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Touching anatomy: On the handling of preparations in the anatomical cabinets of Frederik Ruysch (1638–1731)



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ABSTRACT

This paper argues that the anatomical Cabinets of Dutch anatomist Frederik Ruysch must be understood as an early modern workshop in which preparations were continuously handled. It is claimed that preparations actively appealed to anatomists and visitors to handle, re-dissect, touch, and even kiss them. Touching anatomy, therefore, not only refers to the physical handling of objects, but also to the ways preparations impacted on visitors and touched them emotionally.

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1. Introduction

One of the many bizarre stories in the history of medicine is a tale about the Russian Czar Peter the Great and his visit to the anatomical Cabinets of anatomist Frederik Ruysch in Amsterdam. The Czar was greatly impressed with the collections, in particular with the lifelike way in which Ruysch had preserved the tiny bodies of infants and babies. The story goes that he was so moved by the appearance of a child, which looked as if it were asleep, that he picked it up and kissed its rosy cheek.

Historians have often repeated this story. Few have taken it seriously, however. It has often been omitted from academic work on Ruysch. If historians mention the episode at all, it is almost always in a metaphorical way, not in reference to a real event. For instance, the research team who recently launched a virtual museum exhibiting the Ruysch collections kept in the *Kunstkamera* in St. Petersburg, a joint venture involving Russian and Dutch historians of science and medicine, called the episode a 'fairytale'.¹

They seem to adhere to the argument put forward by art historian Julie Hansen, that

the tale of the czar's embrace implies more than deception by mere imitation: Peter was not tricked into believing that the beautifully preserved child was actually alive; rather it was its eloquence and innocence that provoked his desire to embrace it, and later to possess it.²

Luuc Kooijmans, author of the most recent Ruysch biography, leaves the question of whether the story is true unresolved, but similarly relates the Czar's embrace and kiss to his admiration for the lifelike appearance of the preparations.³ When seen this way, the story mainly highlights the level of artistry of the preparations—they looked so lifelike that visitors could even imagine kissing them. Historians have mainly left it at that and never seriously considered the possibility that the Czar physically touched and kissed the preparation.

Yet there is more truth in the story than we acknowledge. For a start, Ruysch himself described the episode in his collected works.

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¹ According to Anna B. Radzjoen, curator of the Ruysch collections at the *Kunstkamera*, St. Petersburg. See: <http://ruysch.dpc.uba.uva.nl/cgi/t/text/text-idx?page=ruysch-rusland;c=ruysch;cc=ruysch>.

² Hansen (1996), p. 673. See also Roemer (2010) and Jorink (2006).

³ Kooijmans (2004), p. 240.

He proudly stated: 'I prepared the face of a boy so beautifully that a certain great monarch in Europe embraced it and kissed it'.⁴ Moreover, I would argue that at the time it was considered normal to touch and even handle preparations while visiting an anatomical collection. So it is not unimaginable that Ruysch took the child's head out of its container for Peter the Great to hold. This means that, as well as emphasizing the great beauty and perfection of Ruysch's Cabinets, the story gives an important insight into how particular audiences physically and emotionally responded to preparations. In other words, Czar Peter's kiss shows that when we think of Ruysch's preparations solely in terms of their visual beauty, we overlook crucial aspects of how historical actors actually handled and experienced them.

One important reason why historians have hardly ever considered the daily goings-on in Ruysch's Cabinets is that we tend to think about early modern anatomical collections in a nineteenth-century way. Historians of collections and museums have marked the nineteenth century as the period when collections turned into museums, whereby the 'museum is a kind of entombment, a display of once lived activity' and 'collecting is the process of the museum's creation, the living act that the museum embalms'.⁵ What is more, in museum studies it is generally assumed that museums in the nineteenth century adopted a hands-off policy and changed into disciplining institutions, forcing visitors to keep a respectful distance.⁶ In medicine the detachment between anatomical objects and their viewers further increased after the 'laboratory revolution' in medicine and the 'birth of the clinic' pushed anatomical collections into the inaccessible domain of medicine. The ensuing break in the ways anatomy was practised and experienced created a radical divide between medical professionals and students on the one hand, and a lay public for whom it became increasingly difficult to visit and experience anatomical collections on the other.⁷ Whatever was happening behind the doors of medical collections was so much hidden from the public eye, that it has often been assumed that preparations—in particular early modern pieces—became obsolete objects, no longer actively used, merely collecting dust on the shelves. Practices of handling preparations were slowly forgotten. Only recently have historians started to acknowledge that nineteenth-century 'museum medicine', far from forgetting anatomical collections, in fact continued early modern practices of touching, handling and re-dissecting anatomical preparations.⁸

Yet, although historians have started to rewrite the history of nineteenth-century anatomical collection practices, the way we tend to look at eighteenth-century anatomical collections is still heavily influenced by the austere and disciplining image of medical collections as secluded spaces full of 'hands-off' specimens which, once made, were carefully locked away on the shelves of anatomical museums. This is also how historians generally view Ruysch's anatomical preparations—as 'pieces of art', showing God's providential hand in creation, carefully arranged on the shelves to be admired from a safe distance. This image of Ruysch's Cabinets does not however do justice to the fact that Ruysch was always working on and re-using his preparations in the pursuit of new research questions. Nor does it consider how preparations affected visitors, who actively and emotionally engaged with the preparations.

This paper offers a new reading of how anatomy was 'done' in the early eighteenth century. It emphasizes hands-on practices and experiences, the trial and error method of doing anatomy, and the active involvement of both lay and professional audiences. Rather than solely focussing on the sense of sight in the analysis of objects—as is so often the case in the historiography of the visual and material culture of the sciences—the paper follows recent work on the import of the other senses in the making of the sciences.⁹ In so doing it provides an explanation of why Peter the Great's kiss was not so bizarre (even though we shudder at the thought of it).¹⁰

The argument builds on the work of historians and art historians who have hinted at more active and commercial uses of objects in collections. Historian Daniel Margocsy has rightly drawn attention to the fact that anatomists—including Frederik Ruysch—were regularly involved in the marketing of anatomical objects as expensive luxury goods with a significant financial value.¹¹ This argument in itself makes the preparations more profane, i.e. it focuses our attention away from the moral (*memento mori*) messages that have always been at the centre of historical attention.¹²

Moreover, it has been argued that on the art market owners, visitors and potential buyers habitually picked up pieces of art to closely examine them. This is visible on prints of the Antwerp art market, for instance.¹³ Art historian Geraldine Johnson has similarly argued that small-scale sculpture on the Italian market was meant 'to be savoured at close quarters, [and] turned in the hand'. However, as Johnson states, 'the evidence for and implications of such encounters have only rarely been examined in any depth'.¹⁴

Historians of wax models have also stressed the importance of physically experiencing objects. They have argued that wax models—as opposed to earlier anatomical rituals—brought anatomy closer to people. No longer viewed from a distance during a public dissection, organs and body parts could be brought within close proximity of viewers. The materiality of soft, malleable and moist-looking wax gave the models a 'lifelike' appearance, i.e. the choice of material highlighted the anatomist's capacity to replicate life and, as it were his ability to cross the line between the natural and the artificial. Moreover, wax modellers' explicit decision to focus on the senses suggests an intimate connection between anatomy and sensory experience.¹⁵ A material disadvantage of the models was that they were extremely fragile—handling them was reserved for a privileged few. Anna Maerker has argued that in Florence more widespread physical involvement of visitors began in the 1780s with the making of wooden 'dissectible models'.¹⁶

However, although historians have hinted at the importance of handling objects in collections, what the handling actually entailed often remains unclear. I offer here a detailed description of proceedings in Ruysch's Cabinets in pursuit of the argument that we should consider Ruysch's anatomical Cabinets as a typical early modern workshop and the knowledge that emerged from this workshop as a tacit and sensory kind of knowledge embodied in preparations.

⁹ See Roberts (1995) and Roberts et al. (2007) and Ragland (2012).

¹⁰ On the importance of studying hands-on knowledge see: Roberts et al. (2007), p. 38. See also Smith (2004).

¹¹ Margocsy (2011). See also Margocsy (2009). Margocsy's argument is in line with the fairly recent focus among historians on the relationship between collections, craftsmanship and commerce. See for instance Guerrini (2004) 219–239 and Smith & Findlen (2002).

¹² See for instance: Huisman (2009) and Jorink (2006).

¹³ See Honig (1999).

¹⁴ Johnson (2012), p. 183.

¹⁵ Dacome (2007). See also: Messbarger (2010) and San Juan (2011).

¹⁶ Maerker (2011, 2013).

⁴ Ruysch (1744), p. 1222. Unless stated otherwise it is this edition of Ruysch's Works that I have used. The translations of the Dutch are mine.

⁵ Eilsner (1994), p. 155.

⁶ For the history of the nineteenth-century museum as disciplining institutions see: Hooper-Greenhill (1992), Bennet (1995) and Alberti (2009).

⁷ Huijstra (2013).

⁸ Huijstra (2013), pp. 4–5. See also Alberti (2007) and (2011) and McLeary (2001).

