

## Bodies for science. The display of human statues for educational purposes

*Francesca Monza<sup>1</sup>, Silvia Iorio<sup>2</sup>*

<sup>1</sup> Department of Medicine and Aging Sciences, “G. d’Annunzio” University of Chieti and Pescara; <sup>2</sup> Unit of History of Medicine Department of Molecular Medicine, Sapienza - University of Rome, Italy

**Abstract.** Every time von Hagens’ plastinated bodies are exposed, they cause polemics, controversies and an inevitable echo in the media. It is not clear whether what raises greater scandal and ethical doubts is the exposure of real bodies, corpses for anatomical demonstration, or the fact that the Body Worlds Exhibition attracts crowds of visitors, resulting in huge financial revenues. Contextualized within the history of medicine, if it were only the display of “prepared” corpses to be called into question, the issue should not cause outcry, as we are merely in the presence of the latest technique, plastination, in the long evolution of medical and anatomical teaching. Such statues, created in anatomical cabinets, were used in the past as a compendium for courses of anatomical studies. The bodies were prepared using complex techniques, treated with great care and postured as if they were “alive” in order to make them more understandable and effective for teaching. A related theme - with important ethical implications - is how these bodies were made available to anatomical institutes. In Britain there was the very interesting case of Jeremy Bentham (1748-1832), father of utilitarianism: he donated his body for research purposes and display. This philosopher was ahead of his time not only regarding the display of bodies for scientific purposes, but also the formula for the donation of bodies to science, now the only really viable solution for the use of the human body in educational and scientific settings.

**Key words:** medical education, human body exposition, anatomy

### Introduction

Every time the plastinated bodies created by the German doctor Gunther von Hagens have been put on public display, since 1995, they have caused polemics, controversies and an inevitable echo in the media.

It is not clear whether what raises greater scandal and ethical doubts is the exposure of real bodies, corpses for anatomical demonstration, or the fact that the Body Worlds travelling exhibition attracts crowds of visitors – according to recent estimates more than 47 million people – making use of means of communication and advertising and earning huge commercial revenues, to become the most-visited exhibition in history.

Contextualized within the history of medicine, if it were only the display of “prepared” corpses to be called into question, the issue should not cause outcry,

as we are merely in the presence of the latest technique, plastination, in the long evolution of medical and anatomical teaching which, since the 17th century, has attempted to represent the “human machine” not only through tables and drawings, but also using natural and artificial models.

The von Hagens exhibition displays statues created from corpses using a technique invented in 1977, which substitutes blood and other natural fluids with polymer and silicone. The technique substitutes fluids and biological tissues with plastic substances in a series of steps, in order to create models that do not decompose (1).

First formaldehyde is injected into the body through the arteries; later water and soluble fats are melted away by immersing the body in an acetone bath; the substances are then substituted with resins and elastomers, such as silicon rubber and epoxy res-

in, through vacuum-forced impregnation, to then be polymerized by the action of gas, light or heat. This latter phase allows the statues to be placed into the desired pose, as well as obtaining elasticity and durability. Once the process is complete, the end result is anatomical statues frozen in the middle of everyday actions, such as running or dancing, with an overall effect that seems to nod in the direction of contemporary art exhibitions, combining and overlapping the feelings of unease and repulsion that the corpses may generate with feelings of wonder and curiosity towards the strange “object” one observes.

Body Worlds therefore purports to represent a great innovation in the field of contemporary scientific exhibitions, but perhaps it is not that at all, if we examine these statues in the context of the history of medicine and of traditional anatomical museums which the exhibition knowingly and explicitly references (2). In analysing the exhibition, from some points of view we might consider it to be more of a ‘revival’ than something truly original, though without a doubt it has the merit of drawing broader public attention to anatomy. Indeed, the most innovative aspect of Body Worlds, apart from the techniques used, is certainly linked to the methods of promotion, communication and marketing which, employed in a globalized world, have allowed interest in anatomy and the wonders of the human body (an interest that was probably never wholly dormant) to re-emerge. It attracts huge numbers of people, each no doubt with their own different motivations, in what is the largest-ever operation in medical/anatomical education for the broader public.

