frequently and which would have been almost insoluble had it not been for Dr. Scott and Dr. Plenderleith. (Scott 1932: 496)*

Despite tensions, a collaborative working routine was built up during the early years of the laboratory. Collaboration eventually strengthened the links between the staff from the scientific laboratory and the workers from the other departments. Such collaboration highlighted the advantages of scientific advice at the BM, which greatly exceeded the initial need for immediate treatment of the objects that had deteriorated from the storage conditions during World War I. Thus, the need for a permanent scientific laboratory was already established by the time Scott wrote his last annual report in 1931. With the help of these strategic documents, Scott had achieved his goal.

5. Conclusions

The annual reports written by the head of the BM Laboratory, Alexander Scott, from 1919 to 1931 provide insight into the chemist´s attitude towards collaboration, a crucial point that was not only repeatedly highlighted in his reports, but was also put into practice during

[28] Robert Lockhart Hobson (1872-1941) was the Keeper of Ceramics and Ethnography at the BM from 1921, and Keeper of Oriental Antiquities and Ethnography between 1934 and 1938. Hobson had a background in classical culture and was specialised in Western and Oriental ceramics (The British Museum 2019c).

the years of his directorship. Cooperation with external institutions - museums, galleries and other scientific laboratories - was encouraged whenever possible, and work with private individuals, like art collectors and archaeologists, was considered beneficial for the laboratory as well.

Internal collaboration between the staff of the BM Laboratory and the workers of the museum, such as restorers and keepers, was also openly promoted by Scott, and shows how scientific expertise was not imposed upon the museum workers, but served to assist decision-making processes oriented to the treatment and conservation of artworks. This collaboration on an equal basis was fundamental for the BM Laboratory to develop from a temporary initiative to a permanent museum department in its own right. By emphasising the advantages of such collaboration, the annual reports served as strategic documents that Scott used to advocate for - and ultimately achieve - the permanent status of the laboratory.

(Illustration next page: "Diary (13 August 1855 - 21 November 1877)", by Ralph Nicholson Wornum. 1877. Page corresponding to August 1866, no page number. Courtesy of The National Gallery London.)

Diary

1866

August 1st — Mr Hahn from Stettin made some experiments with reference to the preservation of pictures –
The regeneration of Varnish
The removal of Varnish, without touching the paint?
also the straightening of curved panels.
Mr Pinti repairing one of the so called Melozzo da Forlis.

3 — Mr Hahn continuing his experiments – His straightening of panels and regeneration of Varnish seem successful. Wants a thousand pounds! for his recipes –

4th — Received the large Rembrandt, from Aix La Chapelle. formerly in the Schönborn collection, ~~near~~ at Vienna.
N.P. — Purchased from Herr Suermondt, for £7,000 –
"Christ blessing little children" – Singularly simple & forcible –
757 — on canvas, 7 ft. 2 in. h. by 5 ft. 1/2 in. w.
Five & a quarter inches have been added at top – The picture has been badly lined; wants relining, and about four inches cutting away from the top – Engd by C.E.C. Hess.
A good new frame come with it, but it wants a little more ornament –
Ordered a new frame for it

16th — Mr Weekes placed his bust of Mulready in the Hall, presented by a Society of gentlemen. Fixed on a marble pedestal

22 — Mr Moseley's Lady Rich, came to be cleaned
The gold medallion on her breast, a very remarkable piece of painting –

27th — Started for Vacation, to Ventnor

Sepr 27th — Returned from Ventnor

Chapter 2

Before the BM Laboratory

Collaboration and ethics in nineteenth-century England

1. Introduction

The British Museum (BM) Laboratory originated in 1919. While conceived on a temporary basis, over the course of the 1920s it was decided to establish it as a permanent department in the museum, where it still functions today. Chapter 1 examined this changed status of the BM Laboratory and revealed how collaboration between the staff of the laboratory and the workers from the museum took place: the scientific expertise brought by the laboratory staff was not imposed upon the museum workers. On the contrary, during these first years of the creation of the laboratory - between 1919 and 1931 - chemists and restorers[29] worked together valuing each other´s expertise. On a regular basis, science served to advise and assist in decisions over the care and treatment of the museum collection. Collaboration between chemists and museum staff was not based on a specific person or incidental relationship, rather it became a daily working routine in the laboratory. This role played by science was discussed in Chapter 1, showing that the first director of the BM Laboratory, the Scottish chemist Dr Alexander Scott (1853–1947), explicitly advocated for such collaborative decision-making processes in the laboratory as a strategy to gain a permanent status for the BM Laboratory.[30] However, collaboration between chemists and those in charge of museum and gallery collections had already taken place during the nineteenth century, allowing Scott to build upon previous examples when he developed his strategy for a permanent museum laboratory. In this chapter, I argue that even though it did not happen on a permanent basis - as it occurred in the BM Laboratory - collaborative decision-making processes can be traced back to the previous century, when short-term or incidental precedents occurred.

Two examples will be discussed which show how collaboration between chemists and those in charge of the care of art collections took place in nineteenth-century England, a period when the country also held a leading position in the field of restoration practice (Simon 2017). The first case demonstrates that chemists had ethical concerns during the decisions related to the process of taking paint samples from polychrome artworks in order to carry out pigment analysis. In the nineteenth century, chemists became involved in the art world by performing materials characterization through chemical analysis, which led to printed publications about the subject. These textual sources help us to understand the ethical

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[29] Chapter 1 offers a detailed discussion about the words “restorer”, “restoration”, “conservation” and other related terms.

[30] See Chapter 1 for further discussion on this topic.

considerations that chemists took when considering artworks before the establishment of museum laboratories. Scientific analysis of pigments provided information about the object, the composition of its polychromy and possible deterioration processes, but the act of taking samples involved inevitable damage to the artwork. Interestingly, the decision-making process related to taking paint samples in the nineteenth century in England shows that chemists had an ethical perspective about preserving the integrity of the objects. These shared views about the care of artworks reflect the collaboration that occurred between the chemists and those in charge of museum and gallery collections, whose job directly concerned avoiding or reducing damage to the artworks.

The second case study shows how the decision-making processes about the care and treatment of artworks discussed in collaboration between chemists and those in charge of museum and gallery collections in England in the mid-nineteenth century reports can be observed as common practice in preventive measures carried out by the keeper of the NG during the second part of the century. Between 1845 and 1857 the influence of the environment on the artworks became a matter of debate within the National Gallery (NG), London. As a result, several joint reports were written by chemists and people in charge of the care of art collections, in which the role of science was to assist and advise: chemists were interviewed as experts, to provide guidance about the best possible ways to reduce or avoid the deterioration of artworks. During the second part of the century, the debates about decision-making processes related to preventive measures for the care of artworks discussed in these reports - such as temperature, light and relative humidity controls - can be seen to be applied as common practice by Ralph Nicholson Wornum (1812-1877), the keeper of the NG in charge of the care of the gallery collection. In sum, this case study shows how preventive measures were discussed and designed in a collaborative context in the mid-nineteenth century, and how the keeper of the NG significantly contributed to their implementation and to further developments, by translating advice into practices that could be carried out on a daily basis. Although such measures were put into use over many years, this case discusses an incidental practice: contrary to the BM Laboratory - where collaborative practices were implemented by all the staff and for all the treated objects - the example of the NG examines the work carried out by one man and is limited to the Turner watercolours by the British painter William Turner (1775-1851). The following sections go on to discuss these two cases in detail.

2. *Taking paint samples for pigment analysis in nineteenth-century England* [31]

During the nineteenth century, chemists became increasingly engaged in the conservation treatment of polychrome surfaces. The collaborations between chemists and museum workers in charge of easel painting collections were mostly oriented towards the improvement of conservation practices, such as surface cleaning or further treatments aiming to reduce the deterioration of such artworks (Simon 2017). So-called Fine Art painting was considered to be "an essential feature of national prestige and was promoted accordingly" (Nadolny 2012b: 337), and England was a representative example of this. However, pigment analysis of easel paintings was not common practice and it was not until the twentieth century that publications about samples taken from such paintings can be found (Boothroyd Brooks 1999: 240). In the nineteenth century, chemists were also involved in the nascent field of archaeology; they were consulted for materials characterization of objects made of metal, ceramics, and glass, among other materials. Some samples were also removed from wall paintings and artefacts with polychrome surfaces in order to identify historic pigments and binding media. Reports about these pigment analyses were published in different formats: for instance, as letters from the analyst to the person who requested them. Other reports circulated as journal articles, since by the late eighteenth and early nineteenth centuries, prestigious institutions related to the arts and sciences were already established in Europe – the Royal Society in London, the Royal Academy of Sciences in Paris – and specialised journals were being published for a growing audience (Nadolny 2012b: 336).

In the past decades, these reports have been investigated by scholars in search of textual sources referring to chemical analysis of pigments carried out in nineteenth-century Europe. The first study discussing the analysis of pigments and binding media was published by Stephen Rees-Jones (1990), who provides a detailed discussion of the methods used by nineteenth-century English analysts who carried out chemical examination of historical pigments. A more recent article by Barbara Berry (2012) focuses on the nineteenth and twentieth centuries. Berry includes an early history of pigment analysis, a technical discussion about the chemistry of pigments and dyes, and a historical contextualization of

[31] Part of this section was previously published as: Pinto, Mariana. 2018. "Taking Paint Samples for Pigment Analysis in Nineteenth-Century England". *Studies in Conservation*: 1–6. DOI: 10.1080/00393630.2018.1550612.

artists´ pigments. Jilleen Nadolny´s (2003, 2012b) publications offer further information about scientific examination and analysis of historical paintings materials from 1780 to the mid-twentieth century. Nadolny´s article about the first century of scientific analyses of paintings and polychromy provides a table with the most extensive list of publications, ranging from the late eighteenth to the late nineteenth centuries, containing articles from Germany, France, Italy, England and Ireland (Nadolny 2003: 44–47). After thorough research, no additional publications were found by the author of this research, thus, the seven English publications from the nineteenth century included in Nadolny´s table are the source base of the present sections.[32]

While Rees-Jones (1990), Berry (2012) and Nadolny´s (2003, 2012b) articles are remarkably valuable for the early history of pigment analysis, they are silent about the ethical considerations taken by the chemists performing pigment analysis concerning the integrity of the sampled artworks. Nadolny has attributed ethical values to the people in charge of museum collections, for example, the Keeper of the NG Sir Charles Lock Eastlake (1793–1865) (Nadolny 2005: 1031–32) and nineteenth-century scientists have been ascribed diverse epistemic virtues, such as persistence or humility (Kidd 2017; Stanley 2017). However, the ethical considerations of the chemists performing pigment analysis over the sampled artworks have not yet been discussed in detail. It could easily be assumed that these chemists were less concerned with the preservation of the objects from which the samples were taken, since their primary aim was the identification of pigments, and the procedures used relied on destructive methods. However, based on my re-visiting of the nineteenth-century primary sources in which pigment analyses were reported, I argue that chemists did take ethical considerations over the physical integrity of the sampled archaeological objects and their preservation. Such concerns are evident in the description of the processes used when paint samples were taken from the artworks for pigment analysis.

Chemists' concerns for the conservation of archaeological objects and wall paintings

From the sources provided by Nadolny, two examples will be discussed in detail here: publications from the first half of the century that include the most elaborate discussions about the process of taking paint samples from artworks. The first example is a letter

[32] See Table 5 (Appendices), for a general view of the English publications extracted from Nadolny's (2003) article that are analysed in the present study.

written by John Haslam (1764– 1844), an apothecary who had taken medical classes and worked as a doctor and private physician (Rees-Jones 1990: 93–95). Haslam carried out analyses on samples extracted from Westminster Palace, London. In 1800, St. Stephen's Chapel, located in this palace, was renovated in order to provide more space for the new Irish Members of Parliament, who were included after the union of Great Britain and Ireland. During the renovation, the wooden panels from the interior walls of the chapel were removed, and paintings – dating from the fourteenth century– were found behind. Although most of this decoration was lost, John Thomas Smith (1766– 1833), an English engraver and historian who was writing a catalogue about the Westminster buildings at the time of the St. Stephen's Chapel renovations (Smith 1807), took samples from the wall paintings and had them chemically analysed by Haslam. The analysis of pigments and binding medium was performed around 1802 and Haslam sent a letter to Smith reporting his findings (Haslam 1802).

These analyses were most likely based on the samples received from Smith, as the written sources do not inform about any visit paid by the apothecary to St. Stephen´s Chapel. Haslam´s letter includes a brief explanation of his methods: the addition of a reagent or heat to obtain a certain chemical reaction. The results of these reactions - such as colour change, dissolution, precipitation, a specific smell - allowed him to identify the inorganic element that was the main constituent of the pigment. Although chemical reactions are described, the tools used for such work are not included in Haslam´s report, although other English sources from the first half of the nineteenth century could help us to understand the tools that may have been used by Haslam during his experiments.[33] An 1815 report of pigment analysis mentions the use of a blowpipe to increase the application of heat (Davy 1815: 101), and how certain receptacles – a glass tube, a small retort – were used to heat matter in order to observe its reactions (Davy 1815: 113). These tools were commonly used by chemists in Europe; for instance, the blowpipe, previously used by alchemists, became an important analytical tool for chemists from the eighteenth century onwards (Newman 2000).

It is also not possible to determine with certainty whether Haslam´s analyses had been carried out on a macroscopic or microscopic level. The apothecary includes results obtained by visual observation, but still, no tools are mentioned, although other English sources from the early nineteenth century describe the use of magnifying lenses: visual observation of paint samples with the aid of a "strong lens" was included in a pigment analysis report from

[33] See Table 5 (Appendices) for all sources mentioned in the next paragraphs. In addition, Davy and Smithson´s sources are discussed in more detail below.

1824 (Smithson 1824: 116), and close observation of pigment particles with a microscope was described in a text from 1837 (Ure 1837: 301). This difference between the use of a microscope and what seems to be a magnifying glass, may be explained by the thirteen years that elapsed between the two publications. While the microscope held certain popularity among the scientific world in England in the early nineteenth century, it was not until around 1830 that the British merchant Joseph Lister (1786–1869) improved microscopes by reducing the aberrations in their lenses, increasing the quality of the images obtained (Schickore 2007). It is probable then that Haslam performed his analysis in 1802 without the help of a microscope, but could still have used a basic form of magnifying lens.

In his letter, Haslam not only reports on the preservation state of the pigments he analysed, but he also expresses a genuine worry about the physical condition of the wall paintings in St. Stephen's Chapel. Whereas for some paints Haslam only identifies the pigment, for other colours the chemist also mentions the condition in which they were found, whether they were well preserved, or showed signs of deterioration:

> *…red lead, which had wonderfully retained its lustre; white lead, but little altered; and a green, which is a preparation of copper, (in all probability verdigrise). This latter colour, however, had in some parts assumed a blueish appearance, and seems not to have kept so well as the rest. (Haslam 1802: 223)*

Furthermore, the chemist regrets that these wall paintings were being destroyed by new construction work in the building. The following remark shows a deep interest in the preservation of the artworks:

> *…there can be no doubt that every method was employed to preserve these paintings, which must have been regarded as the perfection of the art at that period. It is to be lamented, that at the commencement of the nineteenth century, the coarse hand of the labourer should have violated this monument of regal splendour… (Haslam 1802: 225)*

A second example can be found in an article published in *The Annals of Philosophy* , by James Smithson (c.1765– 1829), an English chemist and mineralogist who reported the analysis performed on a sample extracted from a polychrome bas-relief located in the tomb of King Psammis, Egypt (Smithson 1824). Smithson's article also refers to the preservation of pigments, stating, "I have heard the white of Egyptian paintings extolled for its brilliancy and preservation. I found the present to be neither lead nor gypsum; but carbonate of lime" (Smithson 1824: 116). Smithson highlights the good condition of the Egyptian paintings when he analyses their binding medium: "…what was the glutinous matter which had been so true to its office for no less a period than 3,500 years; for the colours were as firm on the stone as they can ever have been" (Smithson 1824: 116).

Admittedly, some sources show an exclusive interest in pigment and binding medium characterization by the chemists who performed the analyses (Davy 1817; Faraday 1837a; b; Ure 1837; Rokewode 1885). However, a lack of interest in the preservation of antiquities cannot be concluded only by statements – or rather a lack of them – in these written reports, since the format in which the information was delivered also has to be considered. The fact that these texts are mostly letters from the chemists addressed to the antiquarians who requested the analysis, has an influence on the type of information included and the level of detail conveyed in reporting the analysis. It is possible that a chemical report only included the requested information about materials characterization, but any consideration related to the conservation of artworks may have been considered irrelevant for a report. Most of these chemists showed an interest in the conservation of archaeological findings, although it is not expressed in the pigment analysis reports, as discussed in the following section.

How can the removal of samples affect the artwork?

A concern for the physical preservation of artworks is apparent in the process of taking the samples used for the chemical analysis of pigments. As sampling irrevocably changes the object´s material condition, it creates a tension between the wish to cause minimum damage to the artwork while obtaining the maximum amount of information from samples. Studying sources with regard to the size of the samples taken, their points of removal from the artwork, and the quantity of material removed can help us understand to what extent chemists were worried about the conservation of artworks.

In most of the nineteenth-century English sources reporting chemical analysis of pigments, it was not the chemists who performed the sampling, but the antiquarians or archaeologists, as they were usually present at the archaeological sites or in charge of the expeditions (Haslam 1802; Smithson 1824; Faraday 1837b; Wilkinson 1837). Later, they would bring the samples to chemists and ask them to carry out pigment analysis on their behalf. While chemists often did not do the sampling themselves, some reports about scientific analyses of the samples they had previously received reveal shared ethical views. An example is the work performed by the chemist Michael Faraday (1791– 1867) and the members of the committee in charge of the examination of the Elgin Marbles located at the British Museum.

Faraday collaborated extensively with professionals from the art field. He was not only involved in decision-making processes related to the treatment of easel paintings (performing experiments on the protection and deterioration of paintings, for instance) (Brommelle 1956: 184–85), but he also provided advice for the preservation of archaeological objects. The Elgin Marbles – removed from Athens – arrived at the British Museum in 1817, and were moved to new galleries in 1832. The controversies about their status as artworks and their restoration treatments arose even before the marbles arrived at the museum and continued during the nineteenth and twentieth centuries (Jenkins 2001: 1–6). Between 1836 and 1837, a select committee in charge of the examination of the marbles displayed at the museum, worked on these objects. A report on its findings was read by committee member William Richard Hamilton (1777–1859) at the closing ordinary meeting of the session in 1837, and published in 1842 in *Transactions of the Royal Institute of British Architects of London* (Hamilton 1842). As a key member of the committee, Faraday seems to have been the main referent when the committee was examining the condition of the objects to find possible paint residues on their surface: "Dr. Farraday [sic] was of opinion that this circumstance was of itself sufficient to have removed every vestige of color, which might have existed originally on the surface of the marble." (Hamilton 1842: 104)

Faraday was also asked to undertake pigment analysis of samples extracted from the marbles. The publication quotes two brief letters written by Faraday in 1837, in which he reported the results of his chemical analysis performed on the paint samples sent to him. The first one was addressed to one of the members of the committee, the architect Thomas L. Donaldson (1795–1885), from whom he received paint samples extracted from the *Propylea* (Acropolis in Athens) and the *Theseum* (Temple of Hephaestus in Athens). The second letter was addressed to committee member William Richard Hamilton (1777–1859), who had also sent samples to Faraday – extracted from the statues of the Fates – with the aim of identifying possible pigments.

The way Faraday refers to the removed samples in his second letter provides information about their size. When reporting the results of the second group of samples, Faraday calls them "particles", which may give the idea that he had pigment particles in a granular form. However, the chemist adds that the particles "seem to have come from a prepared surface" (Faraday 1837b: 106) and he applies an acid to remove the "adhering matter" and obtain a cleaner sample. This suggests that the samples consisted not only of pigment particles, but of another material, such as adhesive mixed with the pigment or some ground preparation for the marble. Furthermore, Hamilton states that the samples were "peeled off" from the surface (Hamilton 1842: 106), suggesting that these were fragments carefully prised from the surface. Therefore, it is most likely that the samples were pieces – not loose grains –

but that their size was sufficiently small to be called particles; so possibly, the person who removed them tried to minimize the damage to the artwork.

It is still difficult to determine how small these samples were, as to date no samples have been found that survive from this period. Although not from England, certain French and German publications about pigment analysis may provide a reference to compare with Faraday's samples, as they are the few known examples that describe the size of the sample with an objective measuring method. Nadolny (2003: 41) discusses a selection of textual sources from the nineteenth century in which samples were weighed, the smallest one being 0.27 milligrams and the biggest around 4 grams. The latter were reported in German articles about Egyptian and Roman archaeological sites, but in this case the sample did not contain pigment, but plaster instead. The sample weighing 0.27mg was mentioned in a text written by the French archaeologist Benjamin Fillon (1819– 1881), in which the findings relating to a villa and tomb in Saint-Médard-Des-Prés are described (Fillon 1849). Fillon explained that he provided samples to the chemist Michel Eugène Chevreul (1786–1889) for materials characterization and quoted the report written by the chemist. In this report, Chevreul mentioned the weight of the samples as being equivalent to ± 0.27mg.[34] It is important to consider that this is not the weight – and hence the size – of the original sample taken from the archaeological site, as Chevreul describes how he mechanically removed these particles from a larger sample:

> *With great care, but always by mechanical methods, I managed to isolate from this material the yellow grains (…). Although I had only a quantity that did not exceed 0gr005, I could confirm that they were formed of sulfur and arsenic; so they consisted of orpiment.*[35] *(Fillon 1849: 50)*

Although we cannot assume that Faraday's samples were the same size as the ones analysed in Germany or France, it still provides an approximate size range of the samples that chemists were using at that time. Additionally, it was also reported that the pieces

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[34] The weight mentioned by Chevreul is '0gr005' (Fillon 1849: 50). Nadolny recalculates from 'gran' to milligrams as 1 gran=53.1148 mg to obtain the result of the sample weight as 0.27mg (Nadolny 2003: 41).

[35] Translation by the author of this research. Original text: "*Avec beaucoup de soin, mais toujours par des procédés mécaniques, je suis parvenu à isoler de cette matière les grains jaunes (13.3°). Quoique je n'en aie eu qu'une quantité qui n'excédait pas 0gr005, j'ai parfaitement constaté qu'ils étaient formés de soufre et d´arsenic; ils consistaient donc en orpiment*" (Fillon 1849: 50).

were taken using a penknife, which is a sharp precision tool that would allow for the removal of fairly small samples.

The methods and places of removal were also mentioned in Hamilton's report, which states that pieces from the surface were taken "from the back of one of the figures" (Hamilton 1842: 106). While the report offers no explanation as to why pieces were taken from the back side, such an action suggests that the person who performed it was trying to avoid damage to the front of the object, which is the main viewing side for Greek sculpture. Although none of these decisions were made by Faraday himself, he was a member of the committee that examined the marbles. As discussed earlier, he was a main referent when the committee was examining the condition of the objects to find possible paint residues on their surface. Thus, he must have agreed to a certain extent with the methods used by the other committee members.

Another illustrative example is the report written in 1815 by the chemist Humphry Davy (1778– 1829) (Davy 1815). Importantly, this is the only English source from the nineteenth century that has been found to the present date in which the chemist could decide on the sampling process; and it shows a general concern for artworks in the field of archaeology. As part of a Grand Tour around Europe, Davy obtained paint samples from archaeological sites in Rome and Pompeii and performed analyses on them in 1814, while he was still in Rome (Rees-Jones 1990: 97). Davy explained the results of his findings in an article published by the *Royal Society* (Davy 1815). In another article published two years later, the chemist reported the results of analysis carried out on stucco samples from the wall paintings of a Roman house in Sussex (Davy 1817).

Both publications were authored by Davy himself and not quoted in someone else's text, as was the case in most of the other sources. While his later publication only reported the results of the analysis – as it is a letter conveying the results to the person who requested them – his first publication was an article driven by his own interest. In this text, he highlights how he had been able to take the samples himself: "I have been enabled to select, with my own hands, specimens of the different pigments" (Davy 1815: 100). Furthermore, he proudly described the sampling process, how he removed extremely small pieces of paint from places where the loss remained unnoticed:

> *When the preservation of a work of art was concerned, I made my researches upon mere atoms of the colour, taken from a place where the loss was imperceptible: and without having injured any of the precious remains of antiquity…. (Davy 1815: 100)*

Davy's intention of avoiding further damage to the artworks was clearly stated, and his sensibility and attitude towards the conservation of "the precious remains of antiquity" are evident from this text.

In conclusion, the above-mentioned examples document the ethical considerations and interests of nineteenth-century chemists, who became increasingly engaged in aspects related to the treatments of polychrome surfaces and who also became involved in the archaeological field. Chemical analyses of pigments were carried out on samples taken from objects and wall paintings from archaeological or historical contexts and nineteenth-century English reports about these analyses show that there were ethical concerns for the physical preservation of artworks. Although the main goal of the reports about chemical analysis was the identification of pigments, chemists also showed an interest in the conservation of the artworks from which the samples were taken. The decision-making processes involved in the act of taking paint samples for the chemical examination of pigments and binding media indicate that chemists had an attitude of respect towards the physical integrity of objects and wall paintings, shared with those who were in charge of those artworks, by minimizing damage to the objects.

The following case study shows a different way in which science assisted in decision-making processes related to the care of art collections that similarly involved collaboration between chemists and museum workers. Moving forward to the second half of the nineteenth century, this example focuses on preventive measures carried out in the National Gallery (NG) in London and illustrates how the advice and assistance provided by chemists in the 1850s can be found as common practice in the second half of the century by the Keeper of the NG.

3. *The Turner drawings and a Keeper´s diary: Preventive conservation[36] in the National Gallery London in the second half of the nineteenth century [37]*

Certain procedures for the preservation of objects (such as dusting, covering objects to avoid dirt, etc.) have been practiced for centuries as standard housekeeping routines (Staniforth 2013). According to Simon Lambert (2010: 2), the guide to museums and galleries *Museographia* (Neickel 1727) written by the German scholar Caspar F. Neickel[38] offered guidelines to avoid moisture and insect pests in 1727. In Venice, a city with several threats due to its specific climate and location, the restorer Pietro Edwards (1746-1821) provided advice and solutions to problems related to the preservation of paintings (Darrow 2017: 310–11). Textual sources also show that the effect of the environment on paintings - such as temperature, light and pollution - was considered throughout the nineteenth century (Boothroyd Brooks 1999: 10). In Florence, Ulisse Forni (1814–1867) published his *Manuale del pittore restauratore* in 1866. As highlighted by Giorgio Bonsanti (2016: 975), Forni´s manual includes a chapter titled "About the suitable places for the conservation of the paintings, and the means that contribute to reducing their deterioration"[39], where issues about preventive measures related to artworks were raised (Forni 1866: 466–70).

In the National Gallery in London, comments about the existent pollution affecting the collection were reported in sources dating as early as 1839 (Saunders 2000: 77). The new building, which was created to display the gallery paintings collection, had opened a year

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[36] Preventive conservation is nowadays understood as "…all measures and actions aimed at avoiding and minimizing future deterioration or loss. They are carried out within the context or on the surroundings of an item, but more often a group of items, whatever their age and condition. These measures and actions are indirect – they do not interfere with the materials and structures of the items. They do not modify their appearance" (ICOM-CC 2008).