Historian Pamela Smith has summarized the nature of the artisanal knowledge of early modern workshops in five important characteristics:

1. It is produced 'in the act of doing' and refers to what scholars of pedagogy call 'the situated nature of learning'.
2. It was collaborative and resulted in a body of techniques and knowledge that was transmitted in an integral and coherent way.
3. Craft knowledge was demonstrated in public. Artisans proved their mastery of a craft by producing a masterpiece.
4. Craft knowledge was empirical, employing observation, precision, and investigative experimentation.
5. Proceedings in the workshop were never totally controlled by the master but influenced by the vagaries of the physical and social world, which means that knowledge was continually being refined, enriched, or completely revised by experience.¹⁷

All five points are applicable to Ruysch's anatomical Cabinets:

1. Ruysch's anatomical knowledge was produced in the act of doing. The refinement of his injection methods fuelled anatomical theories and, conversely, anatomical assumptions often required the improvement of instruments and techniques.
2. Although Ruysch carefully kept his methods of injecting secret, his anatomical ideas and his methods of preparing were a matter of debate. Colleagues and students gathered in the Cabinets to examine and discuss preparations. The spatial arrangement of Ruysch's house was similar to the set-up of artisanal workshops: the anatomy rooms were simultaneously used for working, exhibiting and lecturing, which means that workbenches and tables shared the same rooms as the shelves containing the preparations.
3. Ruysch's Cabinets were a public place of learning, not only for colleagues and students, but also for lay audiences, who were invited to physically experience his preparations and to declare the truth of Ruysch's anatomical claims. Ruysch enthusiastically showed off his mastery in complicated preparations. The famous tableaux of tiny skeletons standing on heaps of bones and stones (which represent a graveyard) carrying moral messages in the form of flowers (symbolizing mortality), trumpets (referring to the day of judgement) or toys (life is but a game) represent such masterpieces.
4. It goes without saying that the knowledge emerging from the Cabinets was empirical. In fact, visitors were continuously invited to empirically experience, to closely inspect and handle objects.
5. The bulk of Ruysch's preparations were working material. In line with the common notion that workshop products were never finished, Ruysch was continuously adjusting and improving his preparations.

The most important source materials for studying Ruysch's collections are the preparations themselves.¹⁸ Invaluable are Ruysch's own descriptions of his collections, the *Thesauri* and his *Opera omnia anatomico-medico-chirurgica* (1721–1722), published posthumously in 1744. The collected works not only contain the extended catalogues of the collections but also case notes on the

patients whose bits and pieces ultimately ended up as preparations. Moreover, Ruysch carefully described the outlook of his preparations, including their placements on the shelves, as well as how his preparations should be viewed, touched and handled. Ruysch's written works, in other words are 'records of practice', they reflect the hands-on and daily activities in the Cabinets as well as the relationship between anatomists, preparations and visitors 'in the act of doing'.¹⁹

Before discussing the routine of handling preparations and visitors' involvement in Ruysch's Cabinets, we must first consider the pressing early modern problem of and need for 'bloodless dissection', which was of central importance to the business of anatomy.

2. Bloodless dissection

The rapid decay of corpses was one of the most pressing problems in early modern anatomy. As soon as a body became available anatomists had to work round the clock for three days in order to get as much out of a dissection as possible. After that point the stench and the mess made further work impossible. A second, perhaps even bigger problem was that with every cut into the body the abundance of blood made a clear view of tissues and organs virtually impossible. So 'bloodless dissection' was a much sought-after method. Ruysch's methods of preservation solved both these problems. The crux of his public dissections was that most of the time he used preparations, rather than fresh bodies. So Ruysch was never pressed for time. And because he was cutting up preparations he was never bothered by any stench, decay or blood. This, I argue, was an important rationale behind the making of all those anatomical preparations—it enabled Ruysch to perform lengthy dissections, for every kind of audience and at times that suited him best.

Although Ruysch was arguably the best bloodless dissector of his time, he was not the first. Louis de Bils (1623–1669) had already performed the 'miracle' of 'bloodless dissection' in the 1650s.²⁰ According to an eyewitness, De Bils had succeeded in opening up a large dog without any loss of blood. He had even turned out the dog's insides and showed all its innards while keeping the animal alive for five or six hours. The eyewitness furthermore remarked that because of De Bils' exceptional skill that enabled him to 'let the blood go wherever he wished' he 'discovered and showed many things, which other anatomists never knew or could possibly know'.²¹ Although anatomists were convinced there was some trick behind the performance, they were nevertheless impressed, not least because De Bils had also convincingly shown that he was able to prepare organs and tissues in their natural state. This was a skill closely related to 'bloodless dissection'. The eyewitness went on to say in his report that De Bils was not only able to stop bleeding during vivisection, but also that he could dissolve coagulated blood, remove it from a corpse, and so embalm a body in its entirety.²² In 1651 De Bils donated to the Leiden anatomical theatre a number of skeletons and the complete skin of a man (a 'skinman' complete with hair, beard and eyes), followed four years later by a whole body preparation without skin so that the muscles, nerves and interior of the corpse were clearly visible. It was said that Jan van Horne (1621–1670), professor of anatomy, was so impressed by the preparations that he had embraced and kissed De Bils' 'skinman'

¹⁷ Smith (2007), p. 38–43.

¹⁸ The bulk of the material can be found in St. Petersburg. Of the 2000 original preparations that were shipped to Russia, 934 have survived fire, neglect and war. They have been restored and are generally 'available' in an online catalogue. See www.kunstkamera.ru.

¹⁹ Pamela Smith has discussed the difficulties of studying records of practice. See: Smith (2007), p. 36.

²⁰ See Jansma (1919), Cook (2002).

²¹ Naeranus (1661), p. 41.

²² Naeranus (1661), p. 41.

(just as Peter the Great did only a few years later with a Ruysch preparation!).²³

A bloodless dissection and the ways of preparing a corpse (other than simply desiccating it) were both related to the anatomist's skill in controlling the movement of the fluids in the body's tubes and vessels. Both De Bils and Ruysch tried new methods of removing bodily fluids and replacing them with non-perishable substitutes.²⁴ The big challenge was to do this without causing damage to the surrounding tissues. All this required time, skill, trial and error, tacit knowledge and hands-on work.²⁵ Historians have tried to understand how a bloodless dissection works or even to reconstruct the making of an early modern anatomical preparation. However, this has proved very difficult, not least because early modern anatomists kept their methods and ingredients a carefully guarded secret. This goes for the work of De Bils as well as for the Ruysch preparations. The secrecy of Ruysch's methods even added significantly to the commercial value of his preparations.²⁶ From modern research on Ruysch's work we know most of the ingredients, but we do not know the exact quantities, nor do we know exactly how the fluids were injected, for this required tacit knowledge based not only on trial and error, but also on the historical conditions of the day—including for instance the temperature and humidity of the dissection room, the state of the instruments and the mood of the anatomist.²⁷

Yet in scholarship the question of how preparations were *made* has overshadowed the important issue of how preparations were *used* and *experienced*. If we consider this, we find that 'bloodless dissections' ultimately referred not to vivisectioning animals, but to the dissection of existing anatomical preparations. In order to convince his audiences that he was doing something completely new, Ruysch linguistically distinguished his way of practising anatomy (dissection, bloodless or otherwise) from past practices. Ruysch argued that anatomical activities before his time were called 'excarnations', meaning defleshing, and were associated not only with punishment, torture and martyrdom, but also with the process of the soul leaving the body.²⁸

'Excarnation', in other words, referred to the conventional route:

first the lower belly with the organs it contains, including the stomach, intestines, liver, spleen, kidney, and the male and female organs of generation; then the thorax to see the heart and lungs; the head to see the brain and nerves; and then the muscles of the arms and legs and hands and feet. Finally (...) the anatomist (...) prepare[d] the bones before re-articulating them as a skeleton.²⁹

Ruysch, on the contrary, stated that instead of taking away the flesh, he filled the vessels with another substance in order to keep body parts whole as intended by the Creator:

I am surprised that anatomists nowadays still use the word excarnation. It was done in other times, even by us; but it is

completely useless in anatomical investigations, now I leave everything whole, like the Creator of all has made it; I only take off the skin in order to expose the vessels.³⁰

Not only was Ruysch, with his new method, moving away from a theological focus on sin and punishment to an emphasis on the perfection of creation,³¹ he was also proposing a kind of 'sustainable' anatomy based on the 'recycling' of preparations.³² Not only did preparations keep well for a long time, they could also be used more than once (contrary to the process of excarnation, which rendered body parts completely useless). Moreover, Ruysch considered them a necessary addition to public anatomical demonstrations. In fact, he proudly stated that he was the first anatomist to do this:

Above all, it was not usual for professors of anatomy to bring prepared objects suspended in a fluid, to show in addition, as I began to do, for I was of the opinion that anatomical demonstrations performed on fresh bodies were not so instructive if not accompanied by prepared objects.³³

How this worked is made clear in Ruysch's announcement of a series of public dissections in spring 1703. Ruysch invited his audiences to attend, starting on the first Tuesday of August and thereafter twice a week. He explicitly mentioned that for the dissection he would use 'the bodies of three boys, who died about ten years ago [so presumably in 1693], and who had been publically shown in July 1695 and in October 1696'. The first of these three bodies was a seven-year-old boy, 'loved' by Ruysch and 'beautiful, with a well-shaped face, with red cheeks and lips, smooth and without wrinkles'. Normally Ruysch exhibited the boy fully clothed and undisturbed, but four years previously he had publically rubbed the face of the boy with 'sand, salt, soap, water and a cloth, almost to the point of grazing it', in order to refute the accusation that he was in the misleading habit of painting the faces of his preparations. Now, three years later, Ruysch announced he would dissect the boy again, because his 'brain, stomach, bowels, liver, spleen, kidneys, heart, lungs and other intestines are still so fresh and well kept that they surpass those of living people'.³⁴

The second boy was in a less good shape. Ruysch stated that over the years, he had dissected the preparation several times and that in due course he had removed the muscles for lectures and demonstrations. The third boy Ruysch had dissected in such a way that 'each part could be shown separately, so that they could be passed to those who stand further away'. In contrast to the first two bodies, whose organs were still untouched, Ruysch had prepared each organ separately. The body could be opened and the organs taken out one by one for close inspection—a procedure reminiscent of wax models which could be taken apart and reassembled at wish.³⁵

With his public dissections of the three boys, Ruysch defiantly broke with the usual ritual.³⁶ He started his dissections in August, in the full heat of summer and he performed them only twice a week for an unknown period of time. This was unheard of at the

²³ De Bils in Kooijmans (2004), p. 23.