Medical anatomical museums, both university-based and otherwise, that are often closed or inaccessible, without adequate captions and explanatory texts, are at present unable to carry out this function.

### Teaching models

Dissection was the first means by which the human body was investigated and displayed, including to laypeople. Exemplary cases of public dissections took place from the Middle Ages on, such as that conducted by Mondino de’ Liuzzi (1275-1326), or those held in the 16th century beginning with Andrea Vesalio (1514-1564). Just such a public demonstration was

admirably recorded on canvas by Rembrandt amid the light and shade of his *The Anatomoy Lesson of Doctor Nicolaes Tulp* (1632).

Alongside the dissections, however, means were sought by which to preserve bodies for scientific purposes, with a view to making the entire system of the living being both visible and durable. Every anatomical discovery was to be documented and if possible “fixed” from life to make it visible to future generations. The goal was, therefore, to make natural preparations so that the human body might be open to examination in a permanent manner. Such preparations necessarily went beyond mere skeletons, which by their very nature were easily preserved, to include whole human corpses, their skin and outer tissues removed to reveal their innermost secrets (3, 4).

The first to make the creation of natural human statues possible was the naturalist Jan Swammerdam (1637-1680), who first used arterial injections using a method that he published in 1672 in the compendium *Miraculum naturae, sive, Uteri muliebris fabrica* (5).

However it was Frederik Ruysch (1638-1731), a professor of anatomy in Amsterdam, who perfected the technique of injecting liquid wax. He was able to highlight the finest branchings of the circulatory system, creating the “mummies” made famous by Leopardi in his *Operette morali*. He created *tableaux* composed of human and animal remains. In these compositions, such as the *mountains of the vanities*, he artfully placed the skeletons of fetuses upon mountains made up of apparent mineral and vegetable conglomerates, which were in reality parts of arteries injected with wax that were made to seem like corals, with kidney and gallstones in place of rocks. The little fetuses were in poses and attitudes which recalled the theatrical spirit and sense of “wonder” of the 17th century (6). It was only natural that the taste for *Vanitas* themes, common in Dutch still lifes of the time, should be reflected in the compositions of Ruysch’s anatomical collection. The fetuses looked animated, and held evocative objects in their hands, such as a sickle, a pearl necklace, or a handkerchief to cry into (in reality made of human tissue). This represented the *miseria hominum* in the classic iconographies of the *memento mori*, where skulls and precious objects are depicted side by side to symbolize the fleeting nature of the mundane.

This display technique, which was meant to make a naturally macabre subject more pleasing, combines coreographic intent with explicit pedagogical and moralistic function, becoming a benchmark for later anatomical museums.

The true turning point towards new collections for teaching purposes was the collections of the Hunter brothers, William (1718-1782) and John (1728-1793). They prepared human corpses using paints, resins, waxes and mercury and began gathering collection that would be useful for their teaching activity. Together they created two important private collections, later to be bought respectively by the University of Glasgow and the Royal College of Surgeons.

Inspired by the Hunter collections, one of the greatest creators of anatomical preparations of all time created his own collection: Honoré Fragonard (1732-1799), cousin of the painter Jean-Honoré Fragonard, surgeon and professor first at the veterinary school of Alfort and later at the veterinary school of Paris. He created thousands of anatomical preparations, including the statues that were to become famous as *les écorchés* (lit. ‘the flayed’). Made for teaching purposes for the veterinary school of Alfort – under the direction of Claude Bourgelat – the statues known as the “Man with a Mandible” and the “Horseman of the Apocalypse” betray their creator’s ambition to be considered also as works of art. When he came into conflict with Bourgelat, Fragonard was dismissed from the school at Alfort and began to work privately as a creator of anatomical preparations, crafting works for many existing cabinets. He was able to make a small fortune, finding a rich market for his works among collectors of “worldly curiosities”. The school at Alfort fell into decline during the revolutionary period, but Fragonard sought to promote his dream of creating a national school of anatomy in line with his enlightenment convictions, which he expressed in a 1792 report to the legislative assembly. This report, in the context of an organisational project for public education laid out by Condorcet, proposed the creation of “a cabinet in which all the wise men of Europe may find all the anatomical disciplines, be they human or veterinary, in the highest degree of perfection possible, in order to advance such discoveries as are useful to our suffering human kind, and with which national professors may

guide their pupils in the study of the bodies of living beings” (7). In his intentions, his expertise in this field would therefore have been useful for the good of the Nation, although he did not disdain to put his artistic human statues to far more commercial ends.