[37] Part of this section was previously published as: Pinto, Mariana. 2021. "The Turner Drawings and a Keeper's Diary: Preventive Conservation in the National Gallery, London in the Second Half of the Nineteenth Century". *History of Humanities*, Volume 6, Number 1.

[38] Caspar Neickel was a pseudonym, his real name was Kaspar Friedrich Jenequel (Lewis 1999) or Jencquel. On *Museographia*´s title page, his name is mentioned as C.F. Neickelio (Neickel 1727).

[39] Translation by the author of this research. Original text: "*Capitolo LXXVII: Delle località opportune alla conservazione dei quadri, e dei mezzi che concorrono ad allontanarne il deperimento*" (Forni 1866: 466).

earlier - in 1838- and was located in Trafalgar Square, London (The National Gallery 2020a), where it remains today. The levels of air pollution in this central area of the city were high (Saunders 2000: 77) and during the mid-nineteenth century, preventive measures became a documented institutional concern in the gallery: between 1845 and 1857 debates about the influence of the environment on artworks took place at different levels of the organisation, actions were openly debated and several reports were written.

The findings and methods included in these reports are among the earliest recorded discussions about preventive measures. The mid-nineteenth century in the NG, London is considered as one of the key moments of the early history of preventive conservation in museums and scholars have celebrated the evidential value of these reports for the rising impact of science upon conservation practice (Brommelle 1956; Boothroyd Brooks 1999, 2001). A key figure during this period was Sir Charles Lock Eastlake (1793–1865), the Keeper of the NG from 1843 to 1847, who became one of the Trustees in 1850 and was the first director of the gallery from 1855 to 1865 (The National Gallery 2020b; c).

After 1857 and during the second part of the nineteenth century, a decrease in the number of commissioned reports related to environmental issues at the NG, can be observed. Some scholars have taken this to represent a decline in institutional interest about preventive measures. Norman Brommelle claims that there was “little to interest the historian of conservation in the years after the 1853 Enquiry”, and he adds that “Conditions in the Gallery by 1860 had shown no spectacular improvements” in terms of space, number of visitors and air quality (Brommelle 1956: 185). The author is also critical regarding Eastlake´s directorship, as he comments that “his chief concern in the period that followed his appointment as Director in 1855 was the building up of the collection rather than the problems of conservation.” (Brommelle 1956: 178). Garry Thomson (1970: 137) takes this argument further and states that the late nineteenth and early twentieth centuries can be considered as “dark ages” due to a lack of interest by the institutions to adopt preventive measures. According to Thomson, this can be explained by a growing interest in the architecture and public comfort above environmental considerations. Thomson's "dark ages” of preventive conservation metaphor has been repeated in the historiography: Lambert agrees with Thomson that this period of acknowledgement about the benefits of preventive measures was already over by 1860, when “the visitors´ comfort would take precedence over conservation” (Lambert 2014: 3).

However, archival evidence exists that testifies to an ongoing interest in preventive measures at the NG and other institutions from 1857 to 1900, and secondary literature shows that the effects of the environment on paintings discussed during the mid-nineteenth century remained as a genuine concern during the second half of the century

(Boothroyd Brooks 1999: 10–32, 2001). A report was written in 1859 to discuss the safety of illuminating galleries by gas (Faraday *et al.* 1859); and in 1888, another publication was issued in which the action of light on watercolours was examined (Russell & Abney 1888). Geoffrey Swinney (2003) describes the debate about artificial lighting in museums and galleries and its effects on the artworks that took place throughout the second half of the nineteenth century in London. The Trustees of the NG resisted the idea of artificial gas lighting; one of the reasons was related to preventive measures, namely the effects of combustion products from gas lighting on paintings. Although one section of the NG collection was temporarily located in South Kensington Museum (SKM) and illuminated by gas, the Trustees resisted against pressure to follow suit in Trafalgar Square, and a “Commission on the Heating, Lighting and Ventilation of the South Kensington Museum” was created in 1869 to further investigate this topic (Costaras 2017: 18).

Admittedly, the high levels of pollution in the gallery did not improve as quickly as expected during the late nineteenth century. David Saunders (2000) points out the dilemma faced by the NG due to the lack of a system to filter the air from the city: the gallery could only close its skylights to avoid the introduction of pollutants, but this option meant the paintings suffered from poor ventilation and overheated rooms. Although the issues related to air quality remained unsolved until the twentieth century, this cannot be understood as a lack of interest on the part of the gallery staff. Saunders demonstrates how the effects of pollution on paintings was a serious point to consider during the second half of the century, to the extent that certain artworks were not displayed to avoid irreversible damage (Saunders 2000: 81). Eastlake´s worries about the effects of pollution on paintings during his keepership and later as the director of the NG, have also been documented by Susanna Avery-Quash (2015).

To summarise, secondary literature shows how preventive measures discussed in the mid-nineteenth century reports remained real concerns during the second half of the century. Yet, it is important to determine to what extent these worries were translated into practice to help us understand how preventive conservation took place in the late nineteenth century. The notes taken by the Keeper of the NG Nicholson Wornum in his personal diary about preventive measures focused on the care of the drawings by the British painter William Turner (1775-1851), serve as a fruitful case study, as they provide insight into a common practice that was carried out in the gallery which would otherwise remain invisible in other types of source, such as official reports.

In 1856 the Trustees of the NG received the donation of a large number of artworks created by Turner, but the care and safety of the drawings became a challenging goal when signs of deterioration were found on them. Interestingly, Wornum´s personal diary not only shows a detailed report of his observations -related for instance, to temperature control and air quality-; the keeper´s notes also offer a thorough description of the actions taken with the purpose of reducing or avoiding further deterioration of the artworks. Based on the notes taken by Wornum in his personal diary about the care of the Turner drawings, I argue that certain methods discussed in the mid-nineteenth century reports can be observed as common practice in preventive measures carried out in the second half of the century in the National Gallery, London.

The mid-nineteenth century reports at the National Gallery, London

The discussions about the influence of the environment on the NG collection not only took place within the institution, similar debates also occurred among the general public. An early attempt to gain the involvement of the public can be observed in an article published by *The Athenæum* in June 1845. The article referred to a letter written a month earlier to Prime Minister Sir Robert Peel (1788–1850) by Eastlake. In this letter, Eastlake reported his doubts about the suitability of the current NG building in London, citing environmental issues such as poor ventilation of the rooms and the heating system (Eastlake 1845). After Eastlake´s letter, *The Athenæum* tried to promote public awareness by claiming: “We are sure that the public are ready to concur in the verdict, ‘that the time is arrived when a more capacious and suitable building is necessary for the purposes of a National Gallery’. It had arrived, indeed, long ago. We may now rejoice that the conviction has reached the proper authorities” (The Athenæum 1845: 571). Public discussions about the NG’s management became even more evident during the period from 1847 to 1855, to the point that these years were described by a more recent director of the gallery as:

> *…a period when there was an extremely lively public debate in parliament, in books and in periodicals as to how the National Gallery should operate, who its audience should be, and where it should be located. This was the period when ideas and beliefs about the National Gallery changed from it being treated as a gentleman´s club to a much broader and more democratic set of beliefs about its audience… (Saumarez Smith 2009: 61)*

In this context, several reports[40] were written between 1845 and 1857, investigating possible environmental causes for the deterioration of paintings in the NG collection: By May 1845 Eastlake had already raised certain concerns regarding the characteristics of the NG building in London and the need to improve the environment to reduce or avoid damage to the collection. In his report "The National Gallery: Observations on the unfitness of the present building for its purpose" he points out the risks of temperature fluctuations in the rooms: a heating system, which provided warmth unevenly, was considered to be potentially unsafe for the paintings' varnish (Eastlake 1845: 19). Pollution was another topic raised by Eastlake, who acknowledged the building location in the city centre as beneficial for its accessibility, but found it disadvantageous in terms of air quality in the surroundings (Eastlake 1845: 20–21). The effects of polluted air generated by London on paintings was an issue broached by Eastlake on further occasions (Eastlake 1847: 2), although problems with polluted environments were not only limited to the NG building or to London: in the eighteenth and nineteenth centuries, the collection of the Ashmolean museum in Oxford suffered from "An uncontrolled environment, coupled with pollution produced by the open coal fires used to heat the museum…" (Norman 2020: 4).

Certain rooms of the NG building were also mentioned by Eastlake as too small and crowded, exposing the paintings to "…a confined space, at once to a moist atmosphere and to clouds of dust" (Eastlake 1845: 4). Generally, the overall size of the building, considered to be insufficient for the collection, was an important point highlighted by Eastlake. To discuss such issues, the House of Commons selected a committee "to consider the best mode of providing additional room for works of art given to the public or purchased by means of parliamentary grants" (Select Committee 1848: 2). In a report finished on 1 September 1848, the select committee concluded that it was in the gallery´s best interests to remain at its current location, while enlargement of the building was suggested.

Moreover, the role that science played during this period is exemplified in this early report from 1845 in which Eastlake recommends asking for the assistance of a chemist when making decisions about the treatments of artworks: "In connection with the necessary labours of cleaning and restoring pictures, I would beg leave to suggest the expediency of allowing those who may undertake or superintend such operations, to put themselves in communication with some experienced chemists, who might be directed to render assistance when required" (Eastlake 1845: 18). Interestingly, science was already important

[40] See Table 6 (Appendices) for a summary of the mid-nineteenth century reports described in this section.

for Eastlake in terms of assisting and advising during decision-making processes concerning the treatment of artworks.

In May 1850, Eastlake, the chemist Michael Faraday (1791-1867) and the painter William Russell (1880 - 1969) wrote a report in which these three men from different backgrounds collaborated to study the possibility of covering paintings with glass to protect them from further deterioration (Eastlake *et al.* 1850a). This report includes observations about relative humidity, temperature, pollution and dust related to the NG environment, as well as notes about display methods for the paintings. The authors also elaborated a questionnaire about collections in different museums and galleries in France, The Netherlands, Italy, Germany, Belgium and Austria. This questionnaire included fifteen questions related to the galleries, their collections and condition, such as the location of the gallery and ambient levels of pollution, the composition of the walls on which the pictures were hung, materials and care of the paintings, the number of visitors attending, and heating, ventilation and lighting systems. A few questions also focussed specifically on the condition of paintings covered with glass, including the type of glass used and how close the glass was fixed to the paintings. The answers to this survey were included in a further report written six months later by the same authors (Eastlake *et al.* 1850b). Indeed, discussions about protecting artworks from uncontrolled environments also took place in other galleries and museums: the SKM decided to protect its artworks by glazing and backing in the late 1850s and the Portrait Gallery, London began glazing its paintings in 1866 (Simon 2018: 4–5).

Also in 1850, a report was ordered by the House of Commons in order to “consider the present Accommodation afforded by the National Gallery; and the best mode of Preserving and Exhibiting to the Public, Works of Art given to the Nation, or Purchased by Parliamentary Grants” (Select Committee 1850). Three years later, another Select Committee was appointed by the House of Commons to inquire again into the management of the NG and the best ways to preserve and exhibit the collection (Select Committee 1853). This report is divided into four sections, of which the second concerns “The Management of the Gallery, as specially connected with Picture Cleaning”. At the end of this section and under the subtitle “Precautions suggested for the future”, preventive measures were suggested for future care and maintenance, such as lighting conditions and display methods to avoid dust settling on the artworks. Although neither Eastlake nor Faraday were part of the Select Committees, they were greatly involved in both reports, as they were not only asked for advice, but were also witnesses (Robertson 1978: 289–91): together with other museum staff and external workers, they were interviewed about various topics related to conservation treatments and preventive measures.

In 1857 another report was presented to the Houses of Parliament to determine "the site of the new National Gallery, and to report on the desirableness of combining with it the Fine Art and Archaeological collections of the British Museum" (Broughton *et al.* 1857: i). A new location away from the city centre was being considered to avoid pollution within the gallery and to reduce deterioration of the collection. The report was delivered by the five Commissioners - Faraday was one of them - who stated that there was no decisive evidence to justify the relocation of the NG:

> *…we devoted several meetings to the consideration of the effects of the metropolitan atmosphere on pictures and works of art; and we agreed to the following resolution: "The evidence hitherto adduced, considered collectively, does not lead to any decisive conclusion against placing the new National Gallery within the metropolis."* (Broughton *et al.* 1857: iii)

This conclusion was mainly based on the great diversity of opinions found on the subject and the contradictory remarks mentioned in the earlier reports from 1848 and 1850. The commissioners judged that there was no better option for the NG than the building in Trafalgar Square and they observed that "atmospheric impurities" could be addressed by additional care and by protecting the paintings with glass (Broughton *et al.* 1857: vi).

These attempts to control the environment and prevent or reduce further deterioration of the artworks (especially to avoid blackening by pollution) were most likely motivated by an interest to reduce more interventive treatments. Sources from the mid-nineteenth century show this concern about treatments and an incipient interest in reducing surface cleaning by controlling the environment. For instance, in a report from May 1850, the authors mention the methods for cleaning darkened paintings by moistening their surface and rubbing with a handkerchief as not being completely safe, especially for deteriorated surfaces: "…this mode of restoring brilliancy to the picture is only applicable where the sound condition of the surface will allow it" (Eastlake *et al.* 1850a: 2). A great awareness of how a treatment may not be fully effective once the object had already deteriorated, can be observed when it is mentioned that treatment "would not remedy any change which may be produced in the way of discoloration or otherwise by the action on the varnish of the various emanation which have been referred to" (Eastlake *et al.* 1850a: 2). Moreover, when the 1853 report distinguishes between occasional cleaning (similar to what we would understand nowadays as removal of surface dust and grime) and picture cleaning, it is mentioned that occasional cleaning operations are "yet important, inasmuch as due attention to them tends to the preservation of pictures, and may obviate the necessity of cleaning in the larger sense of the word" (Select Committee 1853: viii).

The need to reduce more interventive treatments on artworks was a consequence of the cleaning controversies: the cleaning methods performed on the gallery paintings were also being openly debated at the time. Discussions about the type and extent of cleaning treatments on paintings were not a new phenomenon (Bomford & Leonard 2004: 425–548); they had already taken place in the sixteenth and seventeenth centuries (Anderson 2004: 442). However, they became a matter of public debate only from the eighteenth century, the Louvre being one of its most prominent examples (Hendy 1947: xviii; Massing 2016). At the NG, the controversy started with a letter sent by Morris Moore that was published in the *Times* on 29th October 1846, under the pseudonym "Verax". Moore was an artist and picture dealer who sent several letters in which he criticized the outcome of the cleaning of paintings under Eastlake´s instructions (Hendy 1947: xiii–xix; Daley 1993; Anderson 2004: 443).

The influence of Eastlake´s controversial actions related to the cleaning controversies in the mid-nineteenth century has been extensively studied, as he became the target of accusations about the methods and extent of cleaning treatments carried out on paintings at the NG (Avery-Quash 2015). Yet, accusations about the outcome of the cleaning treatments and the way in which the appearance of such paintings was understood, seem to have been influenced by jealousy or rivalry (Keck 1984; Anderson 2004: 442), and to a certain extent the controversies arising from them are also believed to have been politically motivated (Brommelle 1956: 176–77). Eastlake is considered a fundamental influence in the context of conservation in the mid-nineteenth century (Brommelle 1956; Thomson 1970; Boothroyd Brooks 1999, 2001; Saunders 2000; Swinney 2003; Nadolny 2005; Lambert 2014; Simon 2017, 2018). The first director of the gallery was also engaged in the investigation of more passive treatments on artworks and participated in the production of reports published during the mid-nineteenth century about preventive measures. A few years later, Eastlake also became involved in the discussions about preventive measures related to the Turner drawings.

Donation and care of the Turner drawings

After the death of the British painter William Turner in 1851, many of his paintings, sketches and watercolours were donated to the nation. Although most of this collection is nowadays in the Tate Britain, it was initially handed over to the Trustees of the NG in 1856 (Board of Trustees 1871: 60). Due to a lack of space at the Trafalgar Square site, some artworks were temporarily exhibited in Marlborough House and the SKM, but eventually returned to the NG, where they remained until they were transferred to the Tate Gallery in the early twentieth century (The National Gallery 2019).

During a meeting on 17th November 1856, the Trustees of the NG approved an initiative proposed by Eastlake - then Director - in which he suggested the appointment of a committee to consult on topics related to the Turner collection and its exhibition. The committee was formed by the art collector Hugh Andrew Johnstone Munro of Novar (1797-1864) and the artists Clarkson Stanfield (1793-1867) and David Roberts (1796-1864). The art critic John Ruskin (1819-1900), who was also a watercolourist and great admirer of Turner (Hewison *et al.* 2000), was considered as an advisor for the exhibition of the drawings (Board of Trustees 1871: 60). Ruskin had maintained an ambivalent attitude towards the management of the NG in the past and although he was considered as an advisor, he was not part of the committee (Avery-Quash 2020). The main issues to address at that moment seem to have been how and where the collection was to be exhibited.

In the case of the drawings, preservation of their supports and colours became the first main issue to consider. Already a month after the NG had received the Turner collection, the safety of the drawings was a matter of discussion among the Trustees and the Director. A meeting with the Turner Committee took place in the gallery on the 5th December 1856, with Russell (as one of the Trustees), Eastlake and the Secretary of the NG also present. The issue related to the safety of the coloured drawings was addressed immediately; the concern was the fading of the drawings due to the effects of light: “It was understood that it might subsequently be a question whether certain of the drawings, could, with safety, be permanently exposed to light. But the exhibition even of such specimens, at present, during the winter months, and in a situation not exposed to the sun, did not appear to be objectionable” (Board of Trustees 1871: 64).

Even though the board considered the exhibition of the drawings as safe by the end of 1856, the following year Eastlake suggested that “As such drawings cannot be permanently exposed to the light without injury, I beg to recommend that they should ultimately be deposited in cases, to as to be excluded from light and dust, according to a plan proposed by Mr Ruskin: they could then be re-exhibited occasionally” (Board of Trustees 1871: 77). The measure was presented by Ruskin, who proposed a method of framing the drawings including a cover with glass, which would reduce the influence of the sunlight on the artworks. In the minutes of June 1857, Eastlake recommended that

> *… the plan proposed and exemplified by Mr Ruskin, for preserving from the effects of light, and at the same time affording the means of conveniently inspecting the Turner drawings, be adopted for all the coloured drawings by Turner which might be deemed sufficiently finished, and which from their moderate dimensions would admit of being so framed.* (Board of Trustees 1871: 88–89)

The option of covering paintings with glass or enclosing artworks in a display case had already been considered when Eastlake, Russell and Faraday worked together on the reports of 1850 (Eastlake *et al.* 1850a; b). At that time, they carried out systematic observation of paintings without protection and those that had been covered. This committee also considered the benefits of covering more artworks with glass and the possible damage that this method could cause. The authors concluded that the artworks with protection were better preserved compared with those that had been hung without glass. Thus, during the second half of the century, the practice of glazing paintings in the NG became common (Boothroyd Brooks 2001: 21).

Five months after Ruskin proposed his method, Wornum reported that “The finished Turner drawings, withdrawn from exhibition will shortly be framed and secured in close cases, on the plan proposed and exemplified by Mr Ruskin, and approved by the Trustees at the meeting held on the 22nd of June last.” (Board of Trustees 1871: 120). However, problems with the conservation of the collection and its deterioration arose, creating new challenges for the NG staff.

Environmental measures at the NG in the second half of the century

While the Gallery was closed during a holiday break in 1858 (between 11th September and 25th October) the Keeper found condensation inside the display cases of the Turner drawings. This information is reported in the diary entries that Wornum made throughout the years he worked as Keeper of the Gallery. In November he writes:

> *A moisture appears to have come from the mounts and settled on the glass inside, the outside glasses were also moist, condensed from the atmosphere of the cases. Being so well closed in their cases they could not get dry. (Wornum 1877)*

Eastlake and Wornum knew high levels of humidity and condensation to be a threat. All the reports from 1850 and 1853 refer to this danger. For instance, in May 1850, Russell, Faraday and Eastlake undertook an exhaustive inspection of the building: “It appears to us that the building itself contains no element of danger to the pictures: the walls seem to be perfectly dry, and the boarding upon them is well calculated to prevent any transmission of damp to the pictures” (Eastlake *et al.* 1850a: 1). Also two months later, Eastlake showed knowledge of the topic when he explained to the Select Committee of the NG that “the moisture of the atmosphere is soonest condensed on the coldest surface, and when the surface is once damp, it attracts any floating dust” (Select Committee 1850: 30–31).

In the case of the Turner drawings, as soon as Wornum found mildew, the artworks were "all taken out of their frames, and the frames and glasses were thoroughly cleaned" (Board of Trustees 1871: 146). Yet, the Keeper did not stop here with his preventive measures at this stage, but over the coming years he went on to undertake a systematic survey of the condition of the drawings and frames. He carried out regular preventive inspections of the drawings, at least once a year from 1861[41], when he first found mildew on one of the paper sheets; visual monitoring being an essential aspect of his approach. In most cases, the inspections also included cleaning of the frames. Each time he described the procedure himself in simple terms: taking the drawings out of their frames and cleaning the inside of the glass (Board of Trustees 1871: 297).

Moreover, Wornum made methodical annotations in his diary about the condition of the Turner drawings and he informed the board of Trustees of the NG of any changes. In December 1861, he reported for the first time having found signs of mildew on one of the drawings "causing some slight discolorations in the paper" (Board of Trustees 1871: 279). From that time on, the Keeper continued with his systematic observations and annotations. In November 1863 he reports the presence of "pale spots" on some of the chalk drawings on brown paper and adds that "The mildew is confined to a few mounted drawings, framed and unframed" (Board of Trustees 1871: 315). In 1864, Wornum carries out two examinations, and in February he finds "mildew on thirty six framed drawings and sketches [...]; on several coloured-paper drawings, in parcels; and on a very few white-paper drawings; but on no unmounted drawing whatever" (Board of Trustees 1871: 341).

Interestingly, by the end of 1865 the situation had improved, as Wornum's annotations record the presence of only one spot (Board of Trustees 1871: 374). The next year, his report shows the absence of mildew (Board of Trustees 1871: 386), and the following year the Keeper finds very few spots in only two instances (Board of Trustees 1871: 421, 439). The reason this change occurred in 1865 is because Wornum took into account the influence of the environment as a possible cause for the presence of mildew and implemented measures to prevent condensation. For instance, in January the Keeper observes that "The room on the other side is as thoroughly warm and dry as this room is; a fire is however kept up constantly during six months in the year" and he adds that "Every

[41] The minutes of the NG board meetings show that Wornum reported having checked the condition of the drawings between September and October 1858, when he initially found condensation. He carried out further examinations in December 1861, December 1862, November 1863, February and November 1864, November 1865, December 1866, February and December 1868 (Board of Trustees 1871: 279, 297, 315, 341, 374, 386, 421, 439).

box and case, as well as the drawings sketches singly or in small parcels, was thoroughly aired, the cases being left open and the fire being kept up during the nights and on Sunday, rendering [?] the presence of damp, then and subsequently (with the subsequent precautions) at least highly improbable if not impossible" (Board of Trustees 1871: 341). According to Wornum, the situation had improved considerably by December, as he was enthusiastic enough to claim "the mildew which I have previously reported to have been observed appears to be now conquered", and he mentions the environmental conditions surrounding the Turner drawings again: "The room in which they are placed for the present, is thoroughly well aired, and during half the year, a fire is kept burning in the room, six days of the week" (Board of Trustees 1871: 374).

Although it is not possible to confirm by Wornum´s diary notes alone that the condition of the Turner drawings had indeed improved, the analysis of his methods is still relevant, as they show an approach that informs us about his knowledge of the mid-nineteenth century discussions related to preventive measures and how it became common practice in the second half of the century. For instance, concerns and observations regarding the control of temperature and adequate ventilation had been documented already in the reports from the mid-nineteenth century. The keeper seems to take all these observations into consideration when he develops a method to deal with environmental issues, as his approach is similar to the investigations undertaken in the mid-nineteenth-century reports.

For example, the examination of the room that Wornum carried out resembles the investigation performed by Faraday in collaboration with Eastlake and Russell, in which they also examined the conditions of the building with respect to temperature. Just as Wornum did, the authors of the 1850 report checked the temperature of the gallery: "Without pronouncing an opinion as to whether the system of warming is perfect or complete, we do not think that there is any such imperfection in the mode of regulating the temperature of the rooms as to endanger the pictures" (Eastlake *et al.* 1850a: 1). Moreover, in the report from July 1850, the Select Committee asked Gustav Frederick Waagen (1794–1868), the Director of the Royal Gallery at Berlin, about the condition of their collection in Germany, and the Director cites the temperature as the main cause for the good conservation of the varnishes on their paintings. When the Committee asks Waagen "- Are any of the pictures in the Gallery of Berlin covered with glass?", the Director responds

> *- Not one, because we maintain a moderate temperature. I should say that we varnished the pictures about 25 years ago, and there are, perhaps, not more than 40 or 50 of them that want a new coat of varnish, and that is owing to the good effect of the moderate temperature.* (Select Committee 1850: 37)

Furthermore, proper ventilation of the rooms - another issue considered by Wornum - had also been frequently discussed in the reports from the mid-nineteenth century. An illustrative example can be found in the report from June 1850, when the Select Committee also asked Waagen about the ventilation methods used in the German gallery: “- In what way do you ventilate the Gallery; have you any openings in the ceiling for ventilation?” The Director´s answer seems slightly evasive, without providing much detail, so the Committee asks again “- Are the Committee to understand you, that you have no artificial means of ventilating the rooms?” When Waagen confirms that no ventilation system is used in their gallery, the Committee insists for the third time: “- And your rooms are not so crowded as ever to require it?” The Director then confirms that only a few days in the year is this required and they open the windows afterwards (Select Committee 1850: 39).

Thus, the observations and methods mentioned in the mid-nineteenth century reports include information about regulating the temperature of the environment to avoid or reduce further damage to artworks. These texts also mention close control over the relative humidity present in the surroundings. Proper ventilation of the rooms and avoiding severe fluctuation of temperature and humidity are also recommended. The archival evidence discussed above shows that the legacy of the 1850s reports can be observed during the second half of the century when the earlier recommendations became part of common practice in preventive measures carried out by those in charge of the NG collection.

4. *Conclusions*

During the first years of the establishment of the British Museum Laboratory (1919-1931) chemists and restorers worked together, valuing each other´s expertise. The collaborations took place in a working environment where science served to advise and assist on a regular basis when decisions about the care and treatment of works of art were made. Indeed, the first director of the BM Laboratory, Alexander Scott, explicitly advocated for permanent collaborative decision-making processes as a strategy to gain a permanent status for the laboratory in the early twentieth century.

Incidental joint efforts between chemists and the people in charge of art collections can be traced back to the nineteenth century: this chapter has shown that Scott´s actions were not unprecedented in the history of collaboration between art and science. On the contrary, the chemist could draw on these earlier examples, which demonstrate that such collaborations had already developed gradually for decades, not only at the BM, but also in other institutions and by other individuals.

In the following chapter, I explore if Scott used further strategies to advocate for the permanency of the BM Laboratory and whether and how those have affected conservation practices.

(Illustration next page: Letter to the Department of Scientific and Industrial Research, by Lorymer J. Edkins. 1923. Courtesy of the British Museum.)