²⁴ This is still an important feature of the work of controversial anatomist Gunther von Hagens. He replaces the fluids of the body, first by acetone through diffusion and in a second stage by reactive plastics. See von Hagens (2002), pp. 21ff.

²⁵ Cook (2002) p. 235. See also Cook (2007), pp. 268–288.

²⁶ Margocsy (2009).

²⁷ The ingredients of Ruysch's injection fluids are believed to have been talc, tallow or white wax, cinnabar, oil of lavender and coloured pigments. Normally the preparation was placed in a bottle or a wooden box (or coffin in the case of whole-body preparations) containing *liquor balsamicus* or nantic brandy and black pepper, which prevented decomposition. See: Mulder and Beukers (1990); Cole (1944) pp. 302–310; Hansen (1996), p. 669; Hendriksen (2012).

²⁸ Ruysch (1744), pp. 702 and 752.

²⁹ Cunningham (2010), p. 59.

³⁰ Ruysch (1744), p. 752.

³¹ See also Jorink (2006), pp. 332–337.

³² I use the terms 'sustainable' and 'recycling' here in a way recently proposed by Simon Werrett. They refer to 'a variety of practices that extended the life of material resources for doing science in the early modern period. These included practices associated with maintenance, repair, exchange and the adaptation or reuse of material culture'. See Werrett (2013), p. 627.

³³ Ruysch (1744), p. 660.

³⁴ Ruysch (1744), p. 660.

³⁵ Ruysch (1744), pp. 660–661. With respect to the wax models see for instance the models of Felice Fontana in Florence—every organ could be taken out and studied independently from the body—or the Dutch models of Petrus de Koning.

³⁶ For dissection routines see Cunningham (2010), p. 47.

time. Dissections took place in the middle of winter, preferably in the coldest rooms, for three days, working day and night. Although the cold normally slightly delayed the decaying of the body, after three days it was usually impossible to dissect any further—not only because of the horrific smell, but also because the body itself would be so far gone that it would be impossible to distinguish anything. The problem of decaying bodies is for instance reflected in invoices for money spent on scented candles to ward off the stench of the rotting corpse.³⁷

Ruysch, however, was not bothered by decay. His bodies were already prepared, with the main advantage that they no longer gave off a foul stench. Instead, Ruysch stated, they had a rather ‘pleasant and sweet aroma’. Moreover, unlike the dead bodies which were normally used for public dissections, Ruysch’s whole-body preparations were not subject to the usual subtle changes and losses which normally affect dead bodies, but alive with respect to the natural state of their tissues and organs; they were not stiff with *rigor mortis*, but flexible; they were not bloody and messy upon opening, but offered ‘a more clear, distinct and neat view’.³⁸ Perhaps the greatest advantage of Ruysch’s habit of dissecting preparations was that he was hardly ever pressed for fresh bodies.³⁹ Of course Ruysch was always keen to find new bodies and he always did his utmost to convince the relatives of the women in his care who died in childbirth to hand over the bodies of mother and child. Yet he had plenty of material to show his students and visitors, for both entertainment and teaching purposes.

The advantages of Ruysch’s new method of doing anatomy did not go unnoticed. Christianus Wedelius, a friend and colleague from Jena, wrote in a letter to Ruysch about the advantages of dissecting preparations over the dissection of fresh corpses. In response to Ruysch’s adversaries who argued that the method of injecting vessels changed the size and shape of the tissues he argued that in fresh bodies, as soon as the last breath leaves the body, the vessels often tear (and thus do not keep their original shape). So Ruysch, rather than distorting the vessels, brought them back to their ‘living’ form. Wedelius stated:

The aforementioned manner of preparing a corpse prevents this [the tearing of tissues] from happening, so it should be highly recommended. Moreover, the smaller the vessels, the sooner they decay, making a close inspection impossible. So, for these vessels to be known, it is necessary that they be prepared in this way (...). Also this manner of preparing is very useful. It improves and destroys the stench and other unfortunate circumstances that accompany the dissection of a body, and which have prevented many from dissecting. What else shall I say? This art means that we can dissect any time, even, and this seems wondrous and impossible, during the summer, when it is hot; in the clear weather we can see and study the anatomy of the body much better than at any other time of the year.⁴⁰

Ruysch not only performed public dissections on preparations, he also used them for private viewings in his Cabinets. For this purpose the preparations had to be easy to handle and access, a

requirement that was reflected in the layout of Ruysch’s anatomical Cabinets.

3. Hands-on anatomy

Ruysch kept his preparations in five rooms in his house on Bloemengracht in Amsterdam. They can be roughly divided into three categories: (1) dry preparations such as skeletons, skulls, and dried organs (often also injected with wax); (2) wet (injection) preparations contained in bottles whose lids could easily be removed; and (3) wet preparations in jugs with elaborately decorated lids. Preparations in this last category could not possibly be handled without damage.

It is significant that Ruysch produced preparations in the last category mainly at the end of his life, when he was already over eighty years old. At this time he had already sold his most important collections to Czar Peter the Great (in 1717, along with the secret of his embalming technique) and he had started a new collection, which contained less human material. Instead, Ruysch focused on preparing fruits and vegetables as well as animals, with the main intention of showing the similarities between the vascular systems of human, animal and vegetable ‘organs’. These exuberant preparations differed from his earlier work in one important respect: Ruysch primarily made them for his own amusement. In other words, he no longer actively used them for teaching purposes. He stated that ‘his eyesight had weakened’ and that ‘no spectacles could remedy this shortcoming’. Although he still worked hard and he was happy to publish whatever he discovered, he was less intent on making big discoveries.⁴¹ He did not need to—his reputation was already firmly established.

As a result, Ruysch exceeded himself in decorating his preparations. His collections contained preparations that were attached to other preparations; embalmed babies were laid in tombs decorated with blue silk; prepared baby arms held plants and fruits.⁴² Moreover, Ruysch placed the preparations in bottles with elaborately decorated lids.⁴³ After all, he did not ever intend to open them again in order to work on the preparations.

Things were completely different with many of his earlier preparations: dry preparations and wet preparations in re-usable containers. We are so used to images of Ruysch’s more artistic preparations that we often forget that most of his preparations were ‘working material’. At least 85% of the preparations were anatomical study objects without any decoration. Of the 934 objects still in existence today only 64 are decorated with lace, glass eyes and beads. Ruysch also made only eight tableaux—the best known are the tiny baby skeletons standing on heaps of bones and bladder stones (representing a graveyard) weeping into handkerchiefs made of lung tissue—and they were not all that important. Indeed, only few were exhibited at eye-level, three of them stood collecting dust on the bottom shelves of the cabinet and one of them was standing behind some other preparations.⁴⁴ Thus, without denying the artistry of many of the preparations, it is a little rash to claim that ‘Ruysch should first and foremost be appreciated as an artist’ and that we should view Ruysch’s preparations as ‘art objects’ or ‘anatomical still lifes’ in which he

³⁷ Huisman (2009), p. 31.

³⁸ Ruysch (1744), p. 661.

³⁹ The supply of fresh bodies was a pressing problem in early modern anatomy. For public dissections usually the bodies of criminals were used, but there were not enough bodies to answer the needs of the anatomists. Eventually, it was also permitted to use the bodies of the poor who died in the city hospitals. See Huisman (2009), p. 115.

⁴⁰ Christianus Wedelius to Ruysch, 1 January 1700, published in Ruysch (1744), p. 368.

⁴¹ With the exception of his research on bones which he did on the request of Boerhaave and which kept him intensely busy for some time.

⁴² Kooijmans (2004), p. 362.

⁴³ Sadly the decorated lids, because of their heavy weight, affected the sealing of the bottles and made the preparations inside much more vulnerable to decay, so we do not have many of Ruysch late preparations any more.

⁴⁴ Roemer (2008), p. 224. Although de Roemer has made an inventory of the various preparations and although he has pointed at the low number of artistic preparations, he still devotes the remainder of his article to these preparations.

attempted 'to create a new aesthetic of anatomy that melded the acts of demonstration and display with the stylistic and emblematic meanings of *vanitas* art'.⁴⁵ While this was undoubtedly true of the well-known *memento mori* pieces and some of the preparations depicted in Ruysch's catalogues (which often serve as a basis for these arguments), most preparations were either the result of or made for the purpose of anatomical experimentation and observation and for the public display of Ruysch's injection skills.