Antonio Scarpa (1752-1832) visited William Hunter, in order to perfect his mercury injections technique, which he brought to full fruition in Pavia in an anatomical museum almost entirely made up of natural preparations, with human statues of admirable complexity and elegance, with the sole and exclusive end of improving the effectiveness of his teaching activities (Fig. 1).

The museum of Pavia, first begun by Giacomo Rezia upon the request of Pietro Moscati, came to completion with the arrival as Chair of Anatomy of Scarpa, who immediately made one of the goals of his tenure the desire to carry out practical teaching activity that should not be limited to dissection alone, but should include the creation of anatomical preparations.

His interest in the creation of the most complete anatomical collection possible was immediately evi-



**Figure 1.** Angiological anatomical statues (18th century), Anatomical Museum of the University of Pavia.

dent: his inaugural address as the Chair of Anatomy, *On the necessity of perfecting preparation methods* (8), left no doubt as to the matter.

In this oration he illustrated his teaching methods, which were no longer to be centred around frontal instruction, but rather around a long series of anatomical demonstrations aimed at illustrating the topographical relations between tissues and organs, with particular regard to physiology and an introduction to surgery. The students were to recreate the most important preparations in the dissection rooms, with a view to acquiring objective cognition based on experience.

Going into detail concerning the methods used for creating individual preparations, he gave particular attention to the representation of the circulatory system, mentioning Ruysch and Albino's beautiful preparations, but criticising them because in his opinion they were made more to elegantly adorn cabinets than to contribute new scientific knowledge.

He also criticised some of the preparation methods of the time, abhorring as "utterly flawed" the habit of creating artery (and also nerve) trees removed from the body and laid out on boards. He instead proposed a "more advantageous and more perfect" method of making them useful for teaching purposes, which consisted of separating first muscles and then viscera from the vessels, preparing them separately, and then putting the injected vessels back in place "in their natural line of flow, allowing the ordinary bone structure to be of support to them" (8). He therefore essentially blazed a trail toward the creation, for his cabinet, of whole angiological statues, which were soon to be created. The statues dating back to the time of Scarpa that are still conserved today at the Anatomical Museum of Pavia – in the Institute of Human Anatomy – are included in the Angiology section with the following caption: "Whole dry corpses, injected and prepared (statues)" (9). The didactic intent was to follow the arterial or venous tree in all of its principal branches throughout a whole body.

These statues, as is the case of all the preparations present in the Museum, were to serve as compendiums for the teaching of anatomy, not only because they were carefully observed during the theory lessons, but also because creating such preparations was a useful exercise for future doctors and surgeons, in line with

the indications of the Study and Discipline Plan of the University of Pavia.

The preparations therefore had a two-fold didactic function: on the one hand they helped train the hands of surgeons and make them steady in the creation of preparations, and make them familiar with the inside of the human body and all of its vital systems. On the other hand, the best preparations might be put on display in the Museum, becoming in turn tangible benchmark models that students and, occasionally, the broader public might consult. Occasional openings for students and for the public had an important pedagogical role, leading to contact with a broader public and progress in medical science, and helping to rid the population of superstitions, charlatans and faith-healers (10).

Anatomical preparations and statues filled Italian and European anatomical cabinets from the 18th century onwards, at first often as a result of private initiative, but ever more frequently, from the turn of the 19th century onwards, they came to be a fundamental part of the educational policies of governments and academic institutions, who saw museums as places in which culture was to be put on display and where Enlightenment and, later, Positivist ideas were to be showcased.