12 Southfield Road,
Cotham,
Bristol, 28/2/23.

The Dep.^t of
Scientific Research,
British Museum,
London.

Dear Sirs,

I have read with interest in daily paper of reports published on the cleaning & restoration of Museum exhibits.

I understand that two reports have been issued in connection with this, & shall be much obliged if you could inform me where the reports can be obtained.

Yours faithfully,
Lorymer J. Edkins

Chapter 3

Secrecy and openness in report writing in the British Museum Laboratory

1. Introduction

The change of status of the British Museum (BM) Laboratory from a temporary aid to a permanent department within the museum took place during the 1920s. Chapter 1 examined this change, arguing that the emphasis that the first director of the BM Laboratory, the Scottish chemist Dr Alexander Scott (1853–1947), laid on collaboration between chemists and those in charge of the care and treatment of museum collections was of vital importance for the BM Laboratory to develop from temporary to permanent. The annual reports written from 1919 to 1931 by the director of the laboratory, were not only one of the initial requirements of the Treasury Chambers, but were also used as strategic documents by Scott to advocate for the permanent status of the laboratory. Importantly, another condition requested by the Treasury Chambers prior to the creation of the laboratory was that "…all the results of the investigations must be communicated freely to those in authority at other national collections" (Barstow 1920). This chapter shows that from the very beginning Scott adopted an open attitude to sharing procedures followed for conservation treatments and analyses. Not only was publication one of the requirements established during the creation of the laboratory, but Scott agreed that by being open with the procedures used, treatments became safer for the objects. This attitude also served his goal of achieving a permanent status for the BM Laboratory.

One of the first steps that Scott considered when creating the laboratory was fighting the secrecy of information that most restorers practiced. Scott and Plenderleith´s open position on publication of conservation treatments was clear from the early years of the establishment of the BM Laboratory, and this attitude remained constant over time. The concept of openness here, follows the definition by Pamela Long (2001: 5), who describes it as "…the relative degree of freedom given to the dissemination of information or knowledge" entailing "…accessibility or lack of restrictiveness with regard to communication." As Long (2001: 1) states, by the fifteenth century, artisans passed on their knowledge mostly through a master/apprenticeship system. As craftsman-type workers, restorers learned in a similar way.[42] Although in London the power of guilds had diminished by the eighteenth century as a result of the expansion of markets and rapid urbanization (Stewart 2005: 394), secrecy about artwork treatments remained the norm for restorers until the twentieth century. For instance, when discussing the work of the Italian restorer Pietro Edwards (1746-1821), Elizabeth Darrow points out that "Edwards´s reticence to

[42] See Chapter 4 for further discussion of the training of restorers.

describe his procedure on a specific painting is in line with the secrecy that still surrounds institutional records of conservation history and practice" (Darrow 2017: 310). In addition, Esther Van Duijn and Mireille te Marvelde have highlighted how "…restoration documentation was unusual during the nineteenth century" and added that "Only in the twentieth century did the importance of recording conservation treatment become apparant [sic]…" (van Duijn & te Marvelde 2016: 816–17).

Despite this secrecy surrounding restoration practices in the past, written records discussing the care and treatment of artworks were created long before the establishment of museum laboratories. These records were not treatment reports as we understand them today in conservation practice, yet they show different ways to describe technical information and discuss treatments of artworks by those who considered themselves experts on the subject. The texts were produced in various formats, such as handwritten recipe compilations, manuals or papers, and contain a wide range of information, as they were aimed at different audiences.

One of the earliest examples of technical issues related to the treatment of paintings can be found in a manuscript (MS Sloane 2052) written and compiled by the Genevan-born physician Theodore De Mayerne (1573-1654/55). As explained by Ulrike Kern (2015), this so-called "Mayerne Manuscript" includes 170 folios of different sizes and written with different inks and hands, which were bound together after De Mayerne´s death (De Mayerne 1620). Thus, it is not possible to know whether these writings were originally conceived as a manual. The manuscript includes experiments with inks and pigments, as well as instructions and observations on treatments for the cleaning of paintings (Kern 2015: 700). It indicates the enthusiasm of De Mayerne for restoration practices and other technical issues about paintings, but there is no archival evidence that the person who bound the manuscript after De Mayerne´s death intended to share the information with a wide audience (Boulboullé 2019).

According to Giorgio Bonsanti (2016: 969), the first European manual about conservation was written by the German painter and restorer Christian Koester (1784-1851) in 1827, with the original title *Über Restauration alter Ölgemälde* [About restoration of old oil paintings].[43] The book was edited again one year later, for the third time in 1830, and also translated into Italian (Bonsanti 2016: 969 footnote 12). Bonsanti (2016: 968) also states that Giuseppe Bedotti was the author of the first conservation manual written by an Italian. It was published in 1837 in Paris with the original name in French: *De la restauration des*

[43] Unless stated otherwise, the translations from the original titles have been made by the author of this dissertation.

tableaux. Traité spécialsur la meilleure manière de rentoiler, nettoyer et restaurer le tableaux anciens et modernes [About restoration of paintings. Special treatise on the best way of re-lining, cleaning and restoring old and modern paintings] (Bonsanti 2016: 968 footnote 3).

Almost three decades later, in 1866, the restorers Ulisse Forni (1814-1867) and Giovanni Secco Suardo (1798-1873) published two manuals about the restoration of paintings, which are cited by Bonsanti (2016: 973) as highly important texts in the history of conservation in Italy: *Manuale del Pittore Restauratore* (Forni 1866) [Manual of the painter-restorer] and *Manuale ragionato per la parte meccanica dell'arte del ristauratore dei dipinti* (Secco-Suardo 1866) [Manual raisonné for the mechanical part of the art of the paintings restorer]. According to Forni, his manual was intended for artists intending to become restorers: "Quindi mi crederei assai fortunato se la esposizione sincera di queste mie tecniche e pratiche rivelazioni potesse […] recare qualche poco di lume a quiei giuvani artisti i quali all´ esercizio del resturo bramassero dedicarsi." (Forni 1866: 4) [So I would consider myself very lucky if the sincere exposition of my techniques and practical revelations could [...] bring some light to those young artists who long to devote themselves to the exercise of restoration.] Secco-Suardo´s manual states a similar intention, to unveil the secrets of restoration to provide a guide for those who wanted to dedicate their lives to it: "*Scopo adunque dal mio lavoro non è di dare un´opera compita, ma unicamente di alzare il primo lembo di quel velo fatale, che fino ed ora mantenne nel buio la nobil´arte, e porgere a chi vi si voglia dedicare una guida per dirigere le proprie ricerche.*" (Secco-Suardo 1866: 20) [Therefore, the purpose of my work is not to offer a complete work, but to lift the first edge of that fatal veil, which until now has kept the noble art in the dark, and to offer to those who want to dedicate [to restoration] a guide to develop their own research.]

Many years after the establishment of the BM Laboratory, Plenderleith himself wrote a book about restoration practices, with the first edition published in 1956. The preface states that it was intended for collectors, archaeologists, and museum curators, and "as a workshop guide for the technician" (Plenderleith 1956: vii). Plenderleith states that the collector: "…with a practical turn of mind who desires to carry out for himself the methods described can do so without any special technical training" (Plenderleith 1956: vii). In addition, the book aimed to inform the archaeologist about what science had to offer to the treatment of antiquities and also "…for revealing evidence of value to him in his researches" (Plenderleith 1956: vii). For the museum curator, Plenderleith hoped that the book would "enable him to detect and arrest decay in its early stages, and also to carry out the simple cleaning operations…" (Plenderleith 1956: vii).

Not only were manuals about the care and treatment of artworks published, restorers also wrote papers. As suggested by Alessandro Conti (2007: 168), the publicity throughout Europe that published texts entailed, may have compensated to some extent for the loss of sharing their secrets. Although the efforts by Italian restorer Pietro Edwards (1744-1821) in terms of sharing information about artworks treatments were described by Elizabeth Darrow (2017: 310) as "ambiguous"[44], Edwards wrote papers about principles for a conservation theory, such as the 1758 "*Dissertazione preliminare al piano de custodia da istituirsi per la possibile preservazione e per il miglior mantenimento delle pubbliche pitture"* [Preliminary dissertation on the conservation plan to be established for the possible preservation and better maintenance of public paintings] and *"Piano pratico per la generale custodia delle pubbliche pitture"* [Practical plan for the general care of public paintings] (Darrow 2017: 311).

Another type of manual discussing the care of artworks was published by chemists. By the end of the century, a book describing chemical issues in the restoration and preservation of works of art was published in England. Written by Arthur Herbert Church (1843-1915), professor of chemistry at the Royal Academy of Arts in London, *The chemistry of paints and painting* was published for the first time in 1890 and re-edited several times throughout the early twentieth century (in 1915, Church´s book was edited for the fourth time). Church´s manual offered a chemical explanation of the materials and methods used by painters: "It must be remembered that it is confessedly an elementary manual only, written with a definite aim, but covering a very wide area of inquiry. And if chemists should conclude that it contains too little chemistry, artists may perhaps think that it contains too much" (Church 1890: ix). In his preface, Church states that his manual was written for painters: "It has been written with the view of explaining to artists, whether they be accomplished masters or commencing students, the chief chemical and physical characters of the materials with which they deal and of the operations they practise" (Church 1890: vii). Chapter xxv, named "Conservation of pictures and drawings" (Church 1890: 268–80), discusses preventive measures for the care of artworks and provides advice about treatments for deteriorated varnishes, ground and paint losses, and cleaning of painted surfaces.

A few years after the first edition of Church´s book, the first director of the Royal Museums Laboratory in Berlin, the German chemist Friedrich Rathgen (1862-1942), published a

[44] Darrow points out that Edward wrote condition and treatment reports describing, for instance, damage in the objects and materials used for the treatments "…in a calculated act of transparency", but she also acknowledges that the restorer was reticent to share procedures related to specific artworks (Darrow 2017: 310).

manual for the treatment of antiquities. Although a few articles related to the preservation of archaeological objects had been issued before, Rathgen´s text was broader in scope, including deterioration processes and treatments of diverse materials (Gilberg 1987: 110–11). Originally written in the German language in 1898 as *Die Konservierung von Altertumsfunden*, the book was translated into English in 1905 under the name *The Preservation of Antiquities: A Handbook for Curators* (Sease 1996: 158). According to the English translation, Rathgen's book was not intended for restorers, but for museum curators and private collectors, hoping they would also share their knowledge on the subject: "…it is to be hoped that this handbook will stimulate Curators of State, Municipal and Societies´ Collections, as well as private collectors and others interested in the subject, to make public their further experiences in this field of archaeology" (Rathgen 1905: vi).

Judging from an anonymous article published in the same year as the translation of Rathgen's book, it was well received in England. The text compares the value of this publication to Church´s book and highlights the safety of the procedures described:

> *This book should be as invaluable to those who possess curiosities and antiquities as Professor Church´s well-known hand-book on the chemistry of painting is to artists. The book is modestly described as a hand-book for curators, but it is one which ought to be in the hands of every collector who sets the smallest value upon his possessions. Although the causes of decay are dealt with from a chemical point of view, the methods of preservation are treated from a thoroughly practical standpoint, so that those who have no knowledge of the problems of chemistry involved can use the volume with perfect safety. (Anonymous 1905)*

Moreover, certain books containing technical information and debates about artworks treatments were not originally intended to be published, such as the reports written in the mid-nineteenth century during the controversies related to the cleaning of paintings belonging to the National Gallery collection in London.[45] These reports include detailed discussions about the pros and cons of the cleaning of paintings, but they were a request from the Lords Commissioners of Her Majesty's Treasury (Eastlake *et al.* 1850a; b) or the Lords of the Committee of the Privy Council on Education (Faraday *et al.* 1859). Additionally, other reports were ordered by The House of Commons (Select Committee 1848, 1850, 1853). Thus, this information was not intended to be shared with the general public or other

[45] See Chapter 2 for further discussion related to the mid-nineteenth century reports about the care and cleaning of paintings from the National Gallery, London.

restorers but was meant to be discussed internally within the limits of the NG and other governmental institutions. Possibly, and because of the circumstances in which they were created, these reports do not aim to provide information about how to treat artworks, as manuals would do. The NG reports were conceived as a result of public controversies about cleaning treatments. Thus, they mostly discuss the positive and negative outcomes of certain treatments carried out on paintings and suggest guidelines for future actions.

Whereas the above-mentioned texts about the investigation, care and treatment of artworks are examples of writings before the establishment of museum laboratories, detailed descriptions of conservation treatments related to specific objects are rarely found from before the twentieth century. Perhaps the mid-nineteenth-century reports from the NG could be considered early examples. And yet, in these reports, the technical information about cleaning of paintings is presented within the framework of a debate, not as a detailed description of materials and steps followed during specific restoration treatments. For Scott and Plenderleith, providing access to information about conservation treatments - not only to the staff of the BM, but also to private restorers and other national and international institutions - was a way of fighting against what were considered bad practices linked to secrecy. When Plenderleith was asked how he could "police these people who were using bad techniques?", the chemist simply answered: "Only by publishing good techniques about bad ones. That was the only thing" (Plenderleith 1978: 11).

In his very first report, Scott stated his position on secrecy: "The processes employed, admittedly with great skill and success, are kept more or less as trade secrets by those artificers and treasured by them as their own personal property especially as most of them are not on the regular staff of the museum" (Scott 1919: 2). The chemist also explained how science could help in developing safer treatments for the objects: "…I do not believe much in the secret processes and have no doubt whatever that a little careful work and research will soon discover and elaborate methods more efficient as well as safer than these at present in use…" (Scott 1919: 2).

Plenderleith was even more explicit when he recalled his first years in the laboratory:

> *What I was fighting was the fact that private restorers used their own methods and wouldn´t tell anybody about them. Even in the British Museum I was faced with a man who had done some very good work on cleaning coins but nobody knew what he used or how he had done it and he published nothing. He had bottles of chemicals wrongly labelled just for the sake of putting people off. That was throughout the whole world. Collectors had to fight a conspiracy of silence and this idea of using private recipes. (Plenderleith 1978: 9)*

Such secrecy was reinforced by the fact that most restorers did not work in a specific institution, but were external workers, so this information could help them obtain a job over another worker. Only a few restorers worked for the BM at that time, based in different departments of the museum. Their working conditions are briefly described in the history of the Department of Scientific research: “Before World War II, alongside the scientific work in the Department of Scientific Research, the curatorial departments continued to employ craftsmen restorers, often trained as locksmiths or jewellers, and this tradition continued until the late 1950s…” (The British Museum 2019d). This description is consistent with Plenderleith´s view, who mentions that “…departments had their own technicians, their own people who did technical jobs for them, mounting, printing tables and essential cleaning” (Plenderleith 1978: 15). However, as Scott mentions, most of the restorers in the BM were not employees and the practice of not sharing the details of treatments seems to have been largely extended. In comparison, sharing information about treatments did not represent a professional threat for Scott or Plenderleith. On the contrary, both scientists wished to demonstrate that openness was helpful in conservation, so they emphasised from the very beginning the need for publication to help develop safer treatments for the objects. The outcome of this open attitude to sharing information and the willingness to fight against secrecy was summarised by a later BM worker, Marjorie Caygill, in 1992: “…the old 'trade secrets' of generations of proto-conservators were doomed” (Caygill 1992: 32).

In sum, Scott and Plenderleith not only adhered to the publication requirements imposed by the Treasury Chambers, but they also claimed that sharing information about conservation procedures would improve the safety of the treated objects. Based on the annual reports written by Scott and the publications by the BM Laboratory from 1919 to 1931, I argue that being open with the information by publishing successful treatments was used by Scott as a way to promote the advantages of having a scientific laboratory in the museum and thus help with his goal of achieving the permanent status of the laboratory.

2. *Internal reports: First step in the standardisation of report writing*

Nowadays, it is standard procedure to record conservation treatments in reports. These reports vary depending on the institution, the conservator, the object or the treatment, but general guidelines are usually followed by most professionals and institutions. A treatment proposal may be written, which includes a technical and historical investigation of the object, a condition assessment and options for proposed treatments - sometimes with different levels of intervention on the object. Depending on the institution and circumstances, this could also be presented as three separate reports: an object examination report, a condition report and a treatment proposal. During and after the treatment, another report is written to record all the steps taken, materials and tools used, treatments carried out on the artwork and the outcomes of any tests made (which may have been included already in the treatment proposal, as a basis for the proposed options). Treatment proposals and treatment reports may often include further information about analyses performed on the object, as well as supportive drawings, diagrams and images, including photographs at different scales and under varying types of lighting, such as ultraviolet and infrared images, or photographs taken in normal and raking light.

Nowadays, most institutions have a standard template for treatment reports that are followed by those who carry out treatments on objects and have to keep a record of all interventions. This standardisation of report writing was not achieved in one go however, instead it developed over a long period of time. It raised a point of tension that still exists between the benefits of using dedicated fields to categorize information versus the wish to stay true to the diversity and complexity of specific objects/treatments that can better be conveyed in a synthesized narrative. Treatment reports in particular tend to be less standardised than the examination and condition reports, with a freer text format that allows for descriptions of processes. The treatment report templates for paintings that were published by US conservator George Stout (1897–1978) in April 1935 in *Technical Studies in the Field of Fine Arts* show that years after the establishment of the BM Laboratory this process was still being debated among conservators and scientists. The article included an explanation about the benefits of using a template to report treatments, in which Stout argued: “To deal with the complicated subject of the condition of a painted picture requires a fair amount of formal framework if the record is not to become a kind of free essay about each object” (Stout 1935: 201).

However, at the time when Scott became the first director of the BM Laboratory, there was not yet such a thing as a template to follow. An absence of written records before 1919 seems to have been the norm at the BM. Initially, Scott mentions the absence of any records during treatment and laments that this experience was lost forever:

> *On the other hand as a result of attempts to clean and restore by methods which a scientific man would have condemned at once, it is an open secret that many priceless objects have been lost forever, no record being kept of what was attempted or how the failure occurred so both the object, the experience and the warning have been*

> *altogether lost, not only to the British Museum, but to all museum workers elsewhere. (Scott 1919: 2)*

Between 1919 and 1931, the BM does not seem to have kept written records on treatments either.[46] Plenderleith confesses in an interview: "…I must admit we didn´t make many records because we didn´t have time" (Plenderleith 1978: 13). Yet, the annual reports written by Scott may be understood as an early step in the standardisation of report writing,[47] since his reports include descriptions of tests on objects, failed and successful treatments and results; further follow ups and different possibilities adapted to the needs of each object can be found as well.

Scott´s writings emphasise the need for "research" work, aiming to understand causes of deterioration of the artworks. For instance, when facing the immense number of deteriorated objects that had been stored in the Tube system during the war, the chemist states: "The deterioration of many of these objects under these conditions calls for immediate research…" (Scott 1919: 3). However, his texts not only stress the necessity of undertaking research, but also the importance of performing practical treatments. When describing a treatment for leather, the chemist highlighted: "In cooperation with the Examiner of Book-bindings a number of experiments have been made in the Laboratory to find a dressing for leather which will combine the properties of being ~~theoretically~~ *perfectly* safe and at the same time efficacious and easy to manipulate" (Scott 1928: 10). Interestingly, the chemist crossed out the word "theoretically" in the draft and wrote "perfectly" instead, in handwriting, suggesting that a theoretically safe treatment would not be safe enough for him if it had not been tried in practice.

Not only his writing but also his practice was based on research work and experimentation. In one of his reports Scott states: "…careful work and research will soon discover and elaborate methods more efficient as well as safer than these at present in use" (Scott 1919:

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[46] Despite several efforts, it was not possible to reach the Conservation Department of the British Museum to confirm the lack of treatment reports during the period between 1919 and 1932. The history of the Department of Scientific research briefly mentions that "The Museum was founded in 1753, but little evidence relating to the early conservation of the collection has survived. […] Further information on pre 20th century conservation techniques at the Museum has been gathered from a few drawings in the collection, and from objects which have been re-conserved after treatment in the 19th or early 20th centuries" (The British Museum 2019d). There is no mention of any records during the early 20th century.

[47] See further description of Scott´s annual reports in Chapter 1. Additionally, Table 1 in the Appendices shows a list of all the reports as found in the British Museum Research Laboratory.

2). This statement was supported by an example, where the chemist proves how research and experimentation are effective. In July 1919, the Department of British Art and Ethnography requested Scott´s assistance with certain objects, including a mask of unbaked clay, from which a flesh-colour was flaking off. Scott carried out analysis on clay that had fallen from the mask and claimed that his analysis had identified the problem and his experiments would determine a proper treatment:

> *A determination of the amount and composition of the soluble matter in the clay which had fallen from the object located the trouble at once and conclusively proved it to be due to the plaster of Paris which had been applied as a backing and support of the mask. Experiments are in progress as to adhesive which may retain in their place those portions of the surface which have not actually fallen off. (Scott 1919: 2)*

Examples of experiments undertaken before the treatment of objects are found throughout all Scott´s reports, and the treatment of paper is no exception:

> *Preliminary experiments made in order to test the value of thymol in preventing the growth of moulds in paper seem to prove that our faith in its efficacy is not misplaced. A more rigorous set of experiments is being instituted so as to obtain some quantitative and comparative figures by which it can be compared with other fungicides and also to determine what are the best methods for applying it. (Scott 1924: 1)*

Another example describes the steps followed for the treatment of silver objects. As a result of analyses carried out to determine the composition of different silver alloys used on objects from the coin department and from the British and Medieval Antiquities, Scott found the presence of copper. After explaining the deterioration processes of silver and copper caused by the presence of salts and moisture, the chemist mentioned the need to remove a layer of metal compounds from the surface of the objects. The reason for this is based on aesthetic and safety reasons: "…not only to obtain some idea of the original form and appearance of the object but also in order to protect it from further decay in an atmosphere containing so much moisture as is always present in that of the British Isles" (Scott 1919: 4 Appendix). Knowing the composition of the silver alloy allowed Scott to find a suitable reagent and develop a treatment: "To do this with safety some reagent is required which will remove the copper crust without attacking either the silver or the alloy. […] …formic acid seemed to be an ideal acid for this purpose especially when warm and not too strong" (Scott 1919: 4). The outcome of the treatment was born of the chemist´s knowledge about the reagent and was reported as positive:

> *The results of the treatment of a very large number of objects of silver and its alloys have fully borne out the deductions from a knowledge of the properties of the acid and its salts. The oxides, carbonates oxychlorides of copper are cleanly and safely removed without the silver being attacked in the slightest degree. (Scott 1919: 4)*

In this way, Scott defines practice using a set procedure: Firstly, he undertakes theoretical research and technical investigation of causes of the artworks´ deterioration. Secondly, he applies this knowledge to determine a more effective and safer treatment, in contrast to restorers who, according to his view, were carrying out unsafe practices with the objects.

Interestingly, there is a remarkable absence in mention of the instruments and laboratory equipment used in Scott´s reports and the BM Laboratory publications, although the chemicals and materials used during treatments are listed. For instance, in the example described above concerning the treatment of silver objects, Scott not only mentioned the use of formic acid as a possible effective and safe solution, but also added other possible chemicals for the treatment of deteriorated silver:

> *Other reagents which were used with conspicuous success on some early interesting Peruvian beakers (of silver about 95 per cent purity) were (1) a solution of ammonium sulphide and ammonia containing a certain amount of cuprous sulphite (2) a solution of ammonia and ammonium formate [sic] (3) "zinc Dust" moistened with very dilute sulphuric acid. (Scott 1919: 4)*

Furthermore, previous conditions of the artworks are described in his texts, including images to support written explanations. Although the photographs are not included in the drafts of the reports and were not found in the archives either, references to images are frequently mentioned throughout Scott´s texts. The role of photographs is always to support Scott´s explanations and illustrate the results by contrasting images of before and after treatment: "(Photographs A1 and A2 before and after treatment show the improvement effected by this reagent.)", "(Photographs B1 and B2 show the melted and the restored tablet)" and "(Specimens before and after cleaning are shown in C1 and C2.)" (Scott 1924: 1–2). Publications by the BM Laboratory from the 1920s serve as examples of how these images may have been included in Scott´s reports, although such comparisons should be made cautiously, as there may be differences between the published and the missing unpublished images. For instance, image 1 (Appendices) shows how two images have been contrasted showing the after and before treatment condition (DSIR 1923a). In a few cases, enlarged images seem to have been used to highlight details or information difficult to observe with the naked eye: "The photographs (M and N) show the measure as received and when cleaned. The extent of the porosity may be realised from the portion photographed on a larger scale (P) where the scraped surface is the bronze and the depressions lead" (Scott 1925: 7–8). An example of how this image may have been presented in Scott´s report can be observed in a publication by the BM Laboratory (DSIR 1926), where an earthenware is not only shown as a whole object, but detailed images of specific points of deterioration are also included (Image 2, Appendices). The role that photographic documentation has in Scott´s reports was also suggested by Stout in 1935: "It may be well to point out the value of photographs. They provide evidence which no written record can supply, and the aim of a form is obviously not to supplant photographs but to give them identification and further description" (Stout 1935: 203).

The steps followed by Scott and his report writing can be illustrated by a case study about the application of hydrogen peroxide and other chemicals used to treat deteriorated white pigments or to bleach stains in paper. This one example allows us to follow Scott´s observations throughout the years, from 1919 to 1926, since the same treatment was carried out and discussed in several reports. Thus, it is possible to follow the chemist´s practices and writings from the start and understand his working processes and treatment changes over time.

As early as 1919, Scott found that "In many drawings and coloured pictures of all kinds the white portions are rendered or intensified by means of white lead or lead carbonate…" (Scott 1919: 2 Appendix). The deterioration and blackening of this pigment is explained by Scott as the conversion of the white carbonate into black sulphide of lead (Scott 1919: 2 Appendix). The chemist explains that the treatment of lead white with hydrogen peroxide has been used before: "It has long been known that by means of a solution of hydrogen peroxide the black sulphide may be oxidised into white sulphate of lead and the original whiteness restored" (Scott 1919: 2 Appendix). However, Scott does not consider this treatment safe:

> *To apply such a solution to the great majority of drawings or water colour paintings would almost certainly have disastrous results even if the solution contained no other substances. Solutions of hydrogen peroxide are liable to contain sulphuric and phosphoric acids and also salts of barium. All these may be regarded as most objectionable impurities when considering the treatment of prints. (Scott 1919: 2 Appendix)*

Therefore, the chemist developed a treatment that he considered safer, based on this previous experience about the uses of hydrogen peroxide and his own chemical knowledge:

> *By preparing a flat block of stucco by casting plaster of Paris in a simple mould and then drying the block we have a means of applying hydrogen peroxide in vapour and therefore free from the impurities with which its solution may be contaminated. By distributing as uniformily [sic] as possible over the surface of the block a small quantity of solution of hydrogen peroxide an active surface is obtained. On placing a blackened print at a distance of an eighth of an inch or so the hydrogen peroxide which comes off will restore almost to its pristine purity the whiteness in the course of a few hours. (Scott 1919: 2 Appendix)*

Scott considered this treatment not only safe, but also a success, and he used it also to bleach paper with "mouldy spots" (Scott 1919: 2 Appendix) and other types of stain:

> *The coloured plates in a pamphlet giving an account of Aurora borealis displays in Cambridge were restored completely by the application of an ethereal solution of hydrogen peroxide. The cause of the peculiar dark brown staining has so far baffled detection […] It was not in the form of spots but more in a form which suggested brush marks extending over various colours." (Scott 1925: 1)*

After years of using and testing this treatment, the report from 1926 shows how the treatment was adapted to the requirements of specific situations. Giacomo Guardi´s watercolours presented a blueish-green colour, in which white lead was also used. However, Scott´s intention of treating the white lead with hydrogen peroxide was conflicted with the fact that the watercolours were mounted on a specific paper (Whatman paper with an "1822" watermark) and the standard treatment did not feel safe for the frames: "Because of the mounting neither the stucco block method nor an aqueous solution of hydrogen peroxide could be employed. An ethereal solution had but little effect…" (Scott 1926a: 2). After testing for different treatments used in the past and reporting the failures, the chemist developed a solution for this specific situation:

> *…it was found that an alcoholic solution of hydrogen peroxide (prepared by mixing the "pure" solution of hydrogen peroxide with an equal volume of absolute alcohol) when applied with a soft brush was quite effective. It did not soften the medium of the pigment (probably gelatine or gum) but allowed the peroxide to be absorbed sufficiently to bleach the lead sulphide completely." (Scott 1926a: 2)*

Since each procedure and outcome was described in detail by Scott, this allowed the possibility to have a reference procedure when treating an object and not having to test every treatment from scratch. Scott developed a template for report writing, an important step for the standardisation of treatment reports, which included research about the treated objects and their deterioration causes, and a description of the different steps followed for the treatment of a wide range of objects, their procedures, outcomes and the possible pros and cons. The chemist not only advocated for keeping records of the laboratory procedures, but he also consistently put this into practice in his annual reports. In addition, his treatments also reached workers and connoisseurs outside of the BM Laboratory, as they were published in various journals, reports and magazines.