Seen in the context of the early eighteenth century the argument that we should regard Ruysch's preparations as handling collections should come as no surprise. Collectible items were touched and handled all the time.⁴⁶ For instance, Albertus Seba (1665–1736), an apothecary in Amsterdam who was closely associated with Ruysch, owned a large and prestigious collection of naturalia. In his portrait he casually holds a preparation of a lizard while pointing at book illustrations and some shells lying on the table (Fig. 1). This is a perfect example of how, as Carin Berkowitz has recently argued, Enlightenment 'natural philosophers valued sensory experience—primarily vision, but also that of touch—as the basis of learning'.⁴⁷

Another famous Amsterdam collection at the time was that of damask merchant Vincent Levinus (1658–1727) on Nieuwezijds Voorburgwal, only a few streets away from Ruysch's house. His collections were described in his *Wondertooneel der Natuur* ('Wonder Theatre of Nature') (1715), and printed in Dutch and French with the specific purpose of attracting and entertaining non-Latin-speaking, non-learned audiences (Fig. 2). On the frontispiece we see a lively place where visitors pick up, hold and closely examine naturalia on large tables in the middle of the room. In other prints of Levinus' collections, too, we see visitors discussing preparations while holding the pots in their hands. Other visitors move between the shelves eager to reach for bottles to take down.⁴⁸

The active use of preparations is also hinted at in the frontispiece of Ruysch's *Opera Omnia* (Fig. 3). We see preparations and an opened box randomly scattered around the feet of Ceres (goddess of nature and fertility), holding the horn of plenty, and Saturn (associated with Chronos, the god of time, holding a branch of mistletoe, symbolizing life and fertility). The preparations seem to have come straight from the cabinet at the back—the door is still open so even more pieces can be removed.⁴⁹

How did Ruysch handle his preparations in daily practice? It is possible to distinguish two different kinds of handling: the presentation of pots containing preparations and the active use of preparations themselves. With regard to the first category: Ruysch took the jars off the shelves, he held them to the light and he recommended using magnifying glasses and spectacles in order to view the intricate structure of the vessels better.

The best example of how Ruysch took bottles off the shelves and made them part of an anatomical show is the handling of a preparation of a fish with exceptionally beautiful silver scales suspended on a hair in a bottle (this was one of Ruysch's late preparations), Ruysch advised that the bottle be shaken gently, making it appear as if the fish were swimming. Ruysch explicitly

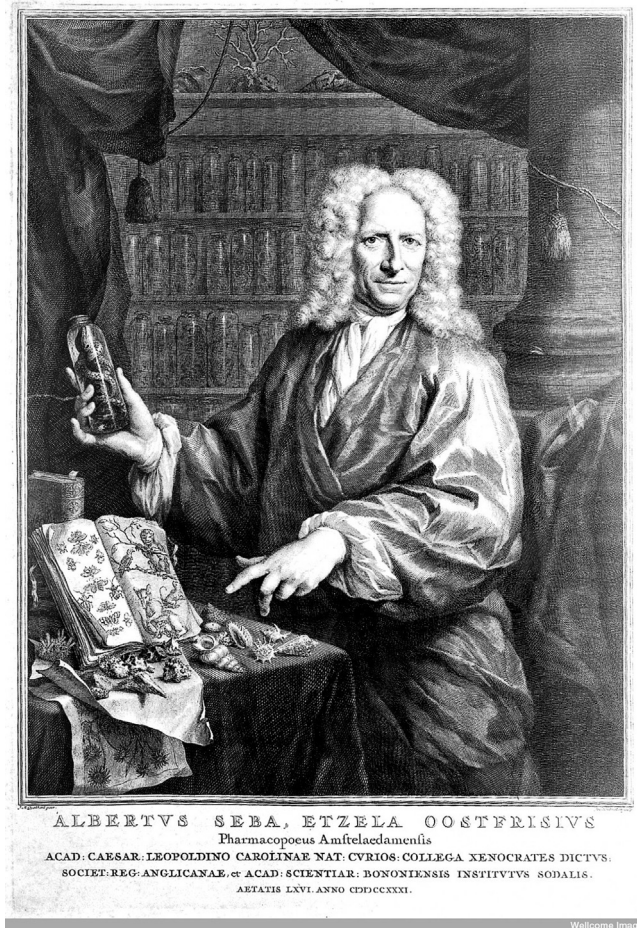


Fig. 1. Portrait of Albertus Seba. Frontispiece of Seba's illustrated volume *Thesaurus*, published between 1734 and 1765. Courtesy of Wellcome Library, London.

stated that in order to allow for shaking he did not place anything on top of the lid.⁵⁰

Ruysch regularly referred to *helder weder*, clear weather, as a prerequisite for seeing the smallest and most intricate structures of his preparations. For instance, he states that a fertilized egg of a few days old in the amnion of a prepared womb can only be seen during times of 'clear weather'.⁵¹ This seems to imply that Ruysch took bottles off the shelves in order to carry them to the window to have a better view, a suggestion which is corroborated by the following detailed description of how a viewer should hold a preparation:

In order to see the roots [of the arteries in the mesentery], the object should be held in clear sunshine, shining from behind the back of the beholder, and one should remove everything from the head of the beholder which can cause even the slightest shadow, yes even the hairs on the head potentially obstruct the light.⁵²

The importance of clear weather as a prerequisite for closely examining preparations is also clear from a lament on the fact that most people visited Ruysch's Cabinets on rainy days. Ruysch

⁴⁵ This argument was put forward by Julie Hansen and repeated ever since. Hansen (1996), p. 671.

⁴⁶ For the importance of touch in the making and trading of art and artefacts see: Honig (1999), Evans & Marr (2006), Dupré & Korey (2009).

⁴⁷ Berkowitz (2013), p. 359.

⁴⁸ See a drawing made by Amsterdammer Jan Velten in 1701 and printed in Jorink (2006), p. 266.

⁴⁹ Thanks to Tim Huisman for suggesting that the man and woman in the foreground might represent the mythological figures of Ceres and Saturn.

⁵⁰ The fish was part of Ruysch's last collections in which he decorated the lids in the same way as the preparations inside.

⁵¹ Ruysch (1744), p. 209. For other references to clear weather see pp. 118, 765, 1176, 1182–1183, 1345.

⁵² Ruysch (1744), p. 1576.



Fig. 2. Frontispiece of Vincent Levinus *Wondertooneel der Natuur* (1715). Courtesy of Rijksmuseum Amsterdam.

complained that his visitors would not see clearly and give false reports to others:

Nobody visiting me on a day with clear weather has doubted the truth of my saying and showing (...) But if someone casually

comes to my Cabinets, and he does so on a dark and rainy day (like many do daily, and look here and there, without making any remark) it is impossible to thoroughly see these subtle matters (...) which occasioned an erroneous report to Professor G.C. Schelhamer.⁵³

Often Ruysch referred to the use of magnifying glasses, spectacles and microscopes. For instance, Ruysch advised that in order to view a calf's lung better 'the extremities of the vessels can be even better studied through spectacles'.⁵⁴ Ruysch particularly referred to the commonly used microscope ('*microscopium*') of Antonie van Leeuwenhoek: 'we can look at them [fertilized eggs] with the magnifying glasses of Mr. Van Leeuwenhoek, which we also have in our possession'.⁵⁵ The advice to use magnifying glasses often went together with a reference to a source of clear light, whether this be sunlight or the light of a candle: 'this object must be viewed through the magnifying glass in clear weather' and 'one should observe all this in the sunshine with a magnifying glass'.⁵⁶ Ruysch not only referred to his own use of magnifying glasses, he also invited others to observe his preparations with a microscope. He stated: 'I invite everyone to witness, who wants to study these parts with a magnifying glass'. Visitors took up his suggestion, as is evident from a letter from Johann Christoph Bohl, close friend and professor of medicine in Königsberg, who wrote that 'for days I have investigated your [Ruysch's] cabinets with magnifying glasses'.⁵⁷

Ruysch's mention of the Van Leeuwenhoek microscope is an important clue substantiating the theory that preparations were actively handled. Typically the microscope was small and the lens had a focal length of three millimetres. This implies that the objects under study had to be placed in very close proximity to the lens and thus—in the case of Ruysch—that objects had to be taken off the



Fig. 3. Frontispiece of Ruysch, *Opera omnia* with, at the back, a typical cabinet containing preparations. Courtesy of Wellcome Library, London.

⁵³ Ruysch (1744), p. 984.

⁵⁴ Ruysch (1744), p. 177.

⁵⁵ Ruysch (1744), p. 976.

⁵⁶ Ruysch (1744), pp. 1182, 1220 (these are two examples of a sentence which Ruysch uttered on 75 pages.

⁵⁷ Ruysch (1744), pp. 1389, 1575.