Other Italian museums, apart from those of Pavia, feature anatomical statues, above all in the Angiology sections, as is the case of the Anatomical Museum of Pisa, founded in 1832 by Tommaso Biancini, where the angiological statues for the demonstration of the circulation of blood vessels are conserved (11). In the Anatomical Museum of Naples, where the collection of dry preparations includes 417 pieces, two desiccated bodies with injected vascular trees are on display. The first is seated upon a wooden pedestal in a classic statuary pose, while the second is standing and displays the whole, interwoven complexity of the blood vessels, injected with two differently coloured substances in order to differentiate between arteries and veins.

### Using art to change meaning

As previously mentioned, the bodies were not only prepared using complex and jealously guarded techniques, but continued to be placed in "animated" poses, remaining within the tradition started by Ruysch, in order to make them more understandable and effective

from the teaching point of view. The poses portraying wonder, melancholy, or inspired by celebrated works of art were intended to produce a change in meaning, transforming “macabre remains” into objects that were useful to knowledge and worthy of display.

For Scarpa and his contemporaries the desire was to achieve a certain elegance, making the subject “speak”, with the intention, perhaps, of conferring upon it the life it could no longer have. To achieve this result the emotions such as wonder and sadness were attributed to the statues, together with detailed study of artistic poses, making highly cultured reference to the works of Michelangelo, Durer, or Borromini.

Anatomists willingly crossed over in this way into the field of art, and indeed considered themselves artists. Often, in fact, they were also connoisseurs of the Fine Arts. Antonio Scarpa, for example, was the owner of a rich collection of paintings, which were put up for auction upon his death, including works by Mantegna, Perugino and Sodoma (12). William Hunter, too, was a passionate collector of the visual arts. It was only natural, therefore, that in order to make corpses less unpleasant and more presentable, inspiration should be taken from both classical and contemporary art.

The stated desire was that of making each preparation “instructive and elegant”. Where elegance is the fundamental means by which to achieve the end of teaching. In order to illustrate musculature it is certainly better to set a figure in a pose of movement, rather than leave it inert. The pedagogical goal was indeed to reveal the secrets of the living body, rather than investigate or display the dead body.

The concept of elegance referred to a human anatomical preparation may seem to be an oxymoron, but it was in keeping with the spirit of the times, and the enthusiasm that was palpable in the anatomical cabinets, where, from one day to the next, one could easily be involved in sensational new discoveries, which could then be “fixed” in an anatomical preparation. There was the desire to highlight the worth of the difficult techniques and challenging works of anatomists, able to conserve in the most natural possible semblances that which would otherwise soon have been lost. It was all thanks to the expertise, the sensitivity and the culture of the person creating the preparation that this change in meaning could be achieved, transforming “macabre remains” into

objects that were useful to knowledge and worthy of display. The same manner of elegance and artistic references was certainly present also in the development of artificial preparations, in the anatomical models created by the Florentine and Bolognese wax modellers of the 18th and 19th centuries, but in their case the connection was, perhaps, more immediate, because it was art that was offering its services up to science and not science imitating art. For this reason the celebrated anatomical statues of the La Specola laboratory, or those by the Manzolini husband and wife team of Bologna, or by Louis Th. Auzoux, were highly successful, but could never perform the same dual didactic function.

### The technical creation of the statues

In order to create natural-looking human statues, “flayed figures”, long and complex artificial processes were necessary. In the cabinets, the anatomists and dissectors were able to create, using techniques that were often kept secret, arterial, venous, neurological and myological statues. Each of the parts were separately prepared and then the whole was reassemble in the most natural way possible, around the skeleton which was in turn adequately prepared.

During the 18th century articles and indeed manuals began to circulate that illustrated the main aspects of these techniques, including the *Antropotomie* by Jean-Joseph Sue and the work of the same title by Pierre Tarin, as well as the articles on the subject by Vicq D’Azir and by Alexander Monro (13). In Italy we find Angelo Dubini’s *Trattato di Antropotomia* (14) which, though a relatively late work, allows us to better understand the techniques and activities of Italian anatomical cabinets in the 18th and 19th centuries, with its reliable, precise content and the breadth of its bibliographical references. In this volume, detailed descriptions of the phases of creations of “arterial statues” can be found. This operation was complex because “it is easily seen how much care and attention is required from dissectors to create a statue in which many objects must be prepared in no longer than eight to ten days after being placed in the conserving solution”, both for “venous statues” and “neurological statues” (14).