3. *External publications: Highlights of the work carried out in the BM Laboratory*

Publications about treatments of objects by the BM Laboratory were not constant between 1919 and 1931.[48] Scott´s reports were constant, as they were submitted annually, but this was internal information that was not meant to be published, at least not in its original form. On the contrary, treatments were not published for the general public from the very beginning; this process seems to have required some time and an increase is observed throughout the years. Yet, the wish of making information accessible to people outside the BM was taken into consideration even before the laboratory was established. The intention of publishing treatments was included in the description of what Scott expected from this new laboratory:

> *As it is to be hoped that results of interest and importance will be a consequence of the establishment of such a laboratory, arrangements should be made for the publication, either in the Journals of the various learned Societies or in special Monographs, or in any way that Council may think best, or all results which may be deemed worthy of publication of communication to the authorities of Museums throughout the world. (Scott 1919: 5)*

[48] See further description of publications by the BM Laboratory in Chapter 1. Additionally, Table 2 in the Appendices show all the publications found until the present date that were published by the British Museum Research Laboratory between 1919 and 1931.

Moreover, the publication of conservation treatments was included in the conditions imposed by the DSIR for the creation of the laboratory: "…Dr. Scott will submit an annual report giving the results of his investigations, and that this report should be available for publication if Their Lordships think fit, while all the results of the investigations must be communicated freely to those in authority at other national collections" (Barstow 1920). Indeed, the results of conservation treatments were published in three reports between 1921 and 1926 by the DSIR named *The cleaning and restoration of museum exhibits* (DSIR 1921, 1923a, 1926) and a journal article summarising the contents of the second report (DSIR 1923b). The reception in the art world seems to have been good, as Scott mentions an increase of correspondence due to these publications: "The publication of our two ´Reports on the Cleaning and Restoration of Museum Exhibits´ and the notices of these and of our work generally have brought us a considerable amount of correspondence as well as interviews with collectors" (Scott 1923: 5). Such interest made it possible for a third report, as an update to the previous ones:

> *A Third Report bringing the earlier ones more or less up to date was published in November last. Although the photographs did not bring out all the detail which our negatives were able to afford, on the whole, they were extremely successful in making clear the results of the cleaning and restoration which they were intended to illustrate. (Scott 1927: 1)*

Information related to conservation was also made available in journals: In Scott´s reports there are comments about publications of treatments in the *British Museum Quarterly* (Scott 1927: 7, 1928: 10, 11, 1929: 14), *Old Furniture* (Scott 1928: 10), *The Museums Journal* (Scott 1928: 10), *Burlington Magazine* (Scott 1927: 7, 1928: 11) and *Journal of the Chemical Society* (Scott 1927: 6). As Plenderleith emphasises, "Everything we were satisfied with, we published…" (Plenderleith 1978: 9). Since 1927, the laboratory published short articles of performed treatments in the museum journal *British Museum Quarterly* under the name "Laboratory Notes". These publications included a chemical test to help in the classification of English porcelain (Plenderleith 1927a), treatments for leather (Plenderleith 1927b; Scott & Hall 1927) and metal objects, some of them from archaeological sites (Plenderleith 1928, 1931a). Another article was published in this journal, although not under "Laboratory Notes", related to the protection of polychrome objects from light (Scott 1930a). Similar information was sometimes available in other journals as well. For instance, the chemical test for porcelain classification was firstly published in great detail in *The Burlington Magazine for Connoisseurs* (Plenderleith 1927c). Also, a similar article about the protection of polychrome objects was re-printed in *The Museums Journal* (Scott & Plenderleith 1931). Moreover, investigations and treatments of archaeological findings from Egypt and Ur were made available in articles or book appendices (Chapman & Plenderleith 1926; Plenderleith 1930a, 1963). In addition, Plenderleith published two reviews of other authors´ texts concerning the treatment of metal objects (Plenderleith 1930b, 1931b) and a review of the Rome conference in 1930 (Plenderleith 1930c).

Yet, it was not always clear how to fit the information into a specific journal or how to reach the right public, given the novel procedures carried out in their work. Scott acknowledged this issue when he considered the possibility of publishing one of his experiments:

> *This raises a question of some importance namely how best to publish the results of much of the analytical work carried out in the laboratory. Many of the experiments made are done to settle certain doubtful points but these often entail much intermediate work a description of which would hardly be accepted for publication by the Chemical Society or the Society of Public Analysts and even if published by either of these societies would hardly reach those interested in museum work. For example, the analysis of a series of bronze or silver coins of Roman origin such as would illustrate the variations in the coinage would interest a coin collector only from the point of view of the fluctuations in value and not so much from the corresponding varying metallographic composition, specific gravities and other physical characteristics. It is possible that publication of such results in the British Museum Quarterly may meet the difficulty, but the question can only be settled when further experience has been gained. (Scott 1927: 9)*

It is possible that the chemist had decided to solve this problem by publishing in several journals with different scopes. For instance, after performing experiments for the preservation of leather, Scott mentions: “This mixture is found to be greatly superior to any dressings previously used and details have accordingly been published in the ´British museum Quarterly´ Vol. 11 No 3, P77, and (by request) in ´Old Furniture´ and in ´The Museums Journal´” (Scott 1928: 10).

The access to information - in the form of treatment records or publications in journals - also generated another outcome: It was now possible for a larger group of people who were in charge of art collections to share similar challenges that they had been facing during their work. Because some of the challenges encountered by the staff of the BM Laboratory were shared by other institutions, publications contained valuable information to deal with these issues by means of scientific procedures. An illustrative example shows how Scott had to face increasing requests for spot tests on porcelain objects after a publication on the topic:

"Since the publication of the drop test for porcelain there has been a continual demand for tests both in the British Museum and Victoria and Albert Museum and it has been possible to cope with this work only to a limited extent" (Scott 1930b: 10). Therefore, while the laboratory was becoming a referent providing access to conservation treatments, the need for its permanent status became clearer. Thus, Scott´s sustained claims about dissemination of treatments also highlighted the valuable outcomes of the laboratory, helping him to achieve its permanent status.

4. *Failure and success: A comparative analysis of internal reports and external publications*

Scott confirms a distinction between private and internal reports and public and external information when in 1932 he compares the annual reports with the DSIR publications: "The private Annual Reports […] have been condensed into three published Reports which are dated 1921, 1923 and 1926"[49] (Scott 1932: 489). By comparing how Scott wrote his reports - which were supposed to circulate internally- and the type of information that was made available in the publications for the general public, it is possible to determine how Scott used report writing about artworks treatments to promote and help the establishment of the BM Laboratory, as I will go on to explain.

The case study concerning hydrogen peroxide explained in the previous section shows how this internal information - including testing of materials, procedures and successful or failed outcomes - was made available as DSIR external publications. The use of hydrogen peroxide to restore white lead and to treat mould and brown stains was considered by Scott a successful treatment, and the chemist expressed this in both the internal and external reports from 1923. In his annual report he writes: "No reagent for the bleaching of white lead which has become blackened and for the removal of foxed marks without applying a liquid has been found to equal hydrogen peroxide" (Scott 1923: 2). Likewise, in the DSIR report Scott claims that

> *…the use of hydrogen peroxide in the form of vapour was recommended for the restoration of white lead preparations which had become blackened by atmospheric agencies and impurities. The*

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[49] The underlining is not in the original text. It has been added by the author of this dissertation to highlight Scott´s differentiation between "private" (internal) and "published" (external) writings.

> *stucco block method has been in constant use with great success both for that purpose and for the bleaching of foxed markings. (DSIR 1923a: 1)*

However, one of the chemist's main concerns was the effect of this treatment on the support of the artworks, which was paper in this case. In his annual report Scott admits that "One objection to the stucco block method of application is that the exposure to the very moist atmosphere naturally produced tends to cause cockling and deformation of the paper. This is specially the case when the paper has been coated partially with any preparation" (Scott 1923: 2). The chemist had to face this issue when treating artworks by the artist William Blake (1757–1827): "… it was found in the case of a large number of paintings by W. Blake that some other mode of restoring the whites must be adopted. Apparently before painting he laid on the paper a ground or "gesso" of whiting and carpenter´s glue and it was on this that he worked" (Scott 1923: 2). Firstly, a treatment with "ozone" was performed on some of the artworks. Possibly because the treatment was not successful, there is no description of the steps followed, only a few lines reporting: "Ozone seemed in other hands to have given fair results and one or two had been thus restored but this method was difficult to apply and control efficiently" (Scott 1923: 2). Consequently, a different - and this time considered successful - treatment was carried out with a mix of hydrogen peroxide and ether: "By the use of an ethereal solution prepared by simply shaking up an aqueous solution of hydrogen peroxide with ether we were able to clear up and restore a large number of Blake´s works without any deformation, the ethereal solution being applied by means of a soft camel´s hair brush" (Scott 1923: 2).

The DSIR publication of the same year presents similar information as in the annual report, although with a few interesting differences. After the recommendation for using hydrogen peroxide, a warning is mentioned if used for the bleaching of brown stains:

> *…especially a word of warning must be given. The time required for the removal of these foxed markings is very much greater than for the bleaching of the blackened lead compounds. Some samples of paper have become brittle and fragile under prolonged treatment, owing apparently to the size used in the manufacture of the paper having been oxidised and destroyed. Most papers, but by no means all, seem to withstand the action of the hydrogen peroxide very well indeed. (DSIR 1923a: 1)*

And yet another warning is included in case the paper is framed:

> *The thickness of the paper and also the methods and materials employed in mounting the pictures may render it inadvisable to expose them to the very moist atmosphere arising from the plaster of Paris block moistened with solution of hydrogen peroxide. […] the centre is liable to expand so much more than the margin that wrinkles and other deformations result, which are not easily smoothed out even by a heavy weight. (DSIR 1923a: 2)*

Some conclusions may be drawn from these paragraphs. The treatment with ozone was not included in the external publications. It is difficult to speculate about the reasons why this information was omitted from the DSIR report. For instance, it may be possible that Scott did not consider it relevant information, since it was a treatment that had failed and was discarded as a whole. However, another failure - the treatment with the hydrogen peroxide - was indeed included in an external publication, indicating that Scott considered failed experiments relevant information. Thus, Scott´s writing strongly suggests that this omission was deliberate, in order to highlight successful treatments to promote the advantages of his laboratory.

In addition, Scott rephrased the recorded failures in the internal report as warnings in the external publication, giving them a more positive connotation. In the internal report, the possible impact of the treatment on the paper is clearly mentioned as a drawback to the treatment: "One objection to the stucco block method of application is that…" (Scott 1923: 2). In comparison, the external DSIR report discloses the same information as a warning: "…especially a word of warning must be given" (DSIR 1923a: 1). This subtle change in how the information is displayed makes an essential difference: the former writing exposes possible negative outcomes for a treatment, the latter mentions a warning, which adds to the safety of the treatment.

Finally, whereas failures were hardly published externally - or included as warnings - the information considered successful was published with a high level of detail and triumphant rhetoric. For instance, the successful treatment was included in the external report as: "In such cases a solution of hydrogen peroxide in ordinary ether has been used with success, the solution being applied to the blackened pigment with a camel´s hair brush" (DSIR 1923a: 2). Moreover, the last DSIR report from 1926 shows a more achieved result in the standardisation of the steps followed for the treatment with hydrogen peroxide. An initial remark is included, highlighting the importance of the long experience gained with certain procedures that were

> *…outlined for the treatment of prints and pictures which have since been employed, in some cases with slight modifications, over a period*

> *of years. They have survived the test of time very favourably, and the experience gained in their application to a great variety of specimens makes it possible, at this stage, to furnish more detailed information both as to the methods available, and to their selection in particular. (DSIR 1926: 4)*

Furthermore, a guideline explains in detail the different steps: dried stucco plate and ethereal and alcoholic solutions of hydrogen peroxide. Not so much as warnings, but as recommendations, each treatment is suggested for different cases depending on the specific situation presented by each object (DSIR 1926: 4–5).

In sum, a comparison between Scott´s writings in his annual reports and the external publications show that the chemist deliberately displayed the information for external publications framed with a positive and successful tone, helping him to promote the advantages of the treatments used by the BM Laboratory.

5. Conclusions

By adhering to the publication requirements imposed by the Treasury Chambers, Scott improved the safety of the treated objects: Each procedure and outcome was described in detail in the reports, creating a future reference when an object needed treatment. Scott also developed a template for his writing - an early step towards the standardisation of report writing - which included the undertaken research work related to the objects and their deterioration causes and a thorough description of diverse treatments tested on a wide range of objects and their possible outcomes.

An open attitude to sharing the steps followed for research, analysis and treatments allowed a wider range of professionals to be informed about similar challenges. When the laboratory became a referent providing information related to conservation treatments, the need for its permanent status became more obvious. By the dissemination of successful treatments, Scott highlighted the valuable outcomes of the laboratory, helping him in his goal of achieving a permanent status for the BM Laboratory.

Chapter 4 discusses how this chemical knowledge, used in museum laboratories for the technical investigation and treatment of artworks, became a required component of conservation training.

(Illustration next page: “Courtauld Institute of Art Scientific department” report, by the Courtauld Institute of Art. 1933. Courtesy of the Courtauld Institute of Art.)

CIA5/2007

Memo for Press March 22 1933

COURTAULD INSTITUTE OF ART

SCIENTIFIC DEPARTMENT

10 Portman Mews, W.1.

The urgent need for the establishment of a centre where systematic investigation could be carried on into the physical character of works of art, and into problems connected with their conservation and restoration, was first made clear at a Conference on Ailing Pictures convened by the Department of Scientific and Industrial Research on October 20th 1931. Full tribute was there paid to the admirable work down by the British Museum Laboratory, and by a number of private investigators; but it was felt that an independent and preferably academic centre would have great advantages over any existing institution, not only in carrying out research but in coordinating work that was being carried out elsewhere.

The University of London had for some time been considering the possibility of organising such a centre at the Courtauld Institute of Art; and the views expressed at the Conference and elsewhere made it clear that such action on their part would receive a widespread welcome.

Chapter 4

The introduction of chemistry into conservation training during the rise of museum laboratories

1. *Introduction*

Nowadays, undergraduate and graduate programmes for conservation training provide instruction in chemistry. Although the emphasis on the scientific approach differs depending on the university and country, a basic education in chemistry is commonly included in these programmes. Chapters 1 and 2 discussed different collaborations between scientists and those in charge of the care and treatment of artworks, and Chapter 3 investigated how the knowledge obtained from such collaborations was framed in a template for internal use and disseminated for external publications. But when and how did this knowledge of chemistry become a required component of training for conservators? To answer this question, it is necessary to look to the past and investigate the training of workers responsible for the treatment and care of museum collections.

These workers from the past may be seen as precursors to the modern conservator, but the terminology is still problematic. As discussed in previous chapters, the term restorer was often used in nineteenth- and early twentieth-century sources to refer to the people who undertook practical treatment of artworks, traditional craftsmen with practical experience. With similar meaning, this word is also used by secondary literature with a historical perspective. In comparison, it seems that there is no word to refer to the new trainees with a chemical background learning treatments in the newly established museum laboratories. Are they to be considered restorers, since they also carried out treatments on artworks? Should they be referred to as chemists due to their background? Or should they be ascribed the more contemporary term, conservators, as their training and scientific knowledge is closer to what we understand today as conservation practice? As will be discussed in this chapter, there was not yet a word to describe these workers by the early twentieth century, since they were not considered in the same category as the traditional craftsmen restorers.[50] Such difficulty in finding a precise vocabulary is partly related to the changes in training that took place in the profession during the establishment of laboratories in museums.

[50] As discussed in Chapter 1, the terms restorer/restoration will be used in the present text to refer to the people treating artworks before the establishment of museum laboratories in the early twentieth century. Likewise, the terms conservator/conservation will be used for those in charge of the treatment of artworks after the establishment of museum laboratories, people with a chemical background who learned practical skills in the labs. When referring to the people in charge of the care of museum collections, a general category is considered that includes all type of workers who carried out treatments on artworks.

I argue that the rise of museum laboratories in the early twentieth century changed the way in which workers responsible for the care of art collections were trained. As one of the first museum laboratories in the world, the British Museum (BM) Laboratory is not only an early, but also an influential example of how this change took place. The first director of the BM Laboratory Alexander Scott (1853–1947) and the chemist Harold Plenderleith (1898–1997) developed a combination of fixed principles based on their chemistry knowledge, which enabled safer, reproducible treatments that could be tailored to suit the individual needs of an object. These principles were subsequently taught to the rest of the staff: the case of the second volunteer assistant Margaret Binyon focuses on the question of what was taught at the BM Laboratory and investigates mobility and the international exchange that took place between the BM and various institutions. In addition, the Courtauld Institute of Art example shows how this knowledge and experience gained at the BM Laboratory contributed to the development of science-based conservation training at universities.

2. *Training in restoration before museum laboratories*

Up until the early twentieth century, the conservation of paintings was generally considered as a craft activity, surrounded by secrecy and taught by master to apprentice, who often belonged to the same family or workshop. In 1961, Rutherford Gettens[51] described the workers who initially treated paintings as "artisans", and mentioned that William Boustead, the conservator of the Art Gallery of New South Wales, referred to them as "craftsman type" (Gettens 1961: 1212). Indeed, in 1960 Boustead described the restorers from the late nineteenth century as "artisans" and "picture-cleaner-craftsmen type" (Boustead 1960: 123). These workers with manual skills, but no formal education in chemistry, were in charge of the treatment of museum collections during the nineteenth century. Many of them had a background as painters (Koller 2000: 7) and gradually turned into restorers. Indeed, at the end of the nineteenth century, the English chemist Arthur Church wrote that "…picture-restorers themselves are too often artists who have mistaken their profession, or who have been imperfectly trained" (Church 1890: 276). This situation also occurred in

[51] Rutherford John Gettens (1900-1974) was a chemist and a pioneer in Conservation Science from the United States (US). He was the Fogg Museum´s first chemist and together with conservator George Stout (1897–1978) he established the first scientific laboratory in a museum in the US at the Fogg (Bewer 2010).

other countries. For instance, Giorgio Bonsanti observes that "…restorers did not exist unless they had first trained as artists, a situation which remained unchanged in Italy at least until the late 1930s" (Bonsanti 2016: 970). Who were these workers and what knowledge did they consider relevant?

The situation across different European countries and in the United States (US) varied, and developments occurred at a different pace. In the seventeenth, and especially in the eighteenth century, specialised studios in restoration first appeared in Italy and France (Coremans 1996: 432). It was not until the nineteenth century that restoration became a separate profession, but one still surrounded by secrecy. This idea of ownership of knowledge had existed among craftsmen at least since the High Middle Ages (Davids 2005: 342–43) and restorers seem to have been familiar with it, as Coremans points out: "Obviously, the reports do not describe operational details, and since the solvents used are part of the secrets of the studio, they are almost never mentioned…" (Coremans 1996: 432).

For the French context, Noémie Étienne (2017: 49–69) offers a detailed investigation of the restorers working in the late eighteenth and early nineteenth centuries. Picture restoration was divided into two main activities: one was a more technical task related to relining and transfer of the support; the other involved cleaning and retouching of the painting itself. Whereas the former activity was seen as a mechanical operation, the latter was considered more prestigious, as it entailed painting, an activity considered a fine art. Étienne offers an example to illustrate this distinction: in 1801, a project to create a school for restorers was proposed in France. Although in practice the school was never realised, documentation of its initial planning survived. Etienne's discussion of these sources helps us understand which qualities and knowledge were considered most relevant to work as a restorer and how these were valued. Both activities, the work on the support and the work on the paint layers, were considered essential, yet, in the initial plan, the cleaning and retouching of paintings was proposed to be better paid than the technical work on the support (Étienne 2017: 50).

In Italy, by the end of the eighteenth century, restorers were already distinguished from painters, as they were considered professionals in their own right with a certain degree of prestige (Conti 2007: 227). In nineteenth-century England, there was also a growing awareness of restorers as being different from painters. According to Jacob Simon, during this period there was a change from painters treating artworks to "specialist restorers" in charge of the museum collections (Simon 2017: 5, 2018: 2). And yet, most of the restorers mentioned by Simon were initially trained as painters, such as Robert Brown (c.1763-1834), John Rising (1753-1817) and William Seguier (1772-1843). Thus, it seems that a background in painting was still a common basis to work as a restorer, even when the profession was becoming separate from that of the artist.

Also, in The Netherlands, painters were in charge of museum collections. In the eighteenth century, the court painter and connoisseur Jan van Dijk (c.1690-1769), became a restorer in the last years of his life. Indeed, a portrait of him as a “picture cleaner” is conserved in the Amsterdam Museum (te Marvelde 1996). During the early nineteenth century Jan Gerard Waldorp (1740-1808), Benjamin Wolff (1758-1825) and C. Apostoll (1762-1844) were trained as artists and carried out treatment of artworks in Dutch galleries and museums (van Duijn 2017: 1–2). Nicolaas Hopman (1794-1879), active during the first half of the century, was also trained and began his career as a painter and gradually transitioned to become a restorer (van Duijn & te Marvelde 2016: 812,814). Contrary to Nicolaas, his son Willen Anthonij Hopman (1828-1910) did not start as a painter, but was trained in his father´s workshop and worked as a restorer during the second half of the century (van Duijn & te Marvelde 2016: 814). Because of this training, he is considered to be the first professional restorer in the country (van Duijn 2017: 3). While he was not an artist, it can be assumed that his training was still based on the experience obtained by being exposed to the treatment of artworks at his father´s studio, and that he learned through a master/apprenticeship model. In terms of skills, both Hopmans worked on the front of paintings as well as on the supports (van Duijn & te Marvelde 2016: 813–15), suggesting that both activities were considered necessary for a restorer at that time.

The life and work of the De Wilds, an important family of Dutch restorers, was investigated by Esther van Duijn and Mireille Te Marvelde (2016).[52] Carel de Wild was active in the last years of the nineteenth century and the first two decades of the twentieth century. Like many restorers of his day, De Wild possessed a background in painting,[53] but had also trained as a restorer. He initially learned basic skills when working for the art dealer Goupil & Cie in The Hague, and later studied in Vienna at the *Kunsthistorisches Museum* and in Berlin[54] with the German restorer Aloïs Hauser Jr (1857-1919) (van Duijn & te Marvelde 2016: 817–18). With Hauser in Berlin, De Wild learned the method of wax-resin lining (van Duijn & te Marvelde 2016: 817). According to the German restorer Helmut Ruhemann

[52] From the De Wild family, the brothers Carel Frederik Louis de Wild (1870-1922) and Derix de Wild (1869-1932), both treated artworks; also Angenitus Martinus de Wild (1899-1969), who was Derix´s son (van Duijn & te Marvelde 2016: 812).

[53] Van Duijn & Te Marvelde (2016: 818) state that he was also regarded as a fine painter.

[54] Hopman was too old to accept De Wild as a pupil and there were no other restorers considered skilful enough, so De Wild had to train abroad (van Duijn & te Marvelde 2016: 817).

(1891–1973), a similar training model of master/apprenticeship also existed in Germany at the turn of the twentieth century: Ruhemann recalls that there were few restorers by this time and "most of them still guarded their secrets carefully and taught them only to their sons" (Ruhemann 1968: 31). In addition, De Wild was also skilful with the front of paintings, as shown during the restoration of artworks by the Dutch painter Frans Hals (c.1582–1666) in 1909, when he was requested to evaluate past treatments on the paintings. De Wild also advised on the possible removal of the varnish layers and overpaintings, and ultimately cleaned one of Hals´ paintings (te Marvelde *et al.* 2017).

In the US, by the first decade of the twentieth century the director of Harvard´s Fogg Museum, Edward Forbes (1873-1969), was aware of the need to introduce practical-based experience to art history students. The Fogg was created in 1895 with the aim of educating the public in the arts. It initially held mainly reproductions, until Forbes offered his personal collection to the museum between 1899 and 1901 (Bewer 2010: 31–32). Together the Fogg and Harvard University created a course in Art History,[55] since it was acknowledged from the very beginning that a proper programme would require the resources and collaboration of both a university and a museum. Not only could the Fogg provide its paintings collection, but by the 1920s it also had a laboratory where technical examination of paintings and practical work could be taught to students (Duncan & McClellan 2018: 70). Besides lectures and readings, Forbes envisioned courses where students would reproduce original paintings with the old masters´ materials and techniques. Although this approach proved challenging to implement at first,[56] Forbes managed to teach courses in which hands-on experience was encouraged, such as preparation of gesso, bole, and gold for wooden panels; grinding of historical pigments and reproduction of painting methods; and assessment of a painting's condition (Bewer 2010: 53–61). The museum never offered a formal programme in conservation (Bewer 2010: 8), but its training courses were considered model examples for other institutions, including the Courtauld Institute programme founded in 1932 (Bewer 2010: 174).[57]

[55] This programme was investigated by Francesca Bewer (2010), who focuses on the history of the Fogg, and by Sally Anne Duncan & Andrew McClellan (2018), who discuss the Art History course specifically.

[56] Forbes was inexperienced in teaching, he lacked the confidence needed for such an innovative approach, and very few students enrolled in his courses at the beginning (Bewer 2010: 56).

[57] The relation between the BM Laboratory and Courtauld Institute will be further developed in the following section of this chapter.