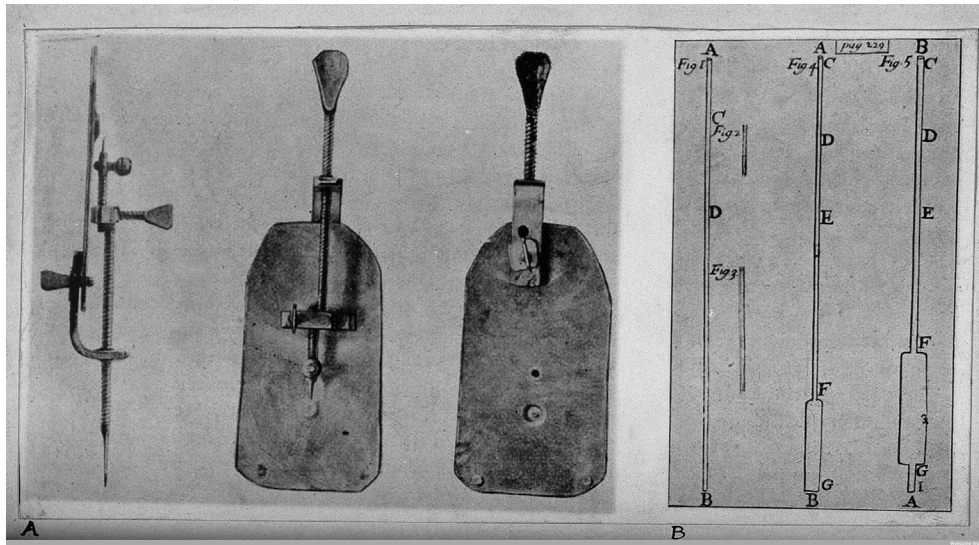


Fig. 4. (A) Leeuwenhoek microscope, showing the side, front and back. The lens may be seen set in the board. (B) Glass tubes which Leeuwenhoek blew himself and used for examining the blood. Courtesy of Wellcome Library, London. According to an object description of the Museum Boerhaave in Leiden: 'The specimen to be studied is placed on the pin and is brought into focus on the small lens by adjusting the two screws. The glass lens is fixed between two brass plates. The microscope would have been difficult and uncomfortable to use as the eye would have to be placed very close to the lens to make any observations. Lighting the specimen would also have been difficult.'

shelves and possibly even out of their containers.⁵⁸ To this end (and also for the close inspection of bodily fluids) the Van Leeuwenhoek microscope could be extended with an attachment for a small glass bottle (Fig. 4).

Van Leeuwenhoek used his microscope extensively to study the anatomy of the body. In fact, the contemporary mechanistic idea that the body is built of large and small vessels, the *vasa minora* and *vasa majora*, which lay at the root of Ruysch's injection technique, was inspired by Van Leeuwenhoek's microscopic investigations, whereby he minutely took apart bodily flesh with the help of needles.⁵⁹ The use of the microscope in anatomical research is further evidenced by the following account of a meeting between Van Leeuwenhoek and Govert Bidloo, professor of anatomy at Leiden University:

Professor Bidloo came to my [Van Leeuwenhoek's] house on 7 March desiring that he might view thro' a Microscope a little piece of Gut, which, he said, was part of the Bowels of a Woman; whereupon I having separated a small Particle thereof from the rest, we discovered in one of the thin Membranes, of which, for the most part, the Gut is composed, a great Number of little Fibres and Vessels, which lay in great Multitudes over and across each other, as also some Particles of Fat, which lay like Bunches of Grapes upon the said Fibres.⁶⁰

In this case the investigation used fresh material. Van Leeuwenhoek explicitly stated that the piece of gut was 'unprepared' and that it was from a woman who had been hanged. The unprepared state of the gut and much of Van Leeuwenhoek's other anatomical material was particularly problematic. In the case of the hanged woman, Van

Leeuwenhoek regretfully mentioned that in the process of examining, the material dried up and shrank and that for this reason he could not be entirely sure whether his description was correct. He confessed to the same problem in a report on the dissection of a whale:

Many times I have examined these aforementioned small pieces of flesh, so that before my face they dried away, and that without the fluid, they became much smaller than when they were filled with water.⁶¹

It is clear that the use of preparations, rather than fresh material, in microscopic investigations of anatomy solved the trouble of shrinking as a result of handling. It is presumably in this context that we must see Ruysch's repeated emphasis of the fact that his preparation technique preserved even the smallest vessels and structures of the body, i.e. the drying of preparations was a thing of the past, belonging to a time when dissections were still called excarnations.

The fact that Ruysch actively used his preparations is not only implicit in the application of Van Leeuwenhoek's microscope, but is further evidenced by Ruysch's descriptions of his preparations. For instance, Ruysch repeatedly wrote about the flexibility of prepared limbs (and thus his extraordinary defeat of *rigor mortis*). In the preface to the catalogue of the tenth Cabinet, Ruysch was particularly keen to point out that his method of embalming preserved the flexibility of limbs—this of course can only be demonstrated by taking a leg or an arm out of the jar.⁶² This suggestion is not so strange if we consider that Ruysch also used preparations for demonstrating surgical procedures and the setting of broken bones.⁶³

Moreover, Ruysch often dissected his preparations again when new research questions needed answering. And he often simply rearranged the contents of the pots. Often Ruysch's son Hendrik would assist him. His task was to open the containers and 'safely

⁵⁸ Museum Boerhaave in Leiden sells replicas and the accompanying booklet includes instructions on the use of the microscope: 'Place a dry specimen, e.g. an insect's wing, on the end of the pin. Hold the arm of the microscope firmly and bring it close to your eye, looking for a source of light. Use one eye to look through the tiny lens at the specimen underneath. By twisting the screws you can adjust the image and focus.'

⁵⁹ See letter from Van Leeuwenhoek to Robert Hooke, 3 March 1682, in Van Leeuwenhoek (1686), pp. 16–17.

⁶⁰ Van Leeuwenhoek (1753), p. 53.

⁶¹ Van Leeuwenhoek (1718), p. 3–4.

⁶² Ruysch (1744), p. 819.

⁶³ Ruysch (1744), p. 662.

pass over, receive again and put everything away again in the glasses, boxes and coffins'.⁶⁴ All this was possible because Ruysch kept a large proportion of his preparations in bottles, not covered with pig's bladders, but with easy-to-remove corks.⁶⁵ He also kept some of his preparations in cedar containers in the bottom drawers of his cabinets, so they would need to be removed from their boxes to enable viewing. Ruysch wrote: 'the drawer under this second cabinet contains several cedar boxes, the first one being opened, shows us...'.⁶⁶ Moreover, contrary to what is often seen in wet preparations, many of these preparations were *not* attached to the lid and kept in place by thin hairs, so removing preparations from their containers was easy enough.

Ruysch mentioned that the great advantage of showing preparations in his own house (rather than during a public demonstration in the anatomical theatre) was that visitors could view the preparations in close proximity. He wrote to Johannes Gaub, an Amsterdam physician:

I am sorry that you were hardly able to see with your own eyes the objects, which were placed too far away. For in public demonstrations the small parts cannot be seen very precisely. There is also no time left to show everyone in detail the things that I explain in public. This is why I thought of continuing the dissection of the same objects in my house to the advantage and use of my pupils, and others...⁶⁷

A spatial analysis of where Ruysch placed his preparations in his cabinets shows how he was in the habit of handling his preparations. Most of the cabinets had five or six shelves. On the top shelves, Ruysch kept preparations he hardly ever used as well as 'sensitive' preparations, such as the preparations of female genitalia.⁶⁸ In the middle of the cabinets, presumably at eye level, Ruysch exhibited some of his showpieces, one of them being a *memento mori* work of weeping baby skeletons standing on heaps of bones and bladder stones. On the lower shelves Ruysch kept preparations that needed handling, for instance because they had to be viewed in the light of the window or a candle. He also kept on these shelves preparations whose limbs were notoriously flexible, as well as numerous preparations still 'in preparation'. Since Ruysch was in the habit of working on his preparations all the time, he kept switching preparations to other shelves and cabinets, so that in the catalogues, written by Ruysch himself, we continuously find descriptions of the same preparations. Ruysch himself realized the confusion this could cause, so he apologetically wrote about the catalogue of his second Cabinet:

The reader will find things, which have already been described in Cabinet 1, because after the descriptions of the first Cabinet saw the light, I discovered several things more precisely, which were at the time unknown to me. Several things I also prepared more neatly and curiously, since I am always busy opening and investigating the human body.⁶⁹

One striking example of how Ruysch re-ordered his preparations is the changing appearance and positioning of the skull of 'the famous whore Anna van Hoorne'. Ruysch described the skull for the first time in the catalogue of his first Cabinet. It was exhibited, together with the womb and right hand of the unfortunate woman, in



Fig. 5. 'Foot of a child treading on parts of the skull', described in *Thesaurus anatomicus septimus*: no. XIV. From the collection of Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences: MAE RAS no. 4070-44.

cupboard H of the first room, within easy reach on the third shelf. Anna van Hoorne had suffered from the venereal disease 'Spanish Pox'—a disease associated with prostitution. Her skull was corroded 'so that in some places it was completely perforated and in other places so thin, that *when held into the light of a candle*, it was translucent'. Ruysch further remarked that he prepared the skull in such a way that the index finger of the right hand touched 'this evil, so that all who come to see will be warned with the motto "in such waters, one catches such fish"'.⁷⁰ The remarkable thing about the description is that Ruysch had prepared the *complete* skull. It was a *dry preparation*, it was regularly viewed *in the light of a candle* and it was kept *within easy reach*.

In the seventh Cabinet Ruysch described the skull of Anna van Hoorne again. This time, the skull is in pieces, part of a wet preparation exhibited out of direct sight on the top shelf. Although Ruysch never stated as much, it is not unlikely that the extremely fragile piece had broken while being handled (held to the light of a candle time and again). In any case the pieces of skull lying on the bottom of the bottle cannot possibly reveal any of the skull's holes or thin places any longer. The only thing left for the viewer was the moral lesson that 'this whore would not have suffered this disease without her ugly trade: because in such waters one catches such fish'. And this was exactly the reason why Ruysch placed the pieces of skull under the scornful foot of a child (Fig. 5).⁷¹

It must be noted that the practice of handling preparations did not preclude them from simultaneously carrying moral meanings.

⁶⁴ Quoted in Kooijmans (2004), p. 382.

⁶⁵ Ruysch often described the boxes, and on page 1257 of his *Works* he states that he stoppered his bottles either with cork or with bladder.