Statues were, in any case, relatively rare in museums. The preferred option was the anatomical prepara-

tion, both dry and in liquid, of specific single organs. Statues, given their greater size and complexity, were more difficult to conserve, and always caused more problems for their creators, who were often accused of nefarious activities. These are among the reasons why most have now been lost. An emblematic case is, however, that of England where statues both human and artificial (mostly in wax) were destroyed in Victorian times, because they were considered scandalous. In the 19th century, anatomical demonstrations were ever more focused on the conservation of body parts in liquid, a technique which allowed the preparation to remain more natural. The fame and importance of anatomical museums diminished hand in hand with progress in the fields of photography and radiography, and all but disappeared around the turn of the 20th century, leading to entire collections being all but forgotten.

In 1886, August Wilhelm von Hofmann (1818-1892) discovered formaldehyde, which was soon introduced as the liquid of choice for the conservation of body parts in liquid in anatomical cabinets and institutes. In the 20th century it was to become one of the basic elements of plastination, the technique that has brought anatomical displays back into the limelight through dry-preserved human statues.

### **Plastination for the teaching and science communication**

The Body Worlds exhibition fits perfectly into the historical development briefly outlined in the present article, which made use of corpses and of “transformed” human bodies.

Von Hagens is familiar with the history of anatomy, and the history of anatomical preparations and their creators and, through the continual and insistent use of citations and references to this rich and complex tradition, he willingly places himself within that same history, continuing its development and bringing it to a level of technical perfection hitherto unknown.

The poses and attitudes of von Hagens’ plastinated statues, which are more extreme, contemporary, and linked to modern everyday life – such as the poker players, or the dancing girl or the horse-rider on his horse – can therefore be wholly placed within the tradition of the “pose”, used as a tool for the aesthetic

acceptance of human remains with the intention to achieve didactic goals, aimed however at a far broader public, certainly made up for the most part of laypeople, but far more knowledgeable than the people who visited the exhibitions of the 18th and 19th century.

Furthermore, the exhibition has a higher educational intent, that is not limited to simple awareness of the human body but, as expressed in the presentation: “In addition to organ functions, common diseases are described in an easily understood manner by comparing healthy and affected organs. They show the long-term impact of diseases and addictions, such as tobacco or alcohol consumption, and demonstrate the mechanics of artificial knee and hip joints” (15).

Before hosting the exhibition in Los Angeles, in 2004/5, the California Science Center requested an ethical evaluation, supported by a report made by an external consultant of international reputation.

The conclusions were the following: “The consensus of the Ethics Advisory Committee was that the exhibit has considerable educational value [...] What makes the exhibit so compelling (real bodies in everyday poses) is also what makes it most controversial. Without those very features, the exhibit would not be such a powerful educational experience [...] The plastinates are displayed in the context of science, health and medical education, and create an atmosphere of respect” (16). The report was updated in 2016/7 (17).

The exhibition, regardless of the didactic and pedagogical messages it is intended to transmit, leads to noteworthy ethical questions (18) every time; questions which are themselves part of the history of medicine and anatomy. It is often the way in which the bodies to be made into statues are acquired that is called into question. Von Hagens has been accused – though without any supporting evidence – of using the bodies of Chinese death row convicts in order to create his works. In reality the Institute of Plastination has access to hundreds of bodies that are daily donated for the purposes of plastination, and therefore has no need to procure bodies through other, illicit means. The present article is not the appropriate context in which to go into greater detail concerning this issue, which has important ethical implications, but it is necessary to at least mention it. The diffidence and scepticism on the subject are not entirely without reason, because

at least until the 18th century the bodies of outcasts, criminals condemned to death or even bodies stolen by grave-robbers were indeed used for dissections. With the Enlightenment, in Italy and France, under the guidance of enlightened sovereigns, doctors were able to obtain the bodies they felt were necessary for their work directly from hospitals, with a view to the benefit their work would bring to the greater community and to the cause of public health.