While a background in painting and practical experience in restoration were considered highly valuable to work as a restorer during the nineteenth and early twentieth century, connoisseurship also seems to have been seen as a relevant skill. The concept of the art connoisseur originated in the eighteenth century; unlike the amateur,[58] the connoisseur was able to assess the quality, provenance and authorship of an artwork, and it entailed a deep knowledge of the nature of the object (Taylor 2016: 510–14; Chapman & Weststeijn 2020: 7). There was no consensus on how to acquire such skills; the literature shows that some taste or sentiment, accumulated experience through exposure to artworks, and knowledge obtained from books (*Catalogue raisonné* and other catalogues, for instance) were common ways to become a connoisseur (Smentek 2014: 115; Friedenthal 2020).

Interestingly, manual practice was also considered relevant. In her study about the collector, dealer and connoisseur Pierre-Jean Mariette (1694-1774), Kristel Smentek demonstrates how Mariette considered this skill important. Smentek quotes Mariette´s words: “Taste and sentiment are indispensably necessary to judge well, but one must add many other kinds of knowledge which can only be acquired by long experience and which are principally conferred by some practice in art making” (Smentek 2014: 115).

The importance of this visual education, experience and artistic knowledge is also highlighted by Manfred Koller (2000) in his history of cleaning treatments. Presented by Koller as a historical phenomenon, cleaning could have different meanings, depending on cultures and time periods. For instance, the darkening layer covering a painting known as “patina” - that might also include dirty and discoloured varnish - was considered by eighteenth-century antiquarians and connoisseurs as a positive addition to the artworks, “as testimony of genuine origin and true age” (Koller 2000: 6), which encouraged restraint, and therefore in some cases it might have led to refraining from cleaning at all.

Furthermore, in an effort to legitimize and elevate their own profession, restorers tried to play down manual aspects when describing their work and emphasized the importance of theoretical knowledge comparable to that held by the figure of the connoisseur. Étienne (2017: 57–66) shows how art connoisseurship was claimed by French restorers to form part of their background skills, in order to distinguish themselves from painters.[59] This seems to be the case in other countries as well; for instance, in The Netherlands, De Wild was

[58] For further reading about the rise and role of the amateur, see Charlotte Guichard (2012), Lisa Skogh (2016) and Paul Taylor (2016).

[59] Although it is arguable if painters were by this time also considered connoisseurs (Taylor 2016: 514), they were sometimes regarded as advisors because of this knowledge in technical aspects of the artwork (Scallen 2020: 270).

regarded as a "notable connoisseur" amongst the other skills he had (van Duijn & te Marvelde 2016: 818). As mentioned by Elizabeth Darrow, the Italian painter Pietro Edwards also "acted as an advisor to many of the most prominent figures in Venice throughout his career, and influenced their collecting practices and valuation of major works of art" (Darrow 2017: 317). By the beginning of the twentieth century, the connoisseur was gradually becoming a museum-based professional with a university degree, where "a practice of the eye" replaced that of the hand (Scallen 2020: 2020); but still, some of this visual education and experience seems to have been expected from restorers as well.

An important question is whether knowledge of chemistry was also part of a restorer´s training. As I will go on to describe, while chemists were engaged in matters related to the treatment of artworks and their preservation from as early as the seventeenth century, it would take until the early twentieth century before chemistry came to be considered an essential component in the training of those in charge of the care of museum collections. For instance, during the eighteenth century, experiments in the chemistry of paintings were carried out in Italy and France to investigate stability of pigments and binding media (Conti 2007: 168–71). Also, Étienne´s study describes how the painter and chemist Jean-François Léonor Mérimée (1757-1836) proposed the creation of a committee "composed of artists, restorers, and chemists for the purpose of improving restoration methods and promoting their dissemination" (Étienne 2017: 57). The involvement of chemists in matters related to materials characterisation and cleaning controversies, took place during the nineteenth century, in countries such as France, England and Italy.[60] The establishment of the first museum laboratory in the Royal Museums of Berlin in 1888 and the appointment of the chemist Friedrich Rathgen (1862-1942) as its first director,[61] also show an early interest in introducing chemistry into the treatment of antiquities in Germany (Riederer 1976; Gilberg 1987). Yet, the involvement of chemists mostly occurred on an occasional and temporary basis (Coremans 1996: 433), nor was chemistry considered an essential part of the training of those in charge of museum collections. For example, Van Duijn & Te Marvelde (2016: 816) refer to Willem Hopman as "the only scientifically informed restorer"[62] in the early

[60] See Chapter 2 for further discussions on the topic of pigment analysis in the nineteenth century and mention of cleaning controversies in the National Gallery, London.

[61] Chapter 1 describes more extensively the establishment of the first museum laboratory in the world at the Royal Museums of Berlin, in 1888. It also discusses the museum laboratories created in the early twentieth century, such as the one at the Harvard´s Fogg Museum.

[62] Van Duijn & Te Marvelde (2016: 815–16) refer to Hopman as scientifically informed on the basis that he translated the book written by the German chemist Max von Pettenkofer (1818–1901) into Dutch in a period when publications about chemical properties of artworks´ materials were limited.

nineteenth century in the Netherlands and admit that "…publications in Dutch on restoration and the chemical properties of materials used in this field were scarce" (van Duijn & te Marvelde 2016: 816).

Although it cannot be understood as a straightforward development, one can observe a growing concern with how chemistry could contribute to restorers´ training in the early twentieth century. For example, the Dutch restorer Carel De Wild has been described as showing "…a good understanding of chemistry as applied to restoration and painting materials…." (van Duijn & te Marvelde 2016: 818).[63] In the US, Forbes showed a strong interest in how chemistry could assist the new generations of museum professionals during the early twentieth century. For instance, the director of the Fogg mailed the British chemist Arthur Laurie requesting information about the chemical examination of pigments[64] (Bewer 2010: 59). Moreover, in 1920, he manifested a desire for the establishment of a school "…where the painters, restorers and museum officials may learn about the chemistry of paintings and the care of them, on strictly scientific principles" (Forbes 1920: 169; Bewer 2010: 74).

However, such understanding of the possible impact that scientific knowledge could have upon the training of those in charge of the treatment of artworks was still not generally accepted. For instance, the disagreements between the German restorer Max Doerner (1870–1939) and the chemist Alexander Eibner (1862-1935) are referred to in a publication by Geert Vanpaemel (2010).[65] The escalating conflicts between them are partially explained

Von Pettenkofer´s book explained his own method of varnish regeneration by exposing oil paintings to solvent vapours. This process was initially considered safe by many, as the solvents were not in direct contact with the paint layers (Schmitt 2012; te Marvelde *et al.* 2017: 4). According to Van Duijn & Te Marvelde, Hopman also consulted a chemist while translating the book.

[63] Carel´s brother, Derix de Wild, also had knowledge in chemistry (van Duijn & te Marvelde 2016: 820). Furthermore, Jan Cornelis Traas (1898-1984), a Dutch restorer who worked contemporaneously with Derix in the Hague, took classes with the chemist Dr J.F. Lijnst Zwikker at the *Kunsthistorisch Instituut* in Utrecht, where he also experimented with different techniques, such as X-rays and ultraviolet light (Hendriks *et al.* 2019: 177).

[64] Arthur Pillans Laurie (1861 – 1949) was a Scottish chemist who performed pigment analysis and carried out investigations related to treatment of artworks (Rawlins 1950).

[65] Vanpaemel´s mention of this conflict is based on the research carried out by Michael von der Goltz about restoration in Germany. The original name of von der Goltz´s book is *Kunsterhaltung - Machtkonflikte. Gemälde- Restaurierung zur Zeit der Weimarer Republik* (von der Goltz 2002), and is

by their common interests but different backgrounds: whereas Doerner specialised in artists´ painting techniques with a practical approach, Eibner was an internationally recognised scientist who specialised in binding media, oils and varnishes. The conflict ended with the closure of Eibner´s institute *Versuchsanstalt für Maltechnik* in 1934 (Woudhuysen-Keller & Woudhuysen 2004: 285; Vanpaemel 2010: 73).

In summary, before the early twentieth century, while circumstances across European countries and in the US were different, chemistry was not yet a fundamental aspect of training for restorers. Although by the end of the nineteenth century, chemistry was gradually beginning to be considered as an aid for the treatment of objects, it was not until museum laboratories were established that chemistry was recognised as a fundamental part of training for those who would be in charge of the care and treatment of art collections. As one of the first museum laboratories in the world and the oldest one still functioning as such, the study of the BM Laboratory shows how this change took place in the early twentieth century.

3. *Training and chemistry at the British Museum Laboratory*

In this period of transformation, the first director of the BM Laboratory Alexander Scott, recruited his staff for the laboratory with a vision of what he considered to be valuable knowledge and skills for a person treating museum objects. But these new workers were not traditional craftsmen restorers, and therefore a difficulty of what to call them was already apparent by that time. In Scott´s reports, the chemist never refers to any of the people working in the BM Laboratory as conservators or restorers; his texts employ a limited vocabulary to describe the staff, who are usually referred to as “assistants” or “workers”. The term assistant was a generic title already used in laboratories during the seventeenth century to designate the personnel who worked under the instructions of the person in charge of the laboratory (Shapin 1989: 554), so Scott´s word choice is perfectly normal.

written in German with no translation. It has been reviewed in English by Renate Woudhuysen-Keller & Paul Woudhuysen (2004).

However, these workers or assistants were not a uniform group of people; they did not share the same background, knowledge and experience.[66] The staff mentioned in Scott´s reports can be divided into three groups: museum workers, laboratory boys/assistants and voluntary workers/assistants. Interestingly, these three groups illustrate the different paths taken by people who dedicated their lives to the care and treatment of artworks. It seems that there was still not a single dedicated path of training during the first ten years of the museum laboratory, but rather a range of ways by which to acquire the experience and knowledge considered relevant for the profession.

Of the three groups, the people mentioned by Scott as museum workers were the traditional craftsmen restorers, who worked in the different departments of the museum.[67] They will not be discussed here, as they were not part of the BM Laboratory.[68] The laboratory boys/assistants and volunteers, who learned to treat artworks within the BM Laboratory, will be described below.

Training of the laboratory boys

In the first years of its existence, the BM Laboratory was short on staff and the few workers present had no experience in treating artworks, neither were they trained as chemists.[69] Plenderleith described his first assistants as “lab boys” and lamented that “Two were originally boys recruited to scrub the floors. They were trained from that stage. Another was a gardener who knew little about laboratories …” (Plenderleith 1978: 5). Besides Plenderleith, Scott was the only chemist and, although he was the head of the laboratory and the main advisor, it is unclear to what extent he was involved in the practical work

[66] Further discussion about the different actors within the BM laboratory can also be found in Chapter 1.

[67] Garry Thomson (1970: 134) comments that before the Second World War, the BM “had craftsmen on its payroll from an early date, but these worked in the separate departments (Egyptology, etc.).” The conservator Andrew Oddey (1942-) also confirms that “Before 1975 the various curatorial departments at the British Museum each had their own conservation workshop” (Plenderleith 1998: 130, note 8).

[68] The collaboration between the restorers from the museum and the laboratory was investigated in Chapter 1.

[69] No list of the people working in the first years of the BM laboratory was found in the archives. According to the people mentioned in the sources, the regular staff members between 1919 and 1931 seems to have been as presented in Table 1, Appendix.

concerning treatments of artworks. According to Plenderleith, Scott did not perform any work on the objects himself: "…it should be clear that he didn´t do any of the restoration himself. […] No, he never did, not certainly on museum material. He did some work at home in testing modern materials, adhesives, etc." (1978: 4–5). In December 1924 the Department of Scientific and Industrial Research (DSIR)[70] hired Plenderleith, who had a PhD degree in chemistry, botanical knowledge and artistic interests.[71]

In general, a process of training and teaching the assistants started in the first years after the laboratory's establishment. After some time, they were able to carry out treatments on the objects and some of them even chose conservation as a profession. An early example of Scott´s assistants is Ernest Padgham, who began his work in May 1920 (Scott 1931: 4). According to Plenderleith (1978: 14), Padgham was a retired gardener assistant with no knowledge in the treatment of artworks. He had, however, experience in a laboratory: Padgham had previously worked with Scott at the Davy Faraday Laboratory of the Royal Institution, and he seemed to have been of great help to the chemist: "His experience in assisting in all kinds of research work has proved of the highest value" (Scott 1931: 2).[72]

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[70] The DSIR was an initiative of the President of the Board of Education to coordinate all governmental bodies with a specialised scientific focus. It was formally established in 1916 as a separate department and remained in its function until the 1950s. The aim of the DSIR was "the organisation, development and encouragement of scientific and industrial research and the dissemination of its results". It created several scientific laboratories, among which was the one at the BM (The National Archives 2019).

[71] Plenderleith seems to have replaced a previous candidate who resigned at an early stage. In the lecture delivered by Plenderleith in 1978, he mentions that when he started working at the BM laboratory, there were two lab assistants and "…my predecessor in the office who had given up and sought employment elsewhere" (Plenderleith 1998: 130). The publication of this lecture took place in 1998, and this written version includes footnotes and biographical data written by conservator Andrew Oddy (1942-). Plenderleith´s predecessor is referenced by Oddy as R.A. Mallet, MC (Plenderleith 1998: 130, footnote 12), although no further mention of this person was found in any other source.

[72] The Minutes of Meetings of the Royal Institution of Great Britain (RIGB) support Scott's assertion that Padgham and himself had previously worked together. The first mention found in the Minutes of Meetings of Padgham working for the RIGB is in October 1896, and coincides with the creation of the Davy-Faraday Research Laboratory (DFRL), which was part of the RIGB. Scott worked at the DFRL from its establishment until 8 April 1911. Padgham stayed at the DFRL at least until 29 May 1918, when a notice of an increase in his salary can be observed in the Minutes (Committee of the Davy-Faraday Research Laboratory 1896: 16, 17, 19, 264, 386). Thus, Scott and Padgham worked at the same

After some time and regular training in the laboratory, Padgham gradually started to perform treatments. The correspondence between Scott, Padgham and a worker from the Office of Works, demonstrates that in 1926 Padgham was also carrying out spot tests for treatments on site (Heasman 1926a; b; Scott 1926b; Padgham 1926). The letters refer to a few experiments that were carried out on the Thornhill ceiling in the Painted Hall of Greenwich Hospital in London. The aim of the tests was to determine a strategy for the treatment of the wall paintings, and though the tests were directed by Scott, the actual work was performed by Padgham:

> *I have arranged with Mr. Padgham to prepare a fair quantity of 5% and 10% celluloid solution for trying experiments on the back of the plaster of the ceiling in the Painted Hall. He will let you know when he has got his materials ready and then you can arrange with him as to the most convenient time for trying the experiments (Scott 1926b).*

The training of Padgham was also corroborated by Plenderleith: "Retired gardener assistant, […] Mr. Padgham did reduction work[73] and the only lab boy, the only other member of staff in this period[74] eventually did reduction work, too i.e. after a number of years" (Plenderleith 1978: 14). Interestingly, the example of Padgham shows how trainees also had an impact on training. Padgham brought certain chemical and practical knowledge learned in the Davy-Faraday Laboratory that he could further develop in the BM Laboratory. In this way, the BM Laboratory also benefitted from Padgham´s experience in the chemistry laboratory, suggesting a knowledge flow from chemistry laboratories to museum laboratories.

Another laboratory assistant, Leonard Bell,[75] was also trained in the BM Laboratory, and he became a photographer and conservator. Although no information has been found to shed light on how Bell´s training was carried out, sources show that he started his work in the

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institution for around fifteen years. In 1920, Padgham joined the BM laboratory (Scott 1931: 4), where he worked until his retirement in 1938 (Plenderleith 1998: 130, footnote 10).

[73] This was a treatment for corroded metals that consisted of reducing an oxidized surface to restore the metal, as described by Plenderleith (1978: 14).

[74] Plenderleith refers to the period between 1919 and 1926, before volunteer assistants with knowledge in chemistry became part of the BM laboratory.

[75] Leonard Henry Bell, MBE (1906-78). Oddy´s footnote written for the publication of Plenderleith´s lecture states that Bell retired in 1971 after 49 ½ years of work at the BM laboratory (Plenderleith 1998: 130, note 11).

laboratory in April 1923 (Scott 1931: 4) and soon enough Plenderleith recognised his potential: "He was a lab boy for some time. […] He became the best photographer of silver I ever met. […] From that he developed an interest in classifying and codifying things. He became one of the most useful people as he developed into a very good restorer as well" (Plenderleith 1978: 6). Six years after Bell joined the BM Laboratory, Scott also confirms how this former lab boy had become a trained conservator and how minor duties were assigned to new staff:

> *"The staff in the Laboratory has been increased by the very necessary addition of a new laboratory boy as L.H.Bell´s time and skill is now, after five years training, too valuable to be wasted in many of the minor duties which must fall to the lot of the junior member of the staff" (Scott 1929: 14).*

Practical experience for volunteers

When the DSIR hired Plenderleith in December 1924, it soon became clear that there was insufficient staff for all the work that had to be carried out in the laboratory, and the budget for hiring more employees was insufficient. Therefore, in the second half of the 1920s, two volunteers were recruited to help Plenderleith with the increasing workload he regularly faced. Plenderleith recalls: "I was able gradually to get assistants to train but this took a long time. […] Then I got volunteer assistants and that was a help. It was many years before I had an established scientific assistant of University standard" (Plenderleith 1978: 5). During 1926 and 1927, Captain R.B. Dent worked in the laboratory as the first volunteer; after leaving, he was replaced by Margaret Binyon. Both volunteers held a degree in chemistry and seem to have been recruited by Scott for this reason. About Dent, the chemist explains:

> *In my last report reference was made to the possibility of utilising the services of voluntary workers in the laboratory; during the year Captain R.B.Dent has served in this capacity. Captain Dent had seen much service in the Regular army in India and the East and on resigning his commission studied chemistry and other branches of natural science at the Imperial college of Science and took his diploma. He was therefore well equipped theoretically for assisting in our work and obtaining experience in our methods (Scott 1927: 1).*

Also, Binyon´s diploma was cited as the reason for being chosen to work in the BM Laboratory:

> *In October Miss Margaret Binyon who had taken her B.A. degree with Honours in Chemistry at Oxford in the previous June was admitted to the Laboratory as a voluntary worker on conditions similar to those arranged for Captain Dent (Scott 1928: 2).*

Importantly, the choices that Scott made when choosing the volunteers provide information about the specific characteristics he considered necessary for the job. It seems clear that a degree in chemistry was the essential education desired for the position. This is also confirmed by the staff that Scott asked for in 1919 for the establishment of the laboratory. Besides a laboratory attendant, the chemist requested: "One or two chemical Assistants, who have been well trained in modern analytical and chemico-physical methods"[76] (Scott 1919: 5). The "modern analytical and chemico-physical methods" seem to be the scientific knowledge that Scott considered relevant for the workers who would be in charge of the treatment of objects; not only chemical knowledge, but also an understanding of the physical response of the object´s materials to these chemical methods applied, to develop a more sensitive, tailored approach towards treatment (this will be discussed in more detail in section 4).

However, it cannot be concluded that Scott considered an advanced knowledge of chemistry as the only requirement. He also acknowledged patience and manual skills as crucial aspects for treating artworks. When reflecting on his staff, the chemist concludes: "My staff is very efficient and takes a keen interest in the many problems to be solved and in the restoration and preservation work to be done. This at times becomes tedious and requires much patient skill and perseverance" (Scott 1926a: 1). A few years later, he insists on these requirements: "…manipulative skill, great patience and sound judgement were all essential" (Scott 1931: 2). In contrast to a background in chemistry, Scott believed that these skills could be achieved with time by the experience gained in the laboratory: "…it must necessarily take some time to attain the high standard of manipulative skill gained by lifelong practical work" (Scott 1919: 2). Indeed, Plenderleith confirms that patience was one of Scott´s characteristics when working in the laboratory: after Scott´s lecture in 1932, Plenderleith points out that "It was the quality of patience, above all, which Dr. Scott impressed on those around him - the use of dilute solutions and taking plenty of time to do the work" (Scott 1932: 496).

A certain aptitude for manipulating objects with their hands was also considered relevant for those in charge of the treatment of artworks in the museum laboratory. Although this aspect was not highlighted by Scott, it was mentioned by Margaret´s father in a letter

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[76] The underlined words are in the original text.

written to Forbes in 1929 to introduce his daughter´s experience at the BM.[77] Among other qualities, Laurence Binyon points out that Margaret "… took a degree in Chemistry at Oxford and is very neat with her fingers" (Binyon 1929a). In addition, connoisseurship seems to remain as an added value for those working in the treatment of artworks. When Scott formulates the requirements for the personnel needed for the BM Laboratory, his description of the chemical assistants also includes a note mentioning that "University men who have had a good classical education at school would probably make the best assistants for the work contemplated" (Scott 1919: 5). It is not possible to claim from this quote that Scott was expecting a connoisseur for the job at the BM Laboratory, as he does not expand further on the topic. Nonetheless, it is significant that the chemist includes this request in his list of what would be the best candidate, so it can be assumed that some artistic sensitivity or interest (inherent to a classical education) was desirable alongside a scientific background.

In this context, it seems remarkable that Scott deliberately hired people with a chemical background with the intention of training them with the necessary practical experience to work on the treatment of artworks. As mentioned before, collaboration between workers with a background in arts and crafts, and people with knowledge of chemistry had already taken place in the nineteenth century, but the BM Laboratory took this collaboration a step further, by training a new model conservator who would have practical experience and artistic sensitivity, but also be knowledgeable in the scientific aspects of artworks treatments.

4. *Margaret Binyon, apprenticeship and methods at the British Museum Laboratory*

Margaret Binyon worked as a volunteer assistant at the BM Laboratory for two years, from October 1927 to 1929. Interestingly, Scott´s only observation about Binyon´s education is her background in chemistry. Yet, as the daughter of the English poet Laurence Binyon,[78]

[77] This letter is related to Binyon´s trip to the US, which will be explained in depth in section 5.

[78] Laurence Binyon (1869-1943) was an English poet, writer and art historian. He worked at the British Museum for 40 years: from 1893 to 1933. In 1893 he started working at the Department of Printed Books. Two years later, in 1895, L. Binyon worked with Campbell Dodgson in the Department of Prints and Drawings, where he was named assistant keeper in 1909. In 1913 he was in charge of the

who was in charge of the Department of Oriental Prints and Drawings at the BM, she may have been in contact with the art world as well. Her father wrote catalogues and monographs for the museum and also published books about painting and poetry (Sorensen 2019).

During her two years at the BM, Margaret Binyon seems to have focused mainly on metals: according to Scott "Her work especially on bronzes and on silver and other coins has been of great assistance and value" (Scott 1928: 2). What were the methods learned by Binyon and used for the treatment of these objects? Unfortunately, it is difficult to trace the treatments carried out by specific workers from the BM Laboratory, as no individual treatment reports were found from this period and only general descriptions of treatments were published by the heads of the laboratory, Scott and Plenderleith. This model had been already present in laboratories in the past: in his study of seventeenth-century laboratory assistants in England, Shapin (1989: 559–60) discusses the concept of "authorship" of experiments and publications. Assistants or technicians who would carry out experiments, take notes about the results, and possibly also write parts of the articles, were not considered their rightful authors. On the contrary, the person in charge - the one who made decisions, was responsible for the staff and had the "authority"- would be considered author of the work undertaken in his laboratory. A similar work dynamic seems to have been the case at the BM Laboratory: whereas in Scott´s reports, there are comments about the work carried out by the staff, there are no mentions of the assistants in the publications.[79] Still, it is safe to assume that Binyon worked on the treatments of metal objects that were carried out during the period that she was a volunteer, and that she also contributed to the articles published by the BM.

A good example are the outcomes of the investigation and treatment of archaeological findings from Egypt and Ur, which were made available by the BM Laboratory in articles and book appendices (Chapman & Plenderleith 1926; Plenderleith 1930a, 1963). Plenderleith also published a brief description of metal treatments in the BM journal: the "Laboratory Notes" from 1928 in the *British Museum Quarterly* (Plenderleith 1928) describe methods used for bronze and silver, the metals mentioned by Scott when referring to Binyon´s work. It is also possible to confirm in this case that Binyon worked on the Ur objects because her father mentions her experience in a letter to Forbes in 1929, when he was arranging the internship for her at the Fogg Art Museum; he describes his daughter´s

Department of Oriental Prints and Drawings and in 1932 he became the keeper of this department for a year, until he retired in 1933 (Sorensen 2019).

[79] See Chapter 3 for further discussions on publications.

experience and mentions that “She did a good deal of work in the Ur thing for Woolley”[80] (Binyon 1929a).

Plenderleith´s publication is helpful to trace what must have been one of the “modern analytical and chemico-physical methods” mentioned by Scott as important knowledge for the chemical assistants to have: the identification of an object´s materials through scientific analysis as a step prior to determining possible treatment. Plenderleith highlights the fact that “The Ur Collections have presented a great mass of interesting material both for renovation and scientific examination” (Plenderleith 1928: 84). This scientific examination consisted of the identification and quantification of the metals used in the alloys of a silver spear-head and two gold beakers. The amounts of gold, silver and copper are indicated in percentages for the three objects.

Such examination - carried out before any intervention on the artefacts - seems to have been performed with the aim of deciding on the best possible treatment. This can be assumed because the methods used for treating the objects are discussed and presented in the text according to the materials characterisation. For instance, Plenderleith recommends a specific treatment for metals with gold additions:

> *In the case of bronzes and silver objects which have been plated strongly or inlaid with gold, the citric acid treatment gives greater control than is possible when dilute mineral acids are employed, and so facilitates the retention of gilding in position even when this is so thin as to wave about in the washing water. The same solutions are very effective with bronze objects containing much tin… (Plenderleith 1928: 84).*

Greater control in the methods used has a positive connotation here and seems to be a goal. This can also be observed in the treatment performed on a silver lamp that was cleaned from soil deposits and other materials. It was carried out in careful steps, taking the necessary time to gradually test the effect on the object:

> *…alternate treatments, carefully repeated during two or three months, with sodium sesquicarbonate and with weak acid and zinc, were necessary to retrieve the specimen from the hard mass of debris with which it was encrusted (Plenderleith 1928: 84).*

[80] Leonard Wolley (1880–1960) was the archaeologist who lead the Ur excavation and brought the findings for the BM Laboratory to treat.

A failure mentioned by Scott in the second report about *The Cleaning and Restoration of Museum Exhibits* (DSIR 1923a; b) also shows his conviction that the best method of treating an object is to investigate its materials first. While trying to restore white lead pigment in a drawing with hydrogen peroxide, the ink adjacent to the white lead, that was believed to be sepia - and according to Scott, not expected to be affected by the hydrogen peroxide - turned out to rapidly discolour. Further investigation showed that the ink was not sepia, but iron-based instead. After describing the treatment to restore the iron-based ink, Scott advocates, “It is therefore of importance to know that the pigments in any drawing will withstand the action of the hydrogen peroxide before exposing the whole drawing to it” (DSIR 1923a: 1).

This initial failure with the inks also illustrates another factor that was considered fundamental in the BM Laboratory: prior local testing of treatments before their application to the whole object. After explaining the use of hydrogen peroxide, Scott recommends that “…before treating drawings supposed to be done in sepia, it is necessary to apply the test to a small portion of the surface” (DSIR 1923b: 173). Not only was spot testing in a small area of the object suggested, but testing in less valuable materials was also recommended. The introduction for the same report advises that “any variation of the instructions given” should be carried out only “after careful prior experiment upon comparatively valueless objects” (DSIR 1923a: iv).