⁶⁶ Ruysch (1744), p. 551. See also pp. 515 and 650.

⁶⁷ Ruysch to Gaub, 4 October 1695, published in Ruysch (1744), p. 232.

⁶⁸ See also Knoeff (2012).

⁶⁹ Ruysch (1744), p. 522.

⁷⁰ Ruysch (1744), p. 212.

⁷¹ Ruysch (1744), pp. 724–725.

Although the majority of Ruysch's collections were working collections, this does not imply a dichotomy between straightforward preparations without any meaning beyond their medical significance and the artful *memento mori* pieces which were not meant to be handled. Without exception, Ruysch's preparations were anatomically relevant and simultaneously bore witness to the wisdom and magnitude of the divine design, the brevity of life and the obligation to live well.⁷² So, in a piece on a preparation of a pregnant womb, Ruysch included all the anatomical details as well as the following remark about the unborn child: 'Formed, died and buried in the same place, so that the womb is my grave'.⁷³ Likewise, Ruysch extensively discussed the anatomy of all the organs, bones and tissues he used for his anatomical showpieces. So an infant skeleton holding a dog's bladder is accompanied by a minute description of all the peculiarities of the bones as well as the saying that 'man is like a bubble' (the Dutch word *blaas* simultaneously means bladder and bubble).⁷⁴ Not surprisingly the skull of Anna van Hoorne, whether complete or in pieces, was accompanied by a moral message referring to the sinful origins of her disease.

Ruysch's active handling of preparations is also evident from many descriptions of his preparations. For instance, in his description of a preparation of the spleen artery, he writes how he touches and handles the preparation in order to show a common mistake. He writes:

I have left it [some surrounding tissue] deliberately, so that it would appear like glands; but when we touch it with the point of a needle and take it apart, the error of this assumption becomes clear.

Ruysch also suggested active handling when describing a set of preparations of children's heads—not the well-known heads decorated with lace and glass eyes, but preparations with the skull detached. In one instance the pieces of the cranium are loosely placed on top of the head. In another preparation the cranium lies upside down inside the head (Fig. 6). Although these preparations have not yet officially been assigned to a specific catalogue description, there are several descriptions which fit the preparations and also suggest active handling. For instance, one of the heads could easily belong to the following description of a preparation kept within easy reach on the second shelf (of six, counted from below) of the second Cabinet:

The head of a child kept in spirits, so curiously prepared, without any white powder or paint, that it represents the head of a fresh and lively child, and has been kept by me for many years. First remark. When we take away the upper part of the skull and even so the brain, we can see appearing ten pairs of nerves, the funnel having a red colour, because of a red fluid filling its small blood vessels.⁷⁵

Not only does the description *when we take away the upper part of the skull and even so the brain*, suggest active handling, it is also necessary to physically turn the brain around: the ten pairs of nerves are located at the base of the brain and not visible when the brain is in place. This means that Ruysch, in order to fully display the import of this kind of preparation, had to open the bottle, take out the preparation and even dismantle it further in order to show what was inside. Other catalogue descriptions substantiate this argument. For instance, in the case of a beautifully prepared face of a child Ruysch wrote that 'I [Ruysch] took away the upper part of



Fig. 6. 'Head of a child several months old with dissected cranium'. From the collection of Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences: MAE RAS no. 4070–171.

the skull, and turned around the brain, and put it back again inside the head, so that one can see the arteries...'.⁷⁶ Or in another case: 'when we take away the cranium and brains, a thin membrane appears'.⁷⁷

Even preparations themselves sometime hold information about anatomical procedures and handling. For instance, the preparation of a child's arm holding a blood clot is a material representation of the procedure of stirring fresh blood by hand for it to cool and clot (so that it is ready for anatomical examination). Even the bottle itself holds information on how preparations should be viewed. Like the other bottles on this particular shelf it is sealed with a thin tissue (and not with a pig's bladder as was normally the case). The tissues were taken from the mesentery, brain or human skin and injected with a red wax-like substance. Ruysch explicitly states that he did so to enable visitors to precisely trace the blood vessels.⁷⁸ Of course, to do so, the pots had to be taken off the shelf, placed on a table, close to a source of light so the viewer could closely examine the tiny vessels.

4. Touching anatomy

The opportunity to actively handle preparations—made possible by Ruysch's perfected preparation methods—turned Ruysch's anatomical workshop into a public place. After the showing of Louis de Bils' whole-body preparations, people already spoke approvingly of the fact that the public were permitted and able to touch preparations. In a pamphlet reporting a discussion between neighbours in Amsterdam, the bloodless dissections and preparations of De Bils were discussed at length. One stated that he did not have any knowledge of anatomy but that he was very impressed with De Bils' work:

It is a miracle that these bodies are embalmed in this way, that they may be viewed outside the liquid [*blood*: naked, exposed] and touched, which has never before been allowed with embalmed bodies. It is true, in contrast to the bodies in the

⁷² This argument has also been put forward by Roemer (2010).

⁷³ Ruysch (1744), p. 162.

⁷⁴ Ruysch (1744), p. 154.

⁷⁵ Ruysch (1744), p. 532.

⁷⁶ Ruysch (1744), p. 728.

⁷⁷ Ruysch (1744), p. 881.

⁷⁸ Ruysch (1744), p. 497.

Anatomical Theatre in Leiden, which cannot be touched, but only viewed through a glass.⁷⁹

The new embalming techniques developed by De Bils and later also by Ruysch made preparations more robust. They were no longer so fragile that they could only be viewed from behind glass, as was the case in Leiden. On the contrary, they could easily be removed from the embalming liquid and even touched without becoming damaged. What is more, the handling of preparations was employed as a tactic to advertise the skills of the anatomist and his mysterious embalming techniques. People could now touch the preparations and make 'informed' guesses about ingredients and techniques.⁸⁰ In the case of Ruysch—as we have seen—on several occasions preparations were scrubbed in order to show they were not painted.

Having established the context in which preparations were actively handled we can now appreciate that it was not so extraordinary for Peter the Great to kiss a preparation of a child's head. However, it does raise the question of whether Ruysch's less distinguished visitors (students, colleagues and lay visitors) were allowed to handle the preparations. Ruysch never really differentiated between different kinds of audiences. Perhaps the only real distinction was the entrance fee. While students and medics enjoyed free admittance, others had to pay.⁸¹ Ruysch regularly lectured in his Cabinets and although it has been argued that this was for interested anatomists only, the travel journal of the Uffenbach brothers who visited Lower Saxony, the Netherlands and England in 1710–1711, suggests that lay people were welcome to listen too. Conrad Uffenbach wrote of his visit on 16 March 1711:

He [Ruysch] had ordered us to his house at 8 o'clock, but when we arrived he had his *auditores* with him, and we were forced to go to the *collegium* as well, and listen to a lecture, which we did with pleasure. He demonstrated the *membrum virile* (...) Doctor Ruysch did not give a good lecture at all, but the demonstration of the preparations was beautiful.⁸²

In this case students and passing gentlemen received the same treatment. During lectures, given in the room where he also stored his cabinets, everyone was allowed to study the preparations very closely, to physically experience, touch and smell them.⁸³ Speaking about the mummy of the aforementioned eight-year-old boy, Ruysch stated that:

The colour and consistency of the skin and muscles appears, *to sight and touch*, natural as if alive: all the parts of the mummy are not made too hard, but demonstrate a softness as if they were still filled with fluids and blood and vigorous.⁸⁴

Ruysch's lament that some visitors had stolen preparations confirms how close visitors could get to the collections. Of an artfully preserved penis (which was considered the most difficult kind of preparation to make, and considered a masterpiece showcasing the anatomist's skill) Ruysch wrote that some visitor—during a particularly busy visit when it was difficult to keep an eye on everyone—tore it off its pedestal and stole it.⁸⁵ According to Ruysch

many a visitor had in this way assembled his own anatomical Cabinet. In connection with the story of the stolen penis, Ruysch also mentioned a very delicate and difficult preparation of ribs (prepared in such a way that the ribs were translucent) that he placed with his most precious objects, presumably out of reach, in order to prevent theft.⁸⁶

Although some touching of preparations was in all probability allowed, it could be argued that most of the handling was done by Ruysch, or by his youngest daughter who also gave guided tours for lay visitors.⁸⁷ The same goes for the numerous preparations that Ruysch advised be held up to the light of a candle, or examined in the bright light of a sunny day. It is unclear whether visitors were free to take preparations off the shelf, carry them to the window and hold them up to the light. It is more likely that Ruysch closely supervised the handling of his preparations and did the risky carrying and touching himself. Whatever the case, it is clear that Ruysch's preparations were far from weird and artful objects that appealed to the visitor from a safe distance and were beyond common understanding.

Ruysch wrote that 'hundreds of people' had already seen his Cabinets: they were all amazed at the wholeness of the bodies and they particularly marvelled at the flexibility of the limbs.⁸⁸ This brings us to the question of why so many people flocked to Ruysch's workshop. What was it about the preparations that attracted them and how did the preparations affect their beholders? I would argue that, particularly for non-medical visitors, preparations had agency, the power to touch visitors emotionally.⁸⁹

So far historians have mainly classified the reactions of visitors into either wonder or disgust. And of course, we recognise these reactions in the reports of modern visitors to shows such as Gunther von Hagens' *Bodyworlds*, which most often reflect a sense of sensation and/or apprehension. Rather than defining a kind of general public reaction to anatomical collections, historian Samuel Alberti has argued that visitors react in a multitude of historically specific ways. Yet he still divides these reactions into wonder and disgust.⁹⁰ However, Ruysch's written works give a rare glimpse into how preparations were also experienced in other ways. Preparations offered consolation and functioned as material mnemonic links to the past (in much the same way as relics do), narrating the stories of lost lives.