It can also be assumed that such principles were learned and performed by Binyon during her time as a volunteer at the BM. Even when the fundamental knowledge that allowed her access to a job at the BM was her background in chemistry, it was during her volunteer time at the laboratory that she gained the necessary experience to be able to treat objects. While this experience may have been acquired in a similar apprenticeship model to that observed for the traditional craftsman type of restorers, it was the application of these fixed principles for every artwork treatment that Binyon learned, that was new. Such principles were open and shared guidelines, a code of conduct that would distinguish conservation from the repair or maintenance work related to traditional craftsmanship restoration.

Admittedly, when considered apart, the described principles learned in the laboratory during Binyon´s apprenticeship - initial investigation of an artwork´s materials, greater control in the execution of treatment (such as the application of solvents) and spot tests on small areas or less valuable items -may have not been completely new for a restorer at the time. For instance, the idea that one should know about the materials of an artwork before treating it already existed. This was the main reason why artists were traditionally in charge of the care and treatment of artworks; they were considered to have the deepest knowledge about the old masters´ materials and techniques (Sease 1996: 157). In addition, the need for greater control in treatments, was also apparent in the nineteenth century. A representative example can be observed in the cleaning controversies that took place at the National Gallery (NG),[81] in which one of the major topics was to determine to what extent a painting should be cleaned and which layers of the painting could be removed without damaging the paint. Neither was spot tests conducted on small areas of an artwork a novel idea; these had been practiced since earlier times to determine the solubility of paint and indicate its binding medium. As Jilleen Nadolny (2003: 40) explains, "These tests - which consisted of wiping a surface with solvents in an attempt to characterise its composition by establishing its solubility parameters - were undertaken to provide evidence for the use of oil-based binders…".

However, such ideas and principles had not been practiced together in a structured combination, as later happened at the BM Laboratory. For example, in the past, even when painters were usually the ones in charge of treating artworks, it was sometimes the owners - probably without any knowledge of painting materials - who undertook cleaning treatments. In her article about the cleaning of oil paintings based on Western European sources published between 1600 and 1900, Maartje Stols-Witlox tells us that "Historical recipes demonstrate that the removal of surface dirt or varnish was often performed by owners themselves." According to her sources, this was considered "periodical maintenance" that could be performed by anybody (Stols-Witlox 2011: 1). Also, the ideas of performing spot tests and the need for a greater control when performing treatments of artworks were not systematically applied in the nineteenth century. This can be observed in the proceedings of the report written by the Select Committee appointed to inquire into the management of the National Gallery in 1853. In the sections concerning the cleaning of oil paintings, the Committee highlights the need for more "fixed principles" that would be followed by restorers, instead of each one deciding on their own:

> *It appears from the evidence that picture-cleaning, as at present practised, is an empirical process, rather than an art guided by fixed principles. While each cleaner has his own peculiar methods, which he for the most part endeavours to keep secret, the method adopted or commended by one as safe and efficacious, is often condemned by another as mischievous or destructive. Even the more experienced members of the profession seem rarely to possess that elementary stock of scientific acquirement which Your Committee consider desirable, if not indispensable, in the application of processes of so*

[81] See Chapter 2 for further discussion on the NG controversies in the nineteenth century.

> *hazardous a nature to precious works of art."* (Select Committee 1853: xxv–xxvi)

It was the application of chemistry knowledge with a structured combination of fixed principles that took shape at the BM Laboratory in the early twentieth century and enabled the possibility of safer, reproducible treatments.[82] These principles were taught to the staff of the laboratory, who would subsequently go on to work in other institutions, carrying their methods, experience and knowledge with them.

5. *Education, mobility and international exchange*

The principles developed at the BM Laboratory reached other institutions when workers left for employment elsewhere. The two volunteers mentioned by Scott who worked in the laboratory continued their professional careers in other museums outside London. For instance, in July 1927 Dent was admitted to the BM Laboratory and according to Scott became a staff member of a museum in Gloucester after a year of volunteer work in the laboratory: "I have also had much assistance from two voluntary workers namely Captain R.B. Dent now curator of the Museum in Gloucester…" (Scott 1931: 4).[83] As Vanpaemel (2010: 73) says, "The laboratory served for the apprenticeship of restorers, who then went on to work in other museums." This is an important general claim that needs to be investigated in depth; Margaret Binyon is an illustrative example of how the knowledge generated was carried forward to other institutions.

After two years of work at the BM Laboratory, Margaret Binyon relocated to the US to work at the Fogg Art Museum between 1929 and 1930. Her father Laurence was in contact with Forbes, the director of the Fogg, and arranged by correspondence a one-year internship for her there. Most of these letters have been kept in the archives of the museum and provide

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[82] It is difficult to determine why more than half a century elapsed between the acknowledgement by the NG committee of the need to train workers with science-based fixed principles and its materialization in the BM Laboratory. Most likely, the collaborative nature that Scott envisioned for the BM Laboratory and put into practice during his directorship played a major role.

[83] The current Museum of Gloucester has a brief record in its archive that confirms Scott´s remark. Dent was hired by the Museum in 1928 to replace the previous curator and his work was described as follows: "Although having a scientific background, Dent created new sections in the catalogues for ceramics, coins and medals and ethnography" (Gloucester Museums Service 2016: 10).

relevant information related to Margaret´s knowledge and practical experience. In 1930, Scott reports her departure as follows: "We have, however, lost the valuable voluntary assistance of Miss Margaret Binyon who was with us for two years and has now an appointment at the Fogg Fine Art Museum in Boston, U.S.A." (Scott 1930b: 11). From Scott´s words, it seems that the chemist was not happy with Binyon´s departure, but he supported her nonetheless; in one of the letters to Forbes, Laurence requests information about the work that his daughter would undertake at the Fogg, explaining that "She would like to be prepared, and Dr Scott would help her in any necessary studies" (Binyon 1929b).

Forbes also confirms the addition of Binyon to their laboratory in several letters and in the report of the Fogg from 1828-29:

> *Arrangements have been made for Miss Margaret Binyon, daughter of Laurence Binyon, the English scholar and critic, to work at the Museum the second half of the coming year on the study of pigments, and other chemical problems which concern art. Miss Binyon has been working in the Chemistry Department of the British Museum. (Forbes 1928: 3)*

During her time at the Fogg laboratory, Binyon was Gettens´ first assistant and, as mentioned in Forbes´ report, her work was focused on pigments. Additionally, Binyon also helped in treatments of Mesopotamian ceramics and fragments from Chinese wall-paintings (Bewer 2010: 178, 299 n.151). Binyon´s experience at the BM had mostly focused on metals, but not exclusively, for her father mentions: "I think her work has been chiefly concerned with metal objects, though not entirely. […] (She has had some experience of cleaning drawings, cleaning pictures but not very much)" (Binyon 1929b). The fact that she treated a variety of object types indicates a broad-based training, similar to the training expected for an all-round objects conservator nowadays, though more extensive, since her experience also included pictures, drawings and wall-paintings.[84]

In 1931, Binyon returned to London to work at the BM again, bringing with her the experience she had gained since her departure: "…Miss Margaret Binyon, B.A. (Oxon) who worked for two years and after a years [sic] work at the Fogg Art Museum in Boston, U.S.A. has returned to work here" (Scott 1931: 4). Consequently, the skills and knowledge learned in the laboratory not only reached the different departments of the BM, but they also

[84] For instance, nowadays, wall-paintings is usually a specialization by itself or it is taught together with easel painting courses or with stone materials, but it is not common to include it in programmes for objects conservators.

spread to other national and international institutions. In turn, this knowledge was also influenced and shaped by input from other museum laboratories around the world.

The contact between the Fogg and the BM Laboratory can be considered an early example of mobility and education in conservation matters, but it was not the only one. For instance, as previously mentioned, the Dutch restorer Carel de Wild had studied abroad between 1894 and 1895. De Wild was first trained in Vienna in the *Kunsthistorisches Museum* and later became Hauser´s intern in Berlin for three months. Interestingly, de Wild learned from Hauser a method of wax-resin lining[85] that was originally invented by a Dutch restorer: Hauser had learned it from Anthonij Hopman in 1891, when the German restorer visited the *Mauritshuis* in The Hague (van Duijn & te Marvelde 2016: 815–17). Such mobility of restorers during the nineteenth century was not uncommon. In his history of structural panel painting conservation in Germany, Austria and Switzerland, Ulrich Schiessl talks of international exchanges between restorers from Italy, France and German-speaking countries. Although limited to "professional upper classes", these exchanges are considered to be a consequence of relationships between governments, collectors and connoisseurs (Schiessl 1998: 201–2).

Turning to the field of art history, during the twentieth century, the report created by the committee of the Courtauld Institute[86] indicates that by the late 1920s there was an understanding of what was happening in terms of educational institutions teaching art history in different countries across Europe and the US. On 8 November 1928, a committee was organised to discuss the first steps for the creation of the Courtauld; the first Minutes of Meetings suggest that "…a Committee be appointed to consider and report upon the scheme for the provision of facilities for the study of the History of Art in England…" (Committee 1928a: 1). A report was compiled to investigate how universities abroad - in the US, Austria, Germany and France - had set up their own courses. This report contains information about the number and type of students attending, the programmes, the entry requirements, the evaluation system, etc. Most programmes included some practical work, such as painting and drawing, to help in the appreciation of art, but were not oriented to teaching on the treatment of artworks (Committee 1928b: Appendix I).

In 1930, international contact between art professionals took place during the Rome Conference, organised by the International Museum Office of the League of Nations "…for

[85] Nicolaas Hopman´s relining method consisted of a wax-resin lining, invented by himself during the first half of the nineteenth century and became known as the "Dutch method" (van Duijn & Filedt Kok 2016: 120).

[86] The case of the Courtauld Institute will be further discussed in the next section.

the study of scientific methods in the examination and conservation of works of art", with the presence of 120 experts (Plenderleith 1930c: 221). The US conservator George Stout is a good example of how international contact was established during and after the Rome Conference. Stout travelled to Rome representing the Fogg Museum, and he gave a presentation about a new transfer method for wall-paintings. This was an adaptation of an existing technique that had been modified to improve the preservation of the wall-paintings. In response, the department from the Fogg was later contacted by several colleagues around the world asking for advice related to treatment of wall-paintings (Bewer 2010: 144–45).

6. Institutionalization of training in conservation

The Rome conference also had an effect on education: as Nadolny points out, "The conference served as a catalyst for the founding of the museum laboratories and conservation education programmes which would provide the context for the analytical study of paintings throughout the rest of the century" (Nadolny 2012b: 340). Indeed, an article was published in the same year in *Mouseion* suggesting the creation of institutions for the education of conservators, which would include practical training and chemical and physical knowledge (Hill Stoner 2017: 630).

It is generally considered that the Courtauld Institute offered the first training in conservation in 1934 (Nadolny 2012b: 340; DeGhetaldi 2012: 5; Hill Stoner 2017: 630) and that other institutions around Europe followed suit: the *Akademie der Bildenden Künste* in Vienna in 1936, the *Doerner Institut* in Munich (1937-1938), the *Istituto Centrale del Restauro* in Rome (1939-1944), the *Jan Matejko Academy of Fine Arts* in Warsaw in 1945, *Institut für Technologie der Malerei* in Stuttgart (1949), the Royal Danish Academy of Fine Arts in Copenhagen in 1950. In fact, the programme offered by the Courtauld in 1934 was not for conservators, but was focused on the history of art instead, for museum professionals. Yet, as part of the internal development of art history courses, the programme included classes oriented to the technical investigation and treatment of artworks. This does not seem to be an exception, as other scholars have observed similar circumstances: "The analytical examination of paintings was initially seen as an essential part of the study of art (and an accessory to art history) and to painters´ practices" (Nadolny 2012b: 340).

Since conservation was not yet established as an independent university career path,[87] these courses oriented to the investigation and treatment of artworks can be considered as some of the first steps towards the establishment of conservation programmes at universities. The Courtauld Institute is an early example of these early stages in the establishment of a science-based training in conservation at university level. It also illustrates how the knowledge and experience gained at the BM Laboratory influenced the development of the Courtauld as a teaching institution. Such influence can be observed during the creation process of the Scientific Research Department (SRD) in 1934, which was a parallel department created within the Courtauld. Conceived to carry out research on the technical examination and treatment of works of art, the aim of the SRD was the improvement of conservation treatments. The creation of the Courtauld and the SRD will be discussed below.

Creation of the Courtauld Institute of Art

The Courtauld initially opened its doors in October 1932. It was funded by Arthur Lee,[88] Samuel Courtauld[89] and Robert Witt[90] and its first director was William Constable[91]. The need for a university-level education in art history for museum professionals was highlighted in the first meetings held:

> *"The facilities in Great Britain for the education of students in the History of Art or the training of Art Critics and Experts are very meagre. […] There is at present no established or qualified field of recruitment for what may be called the "Museum Service." It is suggested that the needs of Great Britain would be met by the establishment of a*

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[87] University-level training in conservation at the Courtauld was established many years later, in 1976, with a three-year postgraduate diploma course.

[88] Arthur Lee (1868–1947) was the first Viscount Lee of Fareham, co-founded the Courtauld and was chair of the Committee (Courtauld Institute of Art 2019).

[89] Samuel Courtauld (1876–1947) was an English industrialist and art collector who donated money, accommodation and artworks to the institute (Courtauld Institute of Art 2019).

[90] Sir Robert Witt (1872–1952) was an English lawyer who donated reproductions of paintings to the institute for teaching purposes (Courtauld Institute of Art 2019).

[91] William Constable (1887-1976), who had worked at the NG, was the first director of the CIA, between 1932 and 1936 (Courtauld Institute of Art 2019).

> *Department of the History of Fine Art…" (Committee 1928b: 1 Appendix b).*

In the report created by the Courtauld committee in 1928, in which other universities were investigated, the course at Harvard University was considered the ideal model: "This is worthy of the closest study, and most nearly provides the ideal which we should seek to attain" (Committee 1928b: Appendix I). The aims of both courses were similar: according to the Courtauld report, the Harvard programme was oriented towards the preparation of teachers and museum workers. Likewise, the Courtauld course was oriented towards two types of student, the first one being the general public with interest in the arts, and the second type of student being similar to that envisioned by the Fogg, namely: "Those who wish to specialise, either as historians, critics and teachers, or as Museum and Gallery officials" (Committee 1928b: 1 Appendix b).

According to the Courtauld committee, the Harvard course was "The most recent organization for the teaching of the History of Art, and the widest in scope" and its programme provided "training in drawing and painting as an aid to appreciation…" (Committee 1928b: Appendix I). Indeed, besides offering art history courses, the Fogg could provide a space for students' learning and experimentation in its laboratories (Duncan & McClellan 2018: 70). Likewise, the teaching of technical aspects related to artworks was considered important for the Courtauld: "…advanced courses both as regards subject and treatment, should be provided. For them, technical knowledge of the art or arts concerned is highly desirable" (Committee 1928b: 2 Appendix b).

This interest in including "technical knowledge" of the arts in the programme can be observed from two aspects. Firstly, the course offered lectures discussing methods and techniques of creating artworks. A draft syllabus for the course written by Constable and Professor Gardner[92] considered different possible levels for the students to reach: Intermediate course (one year); Course for final B.A. Hons, (two years); an M.A. Degree (two years); and a PhD or D. Lit., obtained by the writing and defence of a thesis. The section describing the B.A. shows that a technical course was included: "Technical Methods in painting, drawing, engraving and sculpture" (Committee 1928b: 2 Appendix II). The academic year 1933-1934 also offered four lectures by Constable with the heading "Methods and Materials of Painting", and three lectures given by Ruhemann, advertised as "The Technique of Old Masters and their Conservation" (Courtauld Institute of Art 1934). Ruhemann´s talks were also offered in 1937 under the title "The Technique of Old Masters,

[92] Ernest Arthur Gardner (1862–1939) was an English archaeologist and professor at University College London, and he was part of the Courtauld committee.

with Practical Demonstrations" and "Modern Aids for the Examination of Paintings" (Courtauld Institute of Art 1937).

Secondly, the considerations regarding the accommodation of the institute for the classes indicate an interest in teaching technical aspects to students. The committee contemplated the possibility of having a room that could be used as a workshop. In this space, the students were supposedly introduced to practical aspects of works of art and their treatment. During the discussion about the required accommodation for the institute, a note by Constable suggests the need for "A STUDIO, for the study and practice of technical processes, for the technical analysis of works of art and for the repair,[93] etc. of works of art in the permanent collection" (Committee 1928b: 1 Appendix III). In 1931, Constable also presented a report "mainly concerned with considerations affecting the plans and structure of the Courtauld Institute…" (Committee of Management 1931b: 1[6] Report), in which he described the needs and solutions offered by several universities, galleries and museums from the US in terms of accommodation. Under the "Photographic Rooms, Storage and Workshop" section, this report mentions that "The necessity of a small workshop for small repairs, framing, etc. is everywhere emphasized" (Committee of Management 1931b: 6[11] Report).

Constable´s suggestion from 1928 to create a workshop was taken into consideration, although the location seems to have changed. According to Constable, the studio "…should be of fair size, as it would on occasion be used as a classroom. It should have a strong top light, preferably from the north, should have water laid on; and should preferably be on the same floor as the gallery" (Committee 1928b: 1 Appendix III). In contrast, a memorandum from 1931 about the accommodation, contemplated a different space for the workshop: "Can be in the basement and should be near photographer´s rooms [Sic]" (Committee of Management 1931b: 3 Memorandum). It is difficult to determine whether this change was a consequence of a practical issue - such as a lack of space elsewhere - or if it indicates a different idea about the expectations regarding the room. It is clear that in 1928, the emphasis was on the proximity to the gallery, possibly to access the paintings more easily. In addition, strong top north lighting would be better suited for activities that need this type of light, such as retouching of paintings. The facilities that would allow this space to become a suitable classroom were also highlighted, whereas in 1931, the space was considered important as an appendix to the photographer´s room. Constable had also suggested in 1931 the need for microscopes, and X-ray and ultra-violet equipment for a laboratory

[93] The word "repair" seems to refer to treatments of artworks. This term is also repeated in the following quote in a similar context.

(Committee of Management 1931a: 2 Appendix 4), which would fit in a basement room with little light. Small interventions, such as unframing of paintings to be photographed in the nearby photographer´s room, could also have been carried out with no natural light. However, it is not clear from the sources if either the workshop or the laboratory were finally established by the time the institute opened its doors to the first students, as the programmes from the first years do not show any signs of use of these spaces for teaching purposes. What appears to have been a crucial need since the early stages was the establishment of a Scientific Research Department.

Creation of the Scientific Research Department

The need for a department that would address, centralise and supervise all the issues related to the "care and preservation of works of art" was mentioned in three letters sent to *The Times* in 1931. The first one, expressed the need for a "clinical centre":

> *"The point is rather to call attention to the lack in this country of anything in the nature of a "clinical" centre to which questions relating to the care and preservation of works of art, in public or private possession, can easily be referred with the certainty of the best advice, and, if necessary, treatment at the lowest cost compatible with safety. […] Above all, a centre where the skilled restorer, as such, could work under specialist advice and control…" (Anonymous 1931).*

The following day, Laurie published a letter in the same newspaper, supporting the need for a specialised department and citing the BM Laboratory as an example (Laurie 1931). A day later, a letter written by Lord Parmoor[94] insisted on discussing the possibility of a "…project for combining scientific knowledge, technical craftsmanship, and artistic experience" (Parmoor 1931) and offered the offices of the DSIR. The three letters discussed the potential institutions that could host such a department. A conference on "Conservation of Oil Paintings" was organised by the DSIR on 20 October 1931 to discuss this issue, and Lee and Constable were chosen to represent the Courtauld (Committee of Management 1931c: 2). The minutes from 12 November contain a letter written by Lee, in which the Chairman informs about the conference. According to Lee´s letter, the need for a central reference institution on conservation was largely discussed. Although the NG was suggested as a possible institution to host this space, such a choice was not considered, as

[94] Originally called Charles Alfred Cripps (1852–1941), he was an English lawyer and politician who became the first Baron Parmoor in 1914 (Anonymous 1914; National Portrait Gallery 2020b).

the new department was supposed to be independent of any museum or gallery. Lee and Constable offered the Courtauld as a potential option and this alternative seems to have been generally accepted (Committee of Management 1931d: Appendix), so the Courtauld committee began to discuss the best approach to setting up a department within the institute.

After a few years of intensive search for funding, the SRD was finally open by the end of 1934. Earlier in the same year, a conference that took place on 16 March gathered the main personalities of the art world to discuss the best way for the establishment of this department, a space that should be independent and centralise methods and research related to conservation. Not only were the directors of the main museums present, but also representatives from the Royal Academy and the Courtauld Institute; and Scott and Plenderleith[95] also assisted in the event. This conference was registered by the Chair of the SRD Arthur Lee of Fareham and the documentation survives in the archives of the Courtauld. Such valuable textual sources shed new light on the ideas that were shared regarding the role of science in the treatment of artworks. The discussions that took place at this event also show how the approaches developed in the BM Laboratory served as practice examples for the creation of the SRD. These early steps are highly significant, as they show attempts in establishing an institution that would bring together the connoisseurship of art history, the practical experience in the treatment of objects and the scientific background. The minutes of this conference show that collaboration, transparency, standardisation of safe techniques and practical experience, were all taken into consideration when discussing the best way to establish the SRD within the Courtauld Institute.

The main ideas discussed during the conference on 16 March 1934

The need for a scientific approach within the institute was clearly stated at the beginning of the conference. Lee, the Chairman, reports that "…while the Institute was well equipped on the aesthetic and historical side, it had long been felt the structure should be completed on the scientific side…" (Committee of Management 1934: 1[112] Document B). Also, Constable considered that the Courtauld not only needed to focus on the aesthetic side of

[95] Plenderleith recalls this moment in his interview in 1978. The conservator mentions that the first connection of the BM Laboratory with the London University was with the creation of the Courtauld Institute: "when they established a laboratory there and I was invited to help engage staff" (Plenderleith 1978: 6–7).

art, but he also believed that "everywhere on the Continent there was felt the need of an academic body to supplement the ad hoc work done elsewhere; a place where the art historian and the scientist could be brought into touch" (Committee of Management 1934: 3[114] Document B).

The BM Laboratory was the main referent considered during the meeting; Lee points out that "The Institute was fully aware of the excellent work done by the British Museum Laboratory…" (Committee of Management 1934: 1[112] Document B). Other comments about the work performed by the BM Laboratory are found in the report. For instance, the director of the NG Kenneth Clark expressed that "… the National Gallery referred its problems to the British Museum laboratory, who sent their experts to the Gallery, though in some cases pictures were sent to the Museum" (Committee of Management 1934: 2[113] Document B). Scott and Plenderleith, as representatives of the BM, offered their help and experience for this new project; in Scott´s words: "The British Museum Laboratory would give any help and advice it could" (Committee of Management 1934: 2[113] Document B).

The SRD, however, would present different needs than those that motivated the creation of the BM Laboratory. An idea that was repeated several times during the conference was the urgency of having a centralised institution that would be able to provide guidance on issues related to the treatment of artworks, to both institutions and private individuals. In order to offer independent advice, it could not be associated with any particular gallery or museum. This concept had already been mentioned during the conference on "Conservation of Oil Paintings" organised by the DSIR on 20 October 1931: "…the need of a central institution for advice on physical questions was stressed, especially by provincial galleries and museums." (Committee of Management 1934: 1[112] Document B). During the meeting of 16th March, the representative of the Royal Society, Sir Herbert Jackson, also pointed out that "He was sure that first-class dealers were anxious for help, to add to their own knowledge and not for selling purposes. […] Many antiquaries would welcome knowledge as to the nature of the materials they found…" (Committee of Management 1934: 4[115] Document B).

This need for a centralised department that could address the issues related to the treatment of artworks seems to have originated from the diversity of treatments carried out by restorers. Such a concern was also apparent in other countries: in Italy, local traditions in restoration were a consequence of the country´s political fragmentation. By the early twentieth century, these approaches were gradually becoming unified, with Florence and Rome as the main centres. The state became the main entity responsible for the care of the country´s heritage and a centralised institute, the *Istituto Centrale del Restauro,* was created in 1939 (Ciatti 2017: 812). In England, the delegate from the Tate

Gallery illustrated this situation during the meeting of 16th March 1934 by highlighting that "…very different advice was given by different restorers, and it would be useful to have an institution to which problems could be referred" (Committee of Management 1934: 2[113] Document B). The intentions of the Courtauld Institute were indeed to fulfil this demand, as openly stated by Lee: "[The SRD] hoped to become a clearing-house for information, and to offer advice on the condition of works of art, particularly paintings, and on the problems of preservation and restoration, not merely to institutions but to individuals" (Committee of Management 1934: 1[112] Document B).

For the achievement of such a goal, collaboration was unanimously understood as the best approach. During the discussion about preventive measures and air quality control inside galleries and museums, the representative from the Office of Works suggested collaboration to help institutions defray the costs of expensive methods: "He pointed out the great expense of long-period experiments, and suggested the Institute should co-operate with the galleries in installing plant[96] in the galleries for long-period test" (Committee of Management 1934: 2[113] Document B). Clark agreed on this point and "…welcomed Mr. Macintyre´s suggestion of co-operation over long-period experiments…" (Committee of Management 1934: 2[113] Document B).

Moreover, the application of safe techniques regarding preventive measures and treatment of artworks was considered fundamental if the department was to become a referent for other institutions and individuals. To achieve this, two measures were expected from the SRD. Firstly, collaboration between scientists and "craftsmen" restorers was understood as an essential aspect. Interestingly, it was Scott who introduced the "importance of a good staff who would go carefully" (Committee of Management 1934: 2[113] Document B), and he later highlighted the need for "a skilful craftsman on the staff, who would give confidence to private collectors, would keep research on practical lines and keep the scientist in touch with practical pitfalls" (Committee of Management 1934: 5[116] Document B). Laurie also agreed on this point, mentioning "the importance of a craftsman for cleaning and relining problems. His rule of thumb methods would be of invaluable help to the scientist" (Committee of Management 1934: 5[116] Document B). Plenderleith supported these recommendations and added that "A craftsman would be a very useful acquisition, for a scientist was a potential source of danger unless he had knowledge and understanding of the actual specimens" (Committee of Management 1934: 5[116] Document B).

[96] Control plants refer to equipment for air quality control.

Even though Lee mentions too that "The importance also of having a practical craftsman on the staff was great" (Committee of Management 1934: 6[117] Document B), it is worth mentioning that the expenses considered for the "Craftsman Expert" were the lowest in comparison with the rest of the staff from the SRD and the working conditions were less favourable.[97] These tensions show a struggle to acknowledge two sources of expertise - scientists and craftsmen - and organise them in a field that was not yet clearly defined. Traditional craftsmen restorers were considered secretive - and therefore somehow dangerous - by workers with scientific knowledge, but the traditional restorers were the ones who had the most practical experience and thus, their expertise was valued. This ambivalence is also reflected in the vocabulary used: the institute is sometimes referred as a "clinical centre", a term strongly related to medicine and science, but the treatment of artworks is occasionally referred to as "repair", a word connected with craftsmen´s practical work.

Secondly, an open and transparent attitude towards treatments was regarded as essential, as expressed by the representative of the Victoria & Albert Museum: "It would be satisfactory to have a central body for consultation, who would have no secret methods and would give disinterested advice" (Committee of Management 1934: 2[113] Document B). Individual advice, however, was not enough, it was also expected that the SRD would disseminate the knowledge acquired during research work. H.M. Hake, the director of the National Portrait Gallery, suggested that "a bulletin should be issued by the Institute to keep the galleries abreast of what was happening in the scientific world" (Committee of Management 1934: 2[113] Document B), and praised the articles published by Laurie and Scott, stating that this kind of literature was highly important.[98] The staff from the Courtauld seems to have fully supported this point, as Lee confirms that "…the Institute should become familiar with all the work being done in various institutions and should disseminate this collected wisdom" (Committee of Management 1934: 1[112] Document B).

The dissemination of knowledge by supervision and teaching was also discussed during the conference. As discussed before, the teaching on technical aspects of artworks was already taking place in the Courtauld courses. Constable refers to it when he mentions that "…the students were already given some instruction on the scientific side, but he hoped more

[97] In the Sketch Estimates, the salary for the Head of Department ranged between £600-650, the one for the Assistant was £300 and the one for the Laboratory Attendant was £150, while the fees for the "Craftsman Expert" were £100 (Committee of Management 1934: 1[123] Document F). In later documents, it was also stated that the craftsman would be paid by the hour and work part-time.

[98] See Chapter 3 for further discussion on publication.

would be given in the future" (Committee of Management 1934: 5[116] Document B). Indeed, this instruction seems to have not been enough, as Lee acknowledges that "…it was generally recognised there were no facilities for teaching and long-period research into all the aspects of art with which the Institute had to deal" (Committee of Management 1934: 1[112] Document B).

When J.C. Philip, professor of the Imperial College of Science and Technology, asked to what extent the department would give instruction to students, Constable replied that "…the man at the head of the Department would not teach in the widest sense, but there would be a limited number of research students for whom openings would be made" (Committee of Management 1934: 4[115] Document B). Indeed, the SRD was not created as an educational centre, but a small number of students with a scientific or artistic training would be a good addition to the department, especially for research. In Philip´s opinion "…the main object being research, the people instructed would have to be few in number and qualified by scientific or artistic training" (Committee of Management 1934: 4[115] Document B). It is difficult to determine from the sources the specific background that was expected from the students, whether they were supposed to be chemists, restorers or art historians, for instance. Some comments about students refer to the Courtauld - thus, art history students - but considering that the aim of the meeting was to offer tentative plans for the future, it is possible that also external students would have been accepted if their research projects were aligned with the department´s interests. Laurie also mentioned that "…it would be helpful for one or two trained students to conduct research" and he found it necessary that "the general run of students might be given teaching in technique, mediums, etc." (Committee of Management 1934: 4[115] Document B). Kenneth Clark offered the NG installations for educational purposes in topics related to preventive measures: "He would be glad to give students the opportunity of studying conditioning chambers on the spot" (Committee of Management 1934: 2[113] Document B). Even if the main goal of the SRD was not education or training, the idea of students undertaking research or being trained in specific topics, was clear; possibly a volunteer position or internship, similar to the conditions offered to Margaret Binyon at the BM Laboratory.

7. Conclusions

The rise of museum laboratories in the early twentieth century changed the way in which workers responsible for the care of museum collections were trained. Conservation of paintings had previously been considered a craft activity, and it was not until museum laboratories were established that chemistry became an essential part of the training of those in charge of the treatment of artworks. The director of the BM Laboratory Alexander Scott and the chemist Harold Plenderleith developed a combination of fixed principles based on their chemistry knowledge, which enabled safer, reproducible treatments that could be tailored to suit the individual needs of an object. By the time the BM Laboratory was established as a permanent institution, new workers with scientific knowledge and practical experience in the treatment of artworks were being trained, and they would subsequently go on to work in other institutions, carrying these principles, experience and knowledge with them.

The creation of the Courtauld Institute of Art shows how this knowledge and experience cultivated in the BM Laboratory contributed to the development of science-based conservation training established at universities. The art history programme offered by the Courtauld included classes oriented to the technical investigation and treatment of artworks, which can be considered as some of the first steps towards the establishment of conservation programmes at universities. During the creation of the Scientific Research Department (SRD) within the Courtauld, the need for science-based principles for the treatment of artworks was emphasised. In this process, the BM Laboratory was the main referent. Conceived to carry out research on the technical examination and treatment of works of art, the aim of the SRD was the improvement of conservation treatments by addressing the following needs: 1) a centralised institution that would be able to provide guidance on issues related to the treatment of artworks; 2) the application of safe techniques by close collaboration between scientists and craftsmen restorers; 3) an open and transparent attitude towards treatments; and 4) the dissemination of knowledge by supervision or teaching.

(Illustration next page: "Report on the work carried out in the British Museum Laboratory for the year 1st April 1930 – 31st March 1931", by Alexander Scott. 1931. Page 1. Courtesy of the British Museum.)

(COPY) Final to D.S.I.R.

Report on the work carried out in the British Museum Laboratory for the year 1st April 1930 - 31st March 1931.

As this is the last annual Report which I shall have the honour and pleasure of presenting to the Advisory Council it may not be out of place to put on record here the chief milestones in our history.

Early in 1919 I was asked to report on the situation which had arisen during and largely as a result of the Great War owing to the British Museum having lost some of its younger and most skilled workmen, and in a great measure also to many of the galleries having been used by other Government Departments. In these latter the exhibition cases had been boarded up to protect them from injury whilst the objects which they contained had been exposed to much greater changes in humidity and temperature than would ever have been allowed in the Museum in normal times. The result of these variations coupled with the want of the necessary vigilance and attention to the numerous and sensitive specimens resulted in the serious deterioration and even absolute ruin of many irreplaceable objects.

As the result of several visits to the various Departments during the summer I was able on 1st October 1919, to present a report on the situation and to suggest a remedy for the troubles which had arisen. In it I pointed out that as long as the statutory restrictions on the removal of specimens from the Museum remained in force the only solution which seemed possible was the establishment of a properly equipped chemical laboratory within the precincts of the Museum itself. This naturally would involve the provision of a small staff capable of doing the necessary

Conclusions

In this dissertation I have discussed how science became integrated as a fundamental aspect of conservation and the role that museum laboratories played in this process, by investigating the collaboration between chemists and those responsible for the treatments of artworks during the early years of the British Museum (BM) Laboratory. I have shown how the creation of this laboratory promoted collaborative practices between scientists and workers who took care of the museum´s collection on a regular basis, establishing productive modes of exchange in the BM, which became more generally applied in conservation. In addition, I have demonstrated how the emphasis that its first director, the chemist Alexander Scott (1853–1947), laid on matters of collaboration and openness helped him to achieve a permanent status for the BM Laboratory.

Indeed, collaboration was a crucial point that was emphasised during the first years of the chemist´s directorship: internal collaboration between the staff of the BM Laboratory and the museum workers – such as restorers and keepers – and also external collaboration with other institutions. Scott´s attitude towards collaboration can be clearly observed in the annual reports that he wrote for the first twelve years of his directorship. The provision of annual reports was a condition introduced by the Treasury Chambers at the inception of the BM Laboratory. These reports not only show how scientific expertise served to assist decision-making processes oriented to the preservation and treatment of artworks, but also served as strategic documents to advocate for the permanent status of the laboratory.

Interestingly, Scott´s actions had precedents in the incidental joint efforts that took place between chemists and those in charge of museum and gallery collections in the previous century. I have illustrated with publications describing pigment analysis in nineteenth-century England, that scientists already had an ethical awareness of the integrity of artworks before the twentieth century. Such shared views about the need for reducing or avoiding damage to artworks, between scientists and workers in charge of the preservation of museum collections, are early examples of outcomes of incidental collaboration. In addition, my study of the diary written by Ralph Nicholson Wornum (1812-1877), keeper at the National Gallery (NG) London from 1854 to 1877, shows how the legacy of the much-discussed Committee reports from the NG drawn up in the 1850s was applied as common practice by Wornum during the second half of the century. The 1850s reports, conceived in the context of the public controversies concerning the care and cleaning of the NG paintings, were created as a joint effort between scientists and museum workers. These early examples demonstrate that incidental collaborations between chemists and workers in charge of the care and treatment of artworks were already present before the twentieth century, allowing Scott to build upon them when he faced the challenge of creating and directing the BM Laboratory.

Moreover, Scott used other strategies to advocate for the permanency of the BM Laboratory, which also affected how conservation developed as a professional discipline. By complying with the Treasury Chambers' requirement of writing annual reports, Scott improved the safety of the treatments carried out on objects, since the performed procedures were recorded in his texts, creating a reference for future treatments. In doing so, Scott developed a template for his writing, which can be considered as an early step in the standardisation of conservation report writing. From the beginning, the chemist showed an open attitude to sharing the laboratory´s research, analysis and treatments, allowing other workers to access this information when they faced similar challenges. Thus, not only did the laboratory become a referent concerning conservation treatments, but by publishing successful results Scott also emphasised the value of the BM Laboratory in support of his goal to obtain it a permanent status.

This chemical knowledge used in museum laboratories for the technical investigation and treatment of artworks later became a required component of conservation training. At the BM Laboratory, Alexander Scott and the chemist and conservator Harold Plenderleith (1898-1997) developed a combination of fixed principles based on their chemistry knowledge, such as the investigation of an object´s materials prior to its treatment, spot tests on small areas or less valuable items and establishing a higher degree of control in the execution of treatments. Although not completely new, these principles were practiced together in a structured combination at the BM Laboratory, allowing for safer, reproducible treatments that could be adapted to each object. The new conservators, trained in laboratories with scientific knowledge and practical experience, went to work in other institutions, taking this expertise with them. Additionally, early steps towards the establishment of conservation programmes at universities were taken, for example, by the Courtauld Institute of Art in London. Not only did the Courtauld art history programme offer classes on the technical investigation and treatment of artworks, but also a Scientific Research Department (SRD) had been created within the institute by the end of 1934 with the BM Laboratory as a main referent.

This dissertation ends with the conference that took place on 16 March, 1934, organised to discuss the details concerning the opening of the SRD. Since this conference, collaboration with scientists in the world of conservation has taken place at a growing pace. Most large art institutions, like national galleries and museums, have a scientific department to assist in the investigation and treatment of their collections, and scientific analyses to provide a better understanding of artworks and their deterioration processes are considered common practice. Because of the dialogue surrounding such investigations, conservators are usually trained for – and expected to – interact and communicate effectively with different professionals, such as researchers, curators and scientists. Also, scientific research is carried out by an increasingly wide range of specialists, including chemists, physicists, biologists and experts in data and computer science, to improve the understanding of mechanisms of deterioration in artworks´ materials.

However, trying to identify the different and shifting hierarchies of workers from diverse backgrounds who collaborated in the past remains challenging. Although the nineteenth century saw the temporary engagement of chemists in the world of art, it was not until the period from 1930 to 1950 that collaboration between scientists and those who took care of artworks became widely accepted. This twenty-year period was delimitated by two important events that helped to promote conservation with a scientific base: on the one hand, the Rome conference in 1930, which focused on the study of scientific methods for the investigation and treatment of artworks; on the other hand, the establishment of an institute that supported science-based conservation: the International Institute for the Conservation of Museum Objects (Muñoz Viñas 2005: 69). Known today as the International Institute for Conservation of Historic and Artistic Works (IIC), this institute was founded in the United Kingdom (UK) in 1950 by a group of conservators from Europe and the United States (US) to "improve the state of knowledge and standards of practice and to provide a common meeting ground and publishing body for all who are interested in and professionally skilled in the conservation of museum objects" (IIC 2021b).

As Muñoz Viñas (2005: 70) observed, many museum laboratories around the world were established between these two key events – the Rome conference and the creation of the IIC – taking place. Some examples are the museum laboratory created at the Louvre in Paris, the Research Department at the Fogg Art Museum in the US, the *Istituto Centrale del Restauro* in Rome, and the scientific departments at The National Gallery and The Courtauld Institute of Art in London. Since many professionals working at museum laboratories were Funding Fellows of IIC, the institute was a strong advocate for scientific conservation. For instance, one of IIC´s main concerns was the publication of "technical literature, and original work with a scientific bias" (IIC 2021b). The chemist and conservator Harold Plenderleith (1898–1997), who became part of the BM Laboratory in December 1924 and worked closely with Scott, was one of IIC´s Founder Fellows and Treasurer.

During the second half of the twentieth century, science-based conservation became well-established, and even dominant, according to some scholars. Muñoz Viñas pointed out that scientific conservation "obtained some recognition as the best approach to conservation problems – the only valid one, actually, since non-scientific approaches were disregarded as obsolete at best, or as a product of ignorance in many other cases" (Muñoz Viñas 2005: 70). In 2005 Joyce Hill Stoner reported that "the number of conservation scientists and scientific research and analytical laboratories in the United States has increased substantially since the early 1990s" (Hill Stoner 2005: 55). In many places, the working space changed from an atelier or studio setting, more similar to that belonging to the artist, to a laboratory with microscopes and pipettes, where the conservator wears a white lab-coat like a scientist (Muñoz Viñas 2005: 70, 2020: 6–7; Étienne 2017: xii).

The aspiration to achieve scientific objectivity was considered an ideal in conservation; a special focus was laid on objects, materials and facts, as opposed to ideas and philosophical theories (Muñoz Viñas 2005: 79–80). It was believed that the main purpose was "to maintain or reveal an object's *true nature* or *integrity*" (Muñoz Viñas 2005: 65), while the conservator supposedly played a neutral role, only acting to preserve the material object. This approach to conservation based on scientific methods became so widely accepted that it was rarely challenged; as Muñoz Viñas remarked: "there is no such thing as a theory of scientific conservation. This is because hard sciences are so strongly embedded in our mindset that their validity is taken for granted" (Muñoz Viñas 2020: 6). My research shows how this aspiration to scientific objectivity, so widely associated with science-based conservation, was gradually established from the early twentieth century onwards.

Scientific methods did not initially appear as the most appropriate or only possible approach for the care and treatment of artworks. On the contrary, it required work, effort and time to turn the museum laboratory into a place of authority and establish a place for science in conservation. The early steps of this change can be observed in the BM Laboratory: Far from claiming scientific expertise as the only appropriate choice, Scott shaped the BM Laboratory into an internationally acknowledged place of authority on the conservation of artworks, based on collaboration with workers from different backgrounds and other institutions.

A close study of the textual and oral sources used in my research shows that the categorisation of different fields – such as science and conservation – is much more complex than we tend to think. If we turn to the early twentieth century to investigate how conservation was understood and practiced, as I did in this dissertation, we find an ambivalent and complex world where different actors – chemists, restorers, conservators, museum keepers, etc. – co-existed and worked together towards a shared goal, the successful care of artworks. When we analyse specific situations, actors or institutions at a microlevel, we find a wide range of professionals working together, people with diverse backgrounds and training who had all interacted directly with artworks and been involved in their care and treatment. These studies of the past therefore show that current difficulties in clearly isolating and defining the role of the conservator are not new. In fact, the history of conservation shows the opposite to be true as the role of a conservator was not a fixed one. My research illustrates how terms like "conservator" and "restorer" constantly take shape and discusses these categories and roles by bringing out attentiveness to shifting hierarchies of people and knowledge. These insights are relevant for the conservator, but also for the historian, as they shed new light on past conservation practices.

My thesis also has limitations and reveals new lines of research. Firstly, the suitability of treatments undertaken by the staff of the BM Laboratory falls beyond the scope of my research. Thus, this dissertation has not dealt with conservation treatments and their impact on the objects. Neither has my study discussed the technical advantages or disadvantages of the methods used by Scott and his colleagues as a result of the collaboration between scientists and museum workers. Moreover, the accuracy of Scott´s sources used in this dissertation has not been considered. Did the chemist record and describe every step of the treatments? Did he report all the materials and methods used? These are essential questions for conservators that remain unanswered and call for further research. For instance, what valuable information could we obtain if we followed Scott´s many instructions and reworked the recipes described in his annual reports or publications? Such experiments could shed new light on report writing practices, since by trying to follow Scott´s remarks we could elucidate how accurate the chemist´s notes were. For example, is there any information missing in his reports? Did Scott take any knowledge for granted? If so, which?

These experiments may help to answer other questions too, such as: what is today´s impact of Scott´s methods on the artworks treated during the early years of the BM Laboratory? Answering such questions would allow us to investigate and discuss treatments that were carried out in the past, since the assessment of benefits or drawbacks of past treatment methods helps us to carry forward the development of conservation methods. For instance, the application of a "gallery tone" – to tone down the colours in a painting and provide a more uniform aspect – could have been considered common practice in the past, whereas it might not be an acceptable option under today´s standards. Another example is the Pettenkofer method (mentioned in Chapter 4), which exposed oil paintings to solvent vapours. At the time, the method was believed by many to be safe and was practiced with the aim of regenerating deteriorated varnishes in favour of their removal. It was also regarded as providing successful aesthetical results, while its possible negative long-term impact for the paint layers has only been revealed by studies conducted over the past decades (Schmitt 2012). Such studies to understand the outcomes of past conservation would also provide new insights into the current state of artworks and serve as a benchmark for making conservation decisions.

Furthermore, reflecting on past actions helps us to put current conservation choices into perspective. Decisions are also made based on values associated with an object, but these values are influenced by time-period or culture, and hence may change. For example, the extent and type of intervention carried out on an object may change depending on different traditions. Whereas in a certain culture, time-period, or for a type of object it may be common practice to hide any traces of performed treatments – such as gap-filling of missing parts or colour-integration of lost areas – attitudes may vary, and in other cases, additions that are distinguishable by the naked eye may be preferred. Different weighting of the object's values may account for this, as in the former case the full visual appreciation of the object is privileged, while with the latter example, emphasis is placed upon distinguishing the new treatment from the historic object. Moreover, to disclose the values of an object requires knowledge contributed by many different experts and the decision-making process may therefore involve several stakeholders – including scientists – bringing in different modes of expertise. In addition, new technologies afford further insights into the artwork that were not possible to acquire in the past. It is common practice today to carry out scientific analyses on an object to help us understand the state of deterioration, or to characterise the artworks´ materials, among other reasons. Technological advances allow us to detect information about an object that was not possible to obtain a century ago. This new technology also brings specialists who can add valuable information, thus changing the nature of decision-making processes if compared to past practices. To summarise, investigating decision-making processes in the past and the agency of the stakeholders involved can help us re-examine conservation today, as it encourages a critical and reflexive approach in current decision-making.

By looking at the past we find changing methods, ethics and definitions of terms and concepts concerning the field of conservation. And still today it remains difficult to provide a definitive answer to the seemingly simple question: What is conservation? In the twenty-first century the boundaries of the role of a conservator are becoming more diffuse. One can observe a broad trend away from a specialised object-focused professional who works exclusively on hands-on treatments. Immaterial aspects, such as the history and values of the object are also considered essential components, involving other activities, such as research and documentation to be understood, conveyed, and preserved. Hence, conservation now covers a wider range of activities that in some cases overlap with those of other professionals, such as researchers, historians, archivists, or photographers.

The importance of this approach has been highlighted in the care of conceptual forms of contemporary art, to the extent that Agnieszka Wielocha has raised "the question of whether the set of activities carried out to safeguard contemporary art can still be called 'conservation'. In other words, should conservation remain a material oriented discipline choosing instead a new name for the emerging field of caring for contemporary art?" (Wielocha 2021: 81). Wielocha´s definition of conservation, although specially crafted for contemporary art, seems more comprehensive, as it is not only focused on material preservation, but describes conservation as "an approach that includes all activities that stem from the methodological recognition of an artwork´s identity, are aimed at safeguarding the artwork´s continuation, and are performed in an informed, structured and documented manner" (Wielocha 2021: 81).

Indeed, contemporary art conservation – a specialisation that emerged in the 1980s – has pushed the boundaries of the field since then (Wielocha 2021) and new approaches in the conservation of contemporary art are now influencing the conservation of traditional art forms. Wielocha´s study was performed within the framework of New Approaches to Conservation of Contemporary Art (NACCA) (Wielocha 2021: 2), a research and training programme that aims to resolve "fundamental questions concerning the identity, values and authenticity of modern and contemporary artworks and the consequences for their conservation" (NACCA 2021). NACCA builds on the theoretical foundations laid by the Dutch Foundation for the Conservation of Contemporary Art (SBMK for its name in Dutch), concerning the technical and ethical issues involved in the care of contemporary visual art (SBMK 2021). Moreover, architectural conservation has also questioned how built and landscape heritage are considered as immutable objects to be preserved, and proposes a new approach to preservation "as an effort toward imagination and activation, rather than conservation" (Rietveld & Rietveld 2017: 1).

This change, in which the "scientific objectivity" and the traditional "true nature of an artwork" are being questioned, is not only associated with contemporary art conservation; it has become more evident in all fields of art and cultural heritage, and a movement towards a conservation of values is taking shape (Muñoz Viñas 2020: 7). Most conservators today spend less time in front of an artwork carrying out hands-on treatments, while more time is invested in research and documentation in order to make well-informed choices for conservation and display. Thus, some argue, documentation may become as important as the object in a field that not only aims to preserve the material artworks but also the history and ideas linked to them.

These shifts in the field of conservation emphasise the importance of documenting and archiving. However, such activities change over time and examining how documentation was carried out in the past forms an essential part of conservation history studies. In my dissertation, I have investigated Scott's documentation practices: documenting was not only one of the main requirements imposed upon Scott during the first years of the creation of the BM Laboratory, but the chemist also agreed that keeping records of performed treatments and technical aspects of the artworks helped to develop safer conservation practices. In fact, it was through careful and systematic writing of this documentation that Scott achieved his goal of obtaining a permanent status for the BM Laboratory. Yet, to better understand documentation practices, the longer-term history linking the interval between Scott´s documentation methods and present-day practices remains to be written.

(Illustration next page: “The Material of the English Frit Porcelains”, by Bernard Rackham, Donald A. MacAlister and Harold James Plenderleith. *The Burlington Magazine for Connoisseurs*. 1927. Vol.51, issue 294. Page 142. Courtesy of The Burlington Magazine)

ENGLISH FRIT PORCELAINS BEFORE 1770

	Principal Substances present	I Glassy Porcelain (Calcic)	II Soapstone Porcelain (Magnesic)	III Porcelains of intermediate composition	IV Bone-ash Porcelains (Phosphatic)	V
Non-plombiferous (No flint-glass used)	(No oxide of Lead present)	CHELSEA (Red Anchor) DERBY, 1760-65	BRISTOL, 1750 WORCESTER, before 1770	LONGTON HALL (Lime 15%. No Magnesia)	BOW, 1750 LOWESTOFT, 1760	[BOW, date unknown] CHELSEA (Gold anchor) 1760 LOWESTOFT, date unknown (Derby, after 1780)
	Oxide of lead under 2% (perhaps accidental)	CHELSEA (Raised anchor)			BOW, 1750	BOW, 1750 (Derby, after 1780)
Plombiferous (Flint-glass probably used)	*Oxide of Lead* From 2% to 6%	DERBY, 1756 or earlier DERBY, 1765-70	WORCESTER, 1771 (statuette) (Caughley, 1780)			
	From 6% to 10%	LONGTON HALL (statuette)		LIVERPOOL, 1760 (Lime 15%. No magnesia) BRISTOL, 1750 (Magnesia 13%. No lime)		
	Over 10%	CHELSEA (Triangle period. Requires confirmation)				
Silica (SiO_2) ..		65% and over	Over 65% (added mainly as silicates)	63% and over	50% or less	50% (exceptionally 58%)
Lime (CaO) ..		20% (less if lead present)	Negligible or accidental	The presence of one excludes the other	Due to the bone-ash	5% to 10% additional to bone-ash
Magnesia (MgO) ..		Nil	10% to 15%		Nil	Nil
Bone-ash ..		Nil	Nil	Under 5%	25% to 45%	25% to 45%
Alumina (Al_2O_3) ..		5% (less if lead present)	5% to 7%	10% (less if lead present)	8% to 16%	8% to 20%

ot to be expected in any of the factories, with he possible exception of Worcester, and it is robable that the table will require modificaion when the series of specimens selected for nalysis has been extended by Dr. Plenderleith.

Collectors often come across "problem ieces." Certain pieces of Longton Hall and Derby have been attributed to Bow and even Chelsea. The chemist knows, however, that hatever superficial resemblance the producions of these factories may have for one another here should be no mistake about Bow if the imple test for phosphate be applied. Although Chelsea porcelains of the gold anchor period re also phosphatic the technique and motif iffer so widely from those of Bow porcelain hat their productions can seldom be confused ith one another. It is still possible for certain Derby pieces to be mistaken for Longton Hall Worcester (Dr. Wall period) from pieces made at Bristol but pieces from these factories could seldom be mistaken for Chelsea, Derby, Bow or Longton Hall even without the assistance of the chemist.

The differences between the products of Lowestoft and Bow depend on colour decoration and design rather than on composition, but pieces decorated in underglaze blue are not so easy to distinguish, and reliance has to be placed on certain characteristic features connected with workmanship and finish of detail.

III—CHEMICAL TEST FOR PHOSPHATIC PORCELAIN

By HAROLD JAMES PLENDERLEITH

The task of classifying a collection of early English porcelains requires the grouping of pieces according to the factories from which

Appendices

Table 1 - Annual reports written by Scott located in the British Museum Research Laboratory (Folder 1921-1924), arranged by year

Year	Name	Pages	Format
1919	Report on the British Museum and its scientific problems	13	Main text: 5 pages, written with a typewriter. Appendix: 8 pages, written with a typewriter with added notes and corrections in handwriting.
1922	Report on British Museum Research April 1st, 1921 to March 31st, 1922	6	Written in handwriting with added notes and corrections.
1923	Report on British Museum Research for the year April 1st, 1922 to March 31st, 1923	5	Written with a typewriter.
1924	Report on British Museum Research for the year April 1st, 1923 to March 31st, 1924	5	Written with a typewriter.
1925	Report on British Museum Research for the year April 1st, 1924 to March 31st, 1925	10	Written with a typewriter with added notes and corrections in handwriting.
1926	Report on British Museum Research for the year April 1st, 1925 to March 31st, 1926	16	Written with a typewriter with added notes and corrections in handwriting.
1927	Report on the work carried out in the British Museum Laboratory for the year April 1st, 1926 - March 31st, 1927	9	Written with a typewriter with added notes and corrections in handwriting.

Year	Name	Pages	Format
1928	Report on the work carried out in the British Museum Laboratory for the year April 1st, 1927 to March 31st, 1928	11	Written with a typewriter with added notes and corrections in handwriting.
1929	Report on the work carried out in the British Museum Laboratory for the year April 1st, 1928 - March 31st, 1929	14	Written with a typewriter with added notes and corrections in handwriting.
1930	Report on the work carried out in the British Museum Laboratory for the year April 1st, 1929 - March 31st, 1930	11	Written with a typewriter with added notes and corrections in handwriting.
1931	Report on the work carried out in the British Museum Laboratory for the year April 1st, 1930 - March 31st, 1931	13	Written with a typewriter with added notes and corrections in handwriting.