A touching example of this was a preparation of twins, grown together and born after a pregnancy of eight months. Ruysch, in his role as city obstetrician, was called to the mother while she was in labour and was keen to embalm the twins. For this he needed the permission of the parents and he carefully noted down his negotiations: In return for the babies, he offered free entrance to his Cabinets, so the parents and their friends could visit their children any time. A second clause stated that if the parents were to pass away before Ruysch, the preparation would become the property of Ruysch, but if Ruysch should die first, the twins would be returned to their parents. And so it happened—the parents visited and Ruysch carefully kept track. In the catalogue to the tenth Cabinet Ruysch wrote that although the father had passed away, the mother

⁷⁹ Naeranus (1661), p. 44. It is not clear if 'glass' refers to glass bottles or to the 'glass' in cabinet doors.

⁸⁰ Cook (2002), p. 236.

⁸¹ Kooijmans (2004), p. 169.

⁸² Uffenbach (1753), p. 640.

⁸³ The handing around of body parts during anatomical dissections was common practice. For instance, the rules regulating anatomical dissections in the Leiden anatomical theatre stated that body parts and bones may not be taken home.

⁸⁴ Ruysch (1744), p. 778.

⁸⁵ Ruysch (1744), p. 98.

⁸⁶ Ruysch (1744), pp. 98 and 1015.

⁸⁷ Ruysch's youngest daughter never married and helped her father in all things anatomical: 'she was skilled in her father's arts, with respect to plants and dead bodies, as well as in the knowledge of the diverse parts of the human body'. See Ruysch (1744), p. 9.

⁸⁸ Ruysch (1744), p. 1094.

⁸⁹ For a discussion on agency in the history of science see for instance: Latour (2010) and Coopmans, Vertesi, Lynch, & Woolgar (2014).

⁹⁰ Alberti (2007), p. 387.

was still alive. It is to be assumed that he hoped he would be the owner of the preparation sooner rather than later.⁹¹

Why would parents be interested in visiting the embalmed bodies of their dead children? I would suggest that Ruysch played on the sentiment that parents could find consolation in such a visit. This idea is corroborated by other references to parents of miscarried children. While discussing the perfect, lifelike appearance of a collection of very small embryos and infants Ruysch stated that:

I am gratified that often I was called to such occasions [miscarriages], when I found the parents very sad, for they were of the opinion that they had created monsters. I am in the habit of consoling them, and assuring them that perfect infants change after death in the mother's womb. The parents were inclined to believe me, in particular after I showed them that the infants were brought back to their original state after I blew a little air into the small bodies using a pipe (...) the parents were very pleased about the change and showed me gratitude.⁹²

Thus Ruysch, by changing the shrivelled appearance of infants and turning them into perfect, lifelike little creatures again, offered a means of coping with loss.

It seems Ruysch even allowed parents to make decisions regarding the appearance of his preparations. In reference to the preparation of an embryo no bigger than an aniseed, he explicitly stated that the parents requested he prepare it without the placenta—the reason for this request was presumably because human features would only be visible without the much bigger placenta attached to it. Ruysch stated that after coming home and preserving the embryo he could hardly believe how much the preparation resembled a human being.⁹³ The ‘humanity’ of a preparation was such an issue that Ruysch even argued that in the case of serious malformations (such as a harelip), parents should not mourn if the child died shortly after birth. Ruysch clearly perceived the social difficulties of such malformations—he even kept monstrous preparations out of direct sight to be viewed only on special request.⁹⁴

What Ruysch in fact did was to offer parents a means of physically and emotionally cherishing their children, even after death.⁹⁵ In this sense preparations act like secular relics bringing consolation and acceptance. They fit Alexandra Walsham's definition of relics as:

Material manifestations of the act of remembrance. They sublimate, crystallize and perpetuate memory in the guise of physical remains, linking the past and present in a concrete and palpable way (...) they are ‘remnants of a history that is threatened by forgetting’, they ‘postpone oblivion’ and evoke ‘an absent whole’. A kind of umbilical cord that connects the living and the celebrated dead, they carry messages from beyond the grave and provide a mnemonic ligature to a world that has been lost.⁹⁶

⁹¹ Ruysch (1744), p. 1038. Ruysch writes that in other instances he did not receive permission from the parents. For instance, Ruysch was not allowed to perform a dissection on an eight-year-old boy who died after a fever (p. 551). In the work of other anatomists, too, reference is made to parents refusing or allowing the embalming of their children. See for instance Reinier de Graaf, anatomist in Delft, who was keen on dissecting a hermaphrodite child and, after some negotiation with the parents, received permission to do so ‘in secret’. See de Graaf (1686), p. 369.

⁹² Ruysch (1744), p. 1022–1023.

⁹³ Ruysch (1744), pp. 688–689.

⁹⁴ Ruysch (1744), p. 691.

⁹⁵ I have put forward this argument in Knoeff (2015, in press).

⁹⁶ Walsham (2010), p. 1. Walsham quotes Wharton (2006), pp. 9–10.

Another one of Ruysch's proposals also shows the extent to which an anatomical preparation can turn into a relic providing a consolatory link for loved ones. Ruysch proposed the idea of fabricating and trading in preparations of embalmed hearts:

Hearts embalmed according to my method can be kept for hundreds of years, with a lively colour and a sweet smell, without the least sign of decay (...) The great men of England often have in memory of their deceased wives a ring fabricated from artfully braided hair. Would it not be far more considerate to give them the hearts of their loved ones, embalmed like this, and kept in a gold or silver container, as an eternal memory, through which our art can flourish likewise.⁹⁷

This proposal placed Ruysch in a tradition of keeping the hearts of loved ones, regularly seen in royal households. For instance, Louise de Coligny, widow of the murdered prince William of Orange, cherished the heart of her man until she felt her own end was imminent and the heart was buried alongside the rest of the prince's body.⁹⁸ Ruysch's suggestion took the practice of keeping the heart of a loved one out of the royal domain, making it more widely available to the wealthy (nobility and merchants alike), who could afford such luxury. Moreover, he firmly believed that a trade in embalmed hearts would not only be a material means of consolation, but also boost the art of embalming, although he never actually launched such a trade.⁹⁹

The rare glimpses into negotiations with parents or the suggestion of trading in embalmed hearts suggests that the message of Ruysch's preparations entailed more than traditional *vanitas* motives or references to the perfection of God's creation.¹⁰⁰ The preparations also offered a physical link to the deceased themselves, keeping memories alive, mirroring the pain of loss and sorrow. They were capable of transporting beholders beyond the threshold of death, thereby creating a fictional space where the dead were very much alive, a reminder of what might have been. In times when child mortality was high—almost every parent faced it at some point—Ruysch's collection of prepared infants and children must have emotionally touched virtually every visitor. Every visit was an intimate *danse macabre* in which people reanimated preparations, actively involving them in their own lives. The interaction between audiences and relics has often been described as a remarkably intimate encounter: ‘Those who behold [relics] embrace, as it were, the living body in full flower: they bring the eye, mouth, ear and all the senses into play.’¹⁰¹ By the same token the Tanking twins, the many preparations of infants as well as the embalmed hearts were powerful markers for the living body as a whole. Thus Mr and Mrs Tanking, in allowing Ruysch to embalm their children, kept them alive. Visiting them was a chance to physically and emotionally cherish them.

If we consider Ruysch's preparations as anatomically and emotionally challenging things, continuously luring their audiences into communication and handling, the Cabinets become a much more lively place: visitors walk in and out, preparations keep changing pots and places, experiences are evoked and shared. In this context it is not surprising that the beautifully prepared face of a dead child captivated Peter the Great and enticed him into kissing it—the kiss representing not only respect for Ruysch and his skills,

⁹⁷ Ruysch (1744), p. 623.

⁹⁸ Santing (2007), pp. 203–204.

⁹⁹ The episode illustrates Margocsy's depiction of Ruysch's anatomical cabinets as a commercial enterprise. Margocsy (2009), pp. 187–210.

¹⁰⁰ These aspects have been put forward by Eric Jorink, Bert van den Roemer, and by Julie Hansen. See Jorink (2006), Roemer (2010) and Hansen (1996).

¹⁰¹ Gregory Nyssa, a fourth-century Greek father in Hahn, *Strange Beauty*, p. 17.

but also reflecting the daily practice of continuously handling, touching and remodelling preparations. Yet, there is more to the story. I would suggest that Peter's kiss symbolized more than respect and veneration for Ruysch's skills as an anatomist. Rooted in a Russian Orthodox tradition which valued the veneration (and kissing!) of icons (even though the Czar was known and feared as a 'Protestant' moderniser of the Russian Orthodox church), the kiss also represented a deeply felt emotional link to the dead and eternally innocent world of the child. 'Touching anatomy' therefore, not only refers to the actual practice of touching and handling anatomical preparations, but also to the ways preparations impacted on visitors and touched them emotionally.