Table 2 - Publications by the British Museum Research Laboratory between 1919 and 1931, arranged by year

Year	Author(s)	Title
1921	DSIR	The cleaning and restoration of museum exhibits. Report upon investigations conducted at the British Museum by the Department of Scientific and Industrial Research (DSIR)
1923	DSIR	The cleaning and restoration of museum exhibits. Second Report upon investigations conducted at the British Museum by the Department of Scientific and Industrial Research
1923	DSIR	The cleaning and restoration of museum exhibits. Second Report upon investigations conducted at the British Museum by the Department of Scientific and Industrial Research [article in *The Analyst*]
1926	DSIR	The cleaning and restoration of museum exhibits. Third Report upon investigations conducted at the British Museum by the Department of Scientific and Industrial Research
1926	Chapman & Plenderleith	Examination of an Ancient Egyptian (Tut- ankh-Amen) Cosmetic
1926	Plenderleith	Appendix V: Report on the examination of specimens from the tomb of king Tut.ankh.amen
1927	Plenderleith	Chemical test for phosphatic porcelain
1927	Plenderleith	Laboratory Notes: English Porcelain: An Aid to Classification
1927	Scott & Hall	Laboratory Notes: Egyptian Leather Roll of the Seventeenth Century B.C.
1927	Plenderleith	Laboratory Notes: The Preservation of Book-Bindings
1928	Plenderleith	Laboratory notes
1930	Plenderleith	Black Polished Pottery from Urn-Burials in the Wynaad

Year	Author(s)	Title
1930	Plenderleith	Review of: H.W. Nichols, Restoration of Ancient Bronzes and Cure of Malignant Patina
1930	Plenderleith	International Conference on the Examination and Preservation of Works of Art
1930	Scott	The Protection of Colours from Light
1931	Plenderleith	Laboratory Notes: A Thirteenth-Century Chalice and Paten from Canterbury Cathedral
1931	Plenderleith	Review of: W.F. Collins, The Corrosion of Early Chinese Bronzes
1931	Scott & Plenderleith	Protective Screens for Coloured Objects

Table 3 - Minutes of the British Museum board meetings, arranged by year

Years	Details	Title
1913–1915	Vol. 57, pages 3127 to 3354	Minutes of the British Museum Board Meetings
1915–1918	Vol. 58, pages 3355 to 3600	Minutes of the British Museum Board Meetings
1918–1922	Vol. 59, pages 3601 to 3911	Minutes of the British Museum Board Meetings
1922–1925	Vol. 60, pages 3912 to 4207	Minutes of the British Museum Board Meetings

Table 4 - Retrospective sources, arranged by year

Year	Author	Title
1932	Scott	Romance of Museum Restoration
1960	Plenderleith	Reminiscences from the Laboratories
1978	Plenderleith	Interview of Harold Plenderleith
1998	Plenderleith	A History of Conservation

Table 5 - Sources presenting pigment analysis in nineteenth-century England

Reference for the author´s publication	Author and date of the publication	Analyst and date of the analysis	Reference for the analyst´s report [99]	Sample provenance
(Capon 1835)	William Capon 1835	William Capon Pre-1824		Painted Chamber – Westminster (No samples taken)
(Davy 1815)	Humphry Davy 1815	Humphry Davy 1814		Greek/Roman archaeological sites
(Davy 1817)	Humphry Davy 1817	Humphry Davy 1815		Roman house in Sussex
(Hamilton 1842)	William R. Hamilton 1842	Michael Faraday 1837	(Faraday 1837a) (Faraday 1837b)[100]	Greek/Roman archaeological sites
(Rokewode 1885)	John G. Rokewode 1885	Michael Faraday Pre 1842		Painted Chamber - Westminster

[99] In the cases where the chemist´s report is quoted word by word by the author of the publication, a bibliographical reference for the report itself is also included in the references.

[100] The two letters written in 1837 by Faraday – which are quoted in Hamilton´s publication – are referenced separately: the first one dated in April (Faraday 1837a) and the second one dated in June (Faraday 1837b).

Reference for the author´s publication	**Author and date of the publication**	**Analyst and date of the analysis**	**Reference for the analyst´s report**	**Sample provenance**
(Smith 1807)	John T. Smith 1807	John Haslam c.1802	(Haslam 1802)	St. Stephen´s Chapel - Westminster
(Smithson 1824)	James Smithson 1824	James Smithson 1824		Egyptian archaeological site
(Wilkinson 1837)	John G. Wilkinson 1837	Andrew Ure 1837	(Ure 1837)	Egyptian archaeological site

Table 6 - List of the reports published between 1845 and 1857, arranged by date

Date	Title of the Report	Committee members/Commissioners (as shown in the reports)
May 1845	The National Gallery: Observations on the unfitness of the present building for its purpose	Charles Eastlake
1 September 1848	Report from the Select Committee appointed to consider the best mode of providing additional room for works of art given to the public or purchased by means of parliamentary grants	Committee nominated: Lord John Russell, Sir Robert Peel, Mr. Hume, Tiscount Morpheth, Mr. Goulburn, Mr. Baring Wall, Mr. Charteris, Earl of Lincoln, Sir Benjamin Hall, Marquis of Granby, Mr Parker, Mr. Wakley, Mr. Disraeli, Mr. Vernon Smith, Mr. Bankes
24 May 1850	Report on the subject of the Protection of the Pictures in the National Gallery by Glass	Charles Eastlake, Michael Faraday and William Russell
25 July 1850	Report from the Select Committee on the National Gallery; together with the Minutes of Evidence, Appendix and Index	Committee nominated: Lord John Russell, Sir Robert Peel, Mr. Hume, Lord Seymour, Mr. Goulburn, Mr. Baring Wall, Mr. Sidney Herbert, Sir Benjamin Hall, Marquis of Granby, Mr. Tufnell, Mr. Wakley, Mr. Disraeli, Mr. Vernon Smith, Mr. Bankes, Colonel Rawdon
16 November 1850	Further report on the subject of the Protection of the Pictures in the National Gallery by Glass	Charles Eastlake, William Russell and Michael Faraday

Date	Title of the Report	Committee members/Commissioners (as shown in the reports)
4 August 1853	Report from the Select Committee on the National Gallery with the Proceedings of the Committee, Minutes of Evidence, Appendix and Index	Committee nominated: Colonel Mure, Mr. Labouchere, Mr. Charteris (Lord Elcho), Sr. Stirling, Mr. Raikes Currie, Mr. Monckton Milnes, Mr. Marshall, Lord Seymour, Mr. Vernon, Lord Brooke, Mr. Goulburn, Mr. Ewart, Mr. Baring Wall, Sir William Molesworth, Mr. Hardinge, Lord William Graham and Mr. Hamilton.
15 June 1857	Report of the National Gallery Site Commission	Commissioners: John Cam Lord Broughton, Henry Hart Milman, Richard Ford,[101] Michael Faraday, Charles Robert Cockerell, and George Richmond

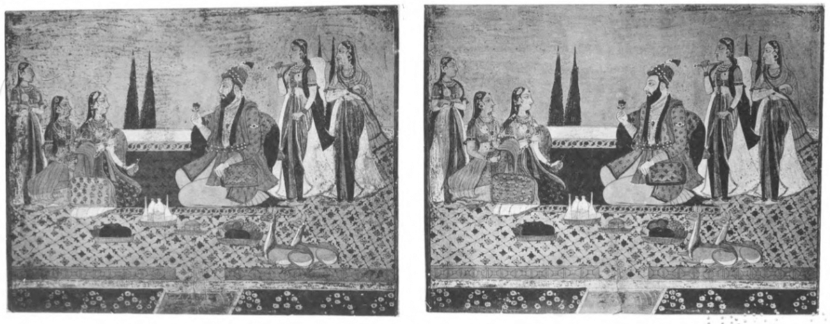
[101] Unable to perform his duties due to an illness, Ford did not remain part of the commission (Broughton *et al.* 1857: iii).

Table 7 - Staff members of the British Museum Laboratory from 1919 to 1931, as mentioned in the sources [102]

Year	Alexander Scott	Ernest Padgham	Leonard Bell	Harold Plenderleith	R.B. Dent	Margaret Binyon
1919	Director	Lab assistant	Lab assistant			
1920	Director	Lab assistant	Lab assistant			
1921	Director	Lab assistant	Lab assistant			
1922	Director	Lab assistant	Lab assistant			
1923	Director	Lab assistant	Lab assistant			
1924	Director	Lab assistant	Lab assistant	Chemist		
1925	Director	Lab assistant	Lab assistant	Chemist		
1926	Director	Lab assistant	Lab assistant	Chemist	Volunteer assistant	
1927	Director	Lab assistant	Lab assistant	Chemist	Volunteer assistant	Volunteer assistant
1928	Director	Lab assistant	Lab assistant	Chemist		Volunteer assistant
1929	Director	Lab assistant	Lab assistant	Chemist		Volunteer assistant
1930	Director	Lab assistant	Lab assistant	Chemist		
1931	Director	Lab assistant	Lab assistant	Chemist		

[102] This table is based on information collected from the following textual sources: Alexander Scott´s reports from 1919 to 1931, interview of Harold Plenderleith in 1978, letters between Scott and the Office of Works during 1926.

Image 1 - Photos comparing before and after treatment



BEFORE. AFTER.

FIG. 1.—INDIAN COLOURED DRAWING TREATED WITH HYDROGEN PEROXIDE VAPOUR.

(DSIR 1923a: between pages 2 and 3)

Public domain, digitized by Google, original from University of California. Courtesy of HathiTrust.

Image 2 - Left photo showing entire vase. Middle and right photos showing detailed images of deterioration

FIG. 16. FIG. 16A. FIG. 16B.

(DSIR 1926: no page number)

Public domain, digitized by Google, original from Princeton University. Courtesy of HathiTrust.

(Illustration next page: "Lectures (Session 1933-34)", by the Courtauld Institute of Art. 1934. Page 1. Courtesy of the Courtauld Institute of Art)

Lectures marked * are open to the public on payment of the specified fee.

Lectures marked ** are open to the public without fee.

Tickets will be issued strictly in order of application, which should be made to the Dir
Courtauld Institute of Art, 20 Portman Square, W.1.

SUMMER TERM, April 24th—June 26th, 1934

Professor DICKIE	History of Architecture. Eight lectures. Fridays, Apr May 4, 11, 18, at 3 p.m.; Saturdays, April 28, May 19, at 11 a.m. (Continuation of Lent Term Course.)
Mr. W. W. WATTS	Metalwork and Enamels. Six lectures. April 24, 2 May 1, 2, 3, at 11 a.m. Fee £2-2-0.
Mr. A. M. HIND	Engraving: with Special Reference to Early Italian Six lectures. May 28, 29, 30, 31, June 1, 4, at 2 p.m. Fee £
Mr. J. BYAM SHAW	18th Century Venetian Painting. Four lectures. Ap 27, May 2, 4, at 12 noon. Fee £1-11-6.
Professor CONSTABLE . . .	17th and 18th Century Spanish Painting. Three lec April 30, May 1, 3, at 12 noon. Fee £1-1-0.
Dr. F. ANTAL	Classics and Romantics. Three lectures. May 7, 9, 12 noon. Fee £1-1-0.
*Mr. H. L. WELLINGTON . . .	Nineteenth Century French Art. Six lectures. May 16, at 11 a.m. and 5.30 p.m. Fee £2-2-0.
Mr. HERBERT READ	The Aesthetic Basis of Modern Art. Six lectures. M 17, 22, 24, 29, 31, at 12 noon. Fee £2-2-0.
*M. ALBERT GLEIZES	Introduction historique et critique à la peinture mo Two lectures. June 4, 5, at 5.30 p.m. Fee 10/-
**Dr. MONTAGUE JAMES . . .	The Hortus Deliciarum. May 24, at 5 p.m.
Dr. PETER BRIEGER	Geographical Influences on the History of Art. Two le May 3, 4, at 5.30. Fee 15/-.
Professor CONSTABLE . . .	Methods and Materials of Painting. Four lectures. 10, 14, 18, at 12 noon. Fee £1-11-6.
*M. DE LOREY	Islamic Painting. Three lectures. May 28, 29, 31, at 5-3
Mr. H. RUHEMANN	The Technique of Old Masters and their Conservation. lectures. April, 24, 26, May 1, at 4.30 p.m. Fee £1-1
Professor W. PERCEVAL YETTS .	Chinese Script and Epigraphy. Nine classes of one hou beginning April 25, at 2.30 p.m. Fee £3-3-0.
**Professor PAUL PELLIOT . . .	Recent Progress in Chinese Archæology. April 30, at 5.
Thomson	May 23 & 25 at 12 noon

UNDER INTERCOLLEGIATE ARRANGEMENTS.

Professor ASHMOLE (University College). History of Ancient Sculpture. Wednesdays, be April 25, at 5.30 p.m.

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(Illustration next page: Letter to Arthur Lee, by Patrick Ritchie. 1934. Page 1. Courtesy of the Courtauld Institute of Art.)

Private.

17, MONTGOMERIE CRESCENT,
SALTCOATS,
AYRSHIRE.

Lord Lee of Fareham.

Dear Sir,

I have to thank you for your confidential letter of 7th June.

It was with great pleasure I heard that my application has received such favourable consideration by the Interviewing Committee of the Courtauld Institute: & it will be quite possible for me to obtain leave from my work here

Nederlandse samenvatting
Acknowledgements
Curriculum Vitae

Nederlandse samenvatting

Vandaag is de samenwerking tussen wetenschap en conservering staande praktijk in musea. Discussies over de mogelijkheden en de grenzen van deze samenwerking worden veelvuldig bediscussieerd in bijdragen van conservatoren aan congressen en publicaties. Terwijl de behandeling van kunstwerken en archeologische objecten een lange traditie kent, is deze samenwerking een relatief nieuwe tendens binnen de conservering van cultureel erfgoed. Pas in de periode tussen 1930 en 1950 werd de wetenschappelijke conservering een alom aanvaarde praktijk. Overal ter wereld werden gedurende deze periode museale laboratoria gevestigd. Maar hoe werd wetenschap een fundamenteel onderdeel van de conserveringspraktijk? En welke rol speelden laboratoria hierin? Historisch onderzoek naar de samenwerking tussen wetenschappers en zij die verantwoordelijk waren voor het behandelen van kunstwerken gedurende het interbellum, legt de processen bloot waarmee wetenschappelijke conservering algemeen aanvaard werd. De focus van deze dissertatie ligt op de periode na de Eerste Wereldoorlog, een periode waarin de toezichthouders van het British Museum (BM) geconfronteerd werden met de achteruitgang van een aanzienlijk deel van de collectie van het museum. De chemicus Alexander Scott (1853-1947) werd aangesteld om de zorg en behandeling van het verloederde deel van de collectie aan te pakken. Het ontstaan en de eerste twaalf jaar van de geschiedenis van het laboratorium van het British Museum, onder leiding van Scott als de eerste directeur, vormt de kern van deze dissertatie. Mijn onderzoek eindigt in 1934, wanneer de eerste stappen worden gezet om chemie in het conserveringsonderwijs aan het Courtauld Institute of Art te introduceren, geïnspireerd door de ideeën van het BM Laboratorium.

De vestiging van het BM Laboratorium wordt gezien als een scharniermoment in de conserveringsgeschiedenis. Het BM Laboratorium kwam in 1919 tot stand als een tijdelijk initiatief, met als doel de behandeling van verloederde objecten uit de museale collectie, objecten die gedurende de Eerste Wereldoorlog opgeslagen werden in het London Underground systeem, te ondersteunen. In de twaalf jaren daarna ontwikkelde het laboratorium zich zo dat het gezien werd als van cruciaal belang voor museale conservering. Het laboratorium verwierf permanente status in het museum, als een van de eerste museale laboratoria ter wereld. Gedurende de vroege twintigste eeuw volgden andere toonaangevende kunstinstellingen het voorbeeld van het BM Laboratorium; ze vestigden museale laboratoria, waarin kunstwerken en andersoortig cultureel erfgoed werden behandeld, en technieken werden ontwikkeld voor het wetenschappelijk onderzoeken van kunstwerken en conservering. Juist in deze eerste museale laboratoria pionierden de museale collectiebeheerders en chemici in de samenwerking aan een gemeenschappelijk doel, namelijk de zorg voor kunstwerken. Natuurwetenschappers – vaak chemici – werden geconfronteerd met de uitdagingen van het behandelen van kunstwerken, en gingen die confrontatie aan met particuliere restauratoren en restauratoren in loondienst van het museum.

Er wordt vaak geargumenteerd dat de oprichting van museale laboratoria de houding van wetenschappers jegens kunst heeft veranderd. Dit argument wordt in deze dissertatie verder uitgewerkt, daar ik onderzoek hoe wetenschappers en de personen verantwoordelijk voor de zorg en de behandeling van kunstwerken in de praktijk samenwerkten. Ondanks het feit dat de totstandkoming van het BM Laboratorium wereldwijd beschreven wordt als een mijlpaal in de conserveringsgeschiedenis, hebben academici weinig aandacht besteed aan de manier waarop deze samenwerking bijgedragen heeft aan de vorming van wetenschappelijke conserveringspraktijken. Onderzoek naar de totstandkoming van het BM Laboratorium brengt aan het licht hoe conservering en wetenschap hand in hand gingen. Deze dissertatie is gericht op de eerste jaren van het BM Laboratorium, aangezien de pionier status van het laboratorium betekende dat er op de werkvloer diende te worden uitgevonden hoe restauratoren en wetenschappers op dagelijkse basis wilden samenwerken onder condities die nagenoeg gene precedenten hadden. De vroege jaren van het BM Laboratorium vormen een sleutelmoment, op basis waarvan we inzicht kunnen verwerven in hoe de samenwerking tussen wetenschappers en museumpersoneel aanvankelijk vorm kreeg.

Dit onderzoek is gebaseerd op een analyse van zowel tekstuele als orale bronnen, met Scotts jaarverslagen als de belangrijkste primaire bronnen. Gedurende de eerste twaalf jaar van het BM Laboratorium schreef Scott over de verschillende behandelingen van kunstwerken. Scott spreekt in zijn verslagen over de fundamentele verandering in de status van het laboratorium, van tijdelijk naar permanent; over de beperkingen waarmee het personeel geconfronteerd werd, maar ook over de uitkomsten van de samenwerking tussen wetenschappers en museumpersoneel. In zijn verslagen beschrijft Scott niet alleen ongebruikelijke behandelingswijzen, maar ook de uitdagingen die museumpersoneel tegenkwam tijdens het uitvoeren van experimenten. Ook zijn bevindingen over de eigentijdse restaurator en zijn originele ideeën over het vakgebied komen uitgebreid aan bod in zijn verslagen, soms impliciet en soms expliciet.

Dit onderzoek draait om de volgende hoofdvraag: Hoe kreeg de samenwerking tussen wetenschappers en verantwoordelijk museumpersoneel vorm gedurende de vroege jaren van het BM Laboratorium? Ik argumenteer dat de creatie van het laboratorium de samenwerking tussen wetenschappers en verantwoordelijken van museale collecties bevorderde, wat leidde tot de totstandkoming van effectieve manieren van uitwisseling in het BM Laboratorium. Deze manieren van uitwisseling zouden later breed geaccepteerd en toegepast worden in het veld van conservering; een fundamentele stap richting een wetenschappelijke conserveringspraktijk. Daarenboven, door de nadruk te leggen op samenwerking en openheid, was Scott in staat om een permanente status te bewerkstelligen voor het BM Laboratorium.

Vandaag wordt in het veld van conservering sterk de nadruk gelegd op het belang van ethiek, interdisciplinaire samenwerking, openheid en opleiding. Deze idealen zijn dusdanig essentieel voor het vakgebied, dat we geneigd zijn ze voor lief te nemen, en over het hoofd zien dat ze gedurende de vorige eeuwen geleidelijk vorm kregen. De sterke nadruk die de scheikundige Scott legde op deze idealen maakte het voor hem mogelijk om permanente status te bewerkstelligen voor het laboratorium als een departement binnen het museum. Dit droeg bij aan de vestiging van conservering als een wetenschappelijk beroep. Om deze reden wordt in elk hoofdstuk van mijn dissertatie een van deze concepten behandeld, wederom gericht op de eerste twaalf jaar van de geschiedenis van het BM Laboratorium, vanaf de oprichting in 1919 tot 1931.

Samenwerking tussen deskundigen uit verschillende disciplines is een essentieel onderdeel van het vakgebied van conservering. In het bijzonder de betrokkenheid van wetenschappers in onderzoek naar en de behandeling van kunstwerken is significant. Vanaf het einde van de achttiende eeuw mengden wetenschappers zich steeds meer in restauratiewerk; gedurende de twintigste eeuw werd de interactie tussen wetenschappers en collectiebeheerders nog groter. In relevante academische literatuur worden de bijdragen van wetenschappelijk onderzoek aan conservering sterk onderstreept, terwijl de samenwerking tussen wetenschappers en museumpersoneel slechts kort genoemd wordt. In deze dissertatie zal ik uitvoerig ingaan op deze samenwerking, die ontstond in het BM Laboratorium. Mijn onderzoek in hoofdstuk 1 zal aantonen hoe de nadruk die Scott legde op samenwerking van groots belang was voor de veranderende status van het BM Laboratorium, van een tijdelijke faciliteit naar een permanente afdeling. Ik zal betogen dat wetenschappelijk expertise niet opgelegd werd aan museumpersoneel; in tegendeel, de expertise diende als hulpmiddel bij het maken van keuzes gedurende het behandelproces van kunstwerken.

Daarenboven wordt in het veld van conservering sterke nadruk gelegd op ethische overwegingen aangaande de integriteit van de objecten. Ethiek bestaat niet uit een op zichzelf staand, statisch geheel aan regels, integendeel, deze ethiek is dynamisch, ze verandert doorheen de tijd, en verschilt ook van land tot land. Het ethische bewustzijn van de wetenschappers die in het BM Laboratorium werkten wordt zichtbaar in Scotts verslagen. Maar hadden wetenschappers die onderzoek deden naar kunstwerken ook al ethische overwegingen aangaande de integriteit van objecten voordat museale laboratoria werden opgericht? In Hoofdstuk 2 zal ik aantonen dat negentiende-eeuwse wetenschappers een ethisch perspectief op het behoud van de integriteit van kunstwerken nastreefden. Hierbij legden deze wetenschappers wederom de nadruk op samenwerking met museumpersoneel. Bovendien zal ik beargumenteren hoe preventieve maatregelen, ontworpen in zo'n context van samenwerking in de loop van de negentiende eeuw, later geïmplementeerd werden door de collectiebeheerder van de National Gallery, Ralph Nicholson Wornum (1812-1977).

Hoewel deze twee voorbeelden typerend zijn voor samenwerking tussen wetenschappers en museale collectiebeheerders vóór de twintigste eeuw, beschrijven ze enkel incidentele gevallen, in tegenstelling tot museale laboratoria, waar samenwerking plaatsvond op reguliere basis. Toch vormden deze casussen een voorbeeld voor Scott, precedenten aan de hand waarvan hij zijn strategie ontwikkelde voor de oprichting van een permanent museaal laboratorium.

Voorts zal ik in hoofdstuk 4 onderzoeken hoe wetenschappelijke kennis onderdeel werd van de opleiding van restauratoren. Vóór de twintigste eeuw werd de behandeling van kunstwerken gezien als een ambacht, overgebracht van meesters op leerlingen. De opkomst van museale laboratoria in de vroege twintigste eeuw veranderde de manier waarop museumpersoneel verantwoordelijk voor de behandeling van museale collecties werd opgeleid. Met de tijd verving universitair onderwijs het model van meester en leerling, en wetenschap werd een fundamenteel aspect van de opleiding. Hoofdstuk 4 behandelt de principes die werden onderwezen in het BM Laboratorium, de communicatie tussen het BM en andere instanties, en de internationale uitwisseling van personeel tussen museale laboratoria. Ik beargumenteer dat de verstrekte opleiding in het BM Laboratorium van invloed was op de institutionalisering van het BM Laboratorium. Het totstandkomingsproces van het Scientific Research Department aan het Courtauld Institute of Art toont bijvoorbeeld hoe de principes ontwikkeld in het BM Laboratorium toonaangevend waren in de ontwikkeling van wetenschappelijke, universitaire cursussen over conservering.

Acknowledgements

I would like to thank my supervisors Sven Dupré and Ella Hendriks for their guidance in this dissertation and Jenny Boulboullé for her support and our fruitful discussions. My gratitude extends to the Artechne team members Thijs Hagendijk, Marieke Hendriksen, Jill Briggeman, Marleen Schans and Jessie Wei-Hsuan Chen for being great colleagues.

I also want to thank Valerie Vocking for her translation of my English summary into Dutch, and Francesca Bewer, Elizabeth Pye, Simon Lambert and Michael von der Goltz for their helpful comments and generosity regarding the bibliography.

This research was only possible due to significant help from all the staff working at the libraries and archives of The National Gallery London, The British Museum, The Victoria & Albert Museum, The Courtauld Institute of Art, The AIC Oral History project, Harvard University Art Museums and The Royal Institution of Great Britain.

Finally, a special thanks to Duncan Hook, from the British Museum, who allowed me access to the archives of the Department of Scientific Research and helped me find Alexander Scott´s annual reports.

Curriculum Vitae

Mariana Pinto is an objects conservator. She has a university degree in Art History (2012) and a MSc in Conservation Studies (2015). In 2016 Mariana joined the ERC-funded ARTECHNE project “Technique in the Arts. Concepts, Practices, Expertise, 1500-1950” as a PhD candidate. Her dissertation is about science and conservation in the early twentieth-century England.

List of Publications

Pinto, Mariana. 2018. “Taking Paint Samples for Pigment Analysis in Nineteenth-Century England”. *Studies in Conservation*: 1–6. DOI: 10.1080/00393630.2018.1550612.

Pinto, Mariana. 2021. “The Turner Drawings and a Keeper’s Diary: Preventive Conservation in the National Gallery, London in the Second Half of the Nineteenth Century”. *History of Humanities*, Volume 6, Number 1. https://doi.org/10.1086/713269

after careful consideration as to the means of provi[ding the]
B. M. with the scientific assistance which it urgently re[quires]
I see no ~~other~~ ~~alternative to~~ other satisfactory met[hod]
than the foundation of a British scientific department preferably w[ithin the]
precincts of the Museum and thus avoiding any difficulty as to t[he removal]
of objects belonging to the Museum

I therefore venture to recommend to the Council th[at]
a move in this direction be made at once by the establish[ment of]
a small but well equipped chem. lab. capable of extension
~~[illegible]~~ in the future.

It may tend towards a concise idea if I add a few [brief]
notes as to the initial minimum

In order to provide the B. M. with the scientific assistance & advice so [urgently]
required I can think of ~~no better~~ ~~or more~~ ~~method~~ nothing
will prove of greater utility and value than the maintenance ~~establishment~~
the precincts of the Museum of a small but well equipped chemical [lab.]

I therefore venture to recommend to the Council [that]
steps should be taken at once to establish ~~foundation~~ of a chemi[cal lab.]
at the B. Museum ~~[illegible]~~ with sufficient staff and equipment [to carry]
out efficiently the work which will fall to it to do.

Should the Council agree with this recommendation th[e following]
notes may prove ~~of~~ useful ~~as a basis for later arrangement~~

The staff at first need only consist of

A. A Director who would discuss all pr[oblems]
with the heads of the various departments and di[rect]
experimental work in the laboratory