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References

- Alberti, S. J. M. M. (2007). The museum affect: Visiting collections of anatomy and natural history. In A. Fyfe, & B. Lightman (Eds.), *Science in the marketplace. Nineteenth-century sites and experiences* (pp. 371–403). Chicago & London: Chicago University Press.
- Alberti, S. J. M. M. (2009). *Nature and culture. Objects, disciplines and the Manchester museum*. Manchester & New York: Manchester University Press.
- Alberti, S. J. M. M. (2011). *Morbid curiosities. Medical museums in nineteenth-century Britain*. Oxford: Oxford University Press.
- Bennet, T. (1995). *The birth of the museum. History, theory, politics*. London: Routledge.
- Berkowitz, C. (2013). Systems of display: The making of anatomical knowledge in enlightenment Britain. *British Journal for the History of Science*, 46, 359–387.
- Cole, F. J. (1944). *The history of anatomical injections* (London)
- Cook, H. J. (2002). Time's bodies: Crafting the preparation and preservation of naturalia. In P. H. Smith, & P. Findlen (Eds.), *Merchants and marvels: Commerce, science and art in early modern Europe* (pp. 223–247). New York: Routledge.
- Cook, H. J. (2007). *Matters of exchange. Commerce, medicine, and science in the Dutch golden age*. New Haven & London: Yale University Press.
- Coopmans, C., Vertesi, J., Lynch, M. E., & Woolgar, S. (2014). *Representation in scientific practice revisited*. Cambridge, MA & London: MIT Press.
- Cunningham, A. (2010). *The anatomist Anatomist's d. An experimental discipline in enlightenment Europe*. Farnham: Ashgate.
- Dacome, L. (2007). Women, wax and anatomy in the 'Century of things'. *Renaissance Studies*, 21, 522–550.
- Dupré, S., & Korey, M. (2009). Inside the Kunstammer: The circulation of optical knowledge and instruments at the Dresden court. *Studies in History and Philosophy of Science Part A*, 40(4), 405–420.
- Elsner, J. (1994). A collector's model of desire: The house and museum of Sir John Soane. In J. Elsner, & R. Cardinal (Eds.), *The cultures of collecting* (pp. 155–176). London: Reaktion Books.
- Evans, R. J. W., & Marr, A. (2006). *Curiosity and wonder from the renaissance to the enlightenment*. Farnham: Ashgate.
- Guerrini, A. (2004). Anatomists and entrepreneurs in early eighteenth-century London. *Journal of the History of Medicine and Allied Sciences*, 59, 219–239.
- Hagens, G. von (2002). Body worlds. The anatomical exhibition of real human bodies. *Exhibition Catalogue*.
- Hahn, C. (2012). *Strange beauty. Issues in the making and meaning of reliquaries, 400 – Circa 1204*. Pennsylvania: Pennsylvania State University Press.
- Hansen, J. V. (1996). Resurrecting death. Anatomical art in the cabinet of Dr. Frederik Ruysch. *The Art Bulletin*, 78, 663–679.
- Hendriksen, M. (2012). *Aesthesis in anatomy. Materiality and elegance in the eighteenth-century Leiden anatomical collections* (Leiden: unpublished PhD thesis)
- Honig, E. (1999). *Painting and the market in early modern Antwerp*. Yale: Yale University Press.
- Hooper-Greenhill, E. (1992). *Museums and the shaping of knowledge*. London & New York: Routledge.
- Huisman, T. (2009). *The finger of god. Anatomical practice in 17th century Leiden*. Leiden: Primavera Press.
- Huistra, H. (2013). *Preparations on the move. The Leiden anatomical collections in the nineteenth Century*. Leiden: unpublished PhD thesis.
- Jansma, J. R. (1919). *Louis de Bils en de Anatomie van Zijn Tijd* (Utrecht: PhD thesis)
- Johnson, G. A. (2012). In the hand of the beholder: Isabella d'Este and the sensual allure of sculpture. In A. E. Sanger, & S. T. Kulbrandstad Walker (Eds.), *Sense and the senses in early modern art and cultural practice* (pp. 183–198). Farnham: Ashgate.
- Jorink, E. (2006). *Het Boek der Natuere. Nederlandse geleerden en de wonderen van Gods Schepping 1575–1715*. Leiden: Primavera Press.
- Knoeff, R. (2012). Sex in public on the spectacle of female anatomy in Amsterdam around 1700. *l'Homme. Europäische Zeitschrift für Feministische Geschichtswissenschaft*, 23, 43–58.
- Knoeff, R. (2015). Ballpool anatomy. On the public veneration of anatomical relics. In R. Knoeff, & R. Zwijnenberg (Eds.), *The fate of anatomical collections*. Farnham: Ashgate (in press)
- Kooijmans, L. (2004). *De doodskunstenaar. De anatomische lessen van Frederik Ruysch*. Amsterdam: Bert Bakker.
- Latour, B. (2010). *On the modern cult of the Factish gods*. Durham & London: Duke University Press.
- Leeuwenhoek, A. van (1686). *Ontledingen en Ontdekkingen van Levende Dierkens in de Teel-deelen van Verscheide Dieren*. Leiden: Vogelen en Visschen.
- Leeuwenhoek, A. van (1718). *Send-Brieven, zoo aan de Hoog Edele Heeren van de Koninklijke Sociëteit te Londen* (Delft)
- Leeuwenhoek, A. van (1753). Microscopical observations on the blood vessels and membranes of the intestines in a letter to the royal society from Mr. Anthony van Leeuwenhoek, F.R.S. (January 1, 1753). *Philosophical Transactions of the Royal Society*, 26(1683–1775), 53–58.
- Maerker, A. (2011). *Model experts: Wax anatomies and enlightenment in Florence and Vienna, 1775–1815*. Manchester: Manchester University Press.
- Maerker, A. (2013). Anatomizing the trade: Designing and marketing anatomical models as medical technologies, ca. 1700–1900. *Technology and Culture*, 54, 549–553.
- Margocsy, D. (2009). Advertising cadavers in the republic of letters: Anatomical publications in early modern Netherlands. *British Journal for the History of Science*, 42, 187–210.
- Margocsy, D. (2011). A museum of wonders or a cemetery of corpses? The commercial exchange of anatomical collections in early modern Netherlands. In S. Dupré, & C. Lüthy (Eds.), *Silent messengers. The circulation of material objects of knowledge in the early modern low countries* (pp. 185–215). Berlin: Lit Verlag.
- McLeary, E. H. (2001). *Science in a bottle. The medical museum in North America, 1860–1940* (Pennsylvania: unpublished PhD thesis)
- Messbarger, R. (2010). *The lady anatomist. The life and work of Anna Morandi Manzolini*. Chicago: University of Chicago Press.
- Mulder, W. J., & Beukers, H. (1990). Injected specimens in the anatomy museum of Leiden. In *Proceedings of the Fundacio-Museu d'Historia de la Medicina de Catalunya, Fifth Colloque of the European Association of Museums of History of Medical Sciences. Barcelona*.
- Naeranus, J. van der (1661). *De tweede Amsterdamsche buuren-kout handelende van verscheide aanmerkenwaardige zaken* (Middelburg)
- Ragland, E. (2012). *Experimenting with chemical bodies: Science, medicine, and philosophy in the long history of Reinier de Graaf's experiments on digestion, from Harvey to Bernard* (Indiana University: unpublished PhD thesis)
- Roberts, L. (1995). The death of the sensuous chemist. The 'New' chemistry and the transformation of sensuous technology. *Studies in History and Philosophy of Science Part A*, 26(4), 503–529.
- Roberts, L., Schaffer, S., & Dear, P. (Eds.). (2007). *The mindful hand. Inquiry and invention from the late renaissance to early industrialisation*. Amsterdam: Edita.
- Roemer, G. van den (2008). Het lichaam als borduursel. Kunst en kennis in het anatomisch kabinet van Frederik Ruysch. *Body and Embodiment in Netherlandish Art. Nederlands Kunsthistorisch Jaarboek*, 58, 216–240.
- Roemer, G. van den (2010). From vanitas to veneration. The embellishments in the anatomical cabinet of Frederik Ruysch. *Journal of the History of Collections*, 22, 169–186.
- Ruysch, F. (1744). *Alle de Ontleed-, Genees-, en Heelkundige Werken van Frederik Ruysch* (Amsterdam)
- San Juan, R. M. (2011). The horror of touch: Anna Morandi's wax models of hands. *Oxford Art Journal*, 34, 433–447.
- Santing, C. (2007). Spreken vanuit het Graf: De Stoffelijke Resten van Willem van Oranje in hun Politiek-Culturele Betekenis. *Bijdragen en Mededelingen Betreffende de Geschiedenis der Nederlanden*, 122, 181–207.
- Smith, P. (2004). *The body of the artisan. Art and experience in the scientific revolution*. Chicago: Chicago University Press.
- Smith, P. (2007). In a sixteenth-century Goldsmith's workshop. In L. Roberts, S. Schaffer, & P. Dear (Eds.), *The mindful hand. Inquiry and invention from the late renaissance to early industrialisation* (pp. 33–58). Amsterdam: Edita.
- Smith, P., & Findlen, P. (Eds.). (2002). *Merchants and marvels*. New York: Routledge.
- Uffenbach, Z. C. von (1753). *Merkwürdige Reisen durch Niedersachsen, Holland und England* (Frankfurt)
- Walsham, A. (2010). Introduction: Relics and remains. *Past and Present*, (Suppl. 5), 9–36, 1.
- Werret, S. (2013). Recycling in early modern science. *British Journal for the History of Science*, 46, 627–646.
- Wharton, A. J. (2006). *Selling Jerusalem: Relics, replicas, theme Parks*. Chicago: University of Chicago Press.