In Great Britain, however, which up until the early 19th century had no laws regarding this type of activity, the terrible case of Burke and Hare occurred (brought to the silver screen by John Landis in the film *Burke & Hare*), in which the West Port murderers provided anatomists with bodies for payment. The case caused a terrible scandal for the British anatomical schools and forced the government to urgently pass an *ad hoc* law, the Anatomy Act.

In this context we find the case of Jeremy Bentham (1748-1832), the founder of modern utilitarianism, who donated his body to his friend, Thomas Southwood Smith, doctor and author of *The Use of the Dead for the Living* (1824), to support the benefits to research of corpses in order to achieve progress in treatment for the living. The body of Bentham was publicly dissected, just before the Anatomy Act of 1832 was passed, and was later put on display at the University College of London (19). With this action the British philosopher proved ahead of his time, not only regarding the display of bodies for scientific purposes, but also the formula for the donation of bodies to science.

The donation of bodies for educational and research purposes, as a voluntary act on the part of the donor, seems to be the only really viable solution for any form of medical anatomical display that might be created today.

## References

- Hagens VG. *Body Worlds: The Original Exhibition of Real Human Bodies*. Nachdruck: Arts & Sciences; 2008.
- Licata M, Gorini I, Iorio S. An osteological museum inside the varesse medical school? A proposal from the medical, anthropological and paleopathological point of view. *Acta Biomed* 2018; 88(4): 510-11.
- Monza F, Licata M. Anatomical Preparations in Museums A Special Category Of Cultural Heritage. *Med Secoli* 2015; 27(2): 615-28.
- Monza F, Badino P, Licata M. Johann Gottlieb Walter (1734-1818) and the technical preparation of bones in an anatomical cabinet in the late eighteenth and nineteenth century. *Acta Med Hist Adriat* 2017; 15(2): 253-60.
- Swammerdam J. *Miraculum naturae, sive, Uteri muliebris fabrica*, Lugduni Batavorum, apud Severinum Mhatthaei. Leiden: Publisher Leiden; 1672.
- Ruyschii F. *Thesaurus Anatomicus Primus*, Amstelodami, apud Janssonio Waesbergios, MDCCXXXIX. 1721.
- Degueurce C. Honoré Fragonard et ses écorchés. *Un anatomiste au Siècle des lumières*. Paris; 2010 pp 147-50.
- Scarpa A. *Opere del Cav. Antonio Scarpa, prima edizione completa in cinque parti*. Tip. Della Speranza; 1838: 537-53.
- Zoja G. *Il Gabinetto di Anatomia Umana*. Pavia: Università di Pavia; 1882: 23-4.
- Carli A. Il valore educativo e la rilevanza formativa dei preparati anatomici tra XVIII e XX secolo. *Alcuni brevi spunti*. *Riv Sto Med* 2010; 1(2):1-10.
- Marinozzi S, Gazzaniga V, Iorio S. The Earliest Blood Transfusions in 17th-Century in Italy (1667-1668). *Transfus Med Rev* 2018; 32 (1): 1-5.
- Momesso S. *La collezione di Antonio Scarpa*. Padua: Edizioni prioritarie; 2007.
- Sue JJ. *Antropotomie ou l'art du disséquer, d'embaumer et de conserver les parties du corps humain, &c., 2° edition revue et considérablement augmentée*. Paris: Cavellier; 1765.
- Dubini A. *Trattato di Antropotomia o dell'arte di eseguire e conservare in cera le preparazioni anatomiche del dottore Angelo Dubini*. Milano: Tipografia di P.A. Molina; 1837.
- Von Hagens G. *Body Worlds: The Original Exhibition of Real Human Bodies*, <https://bodyworlds.com/about/philosophy/>
- California Science Center, *Body Worlds: An Anatomical Exhibition of Real Human Bodies*. Summary of Ethical Review, 2009. [https://koerperwelten.de/wp-content/uploads/2017/09/EthicReport\\_CSC\\_E\\_190110.pdf](https://koerperwelten.de/wp-content/uploads/2017/09/EthicReport_CSC_E_190110.pdf)
- California Science Center; *Gunther von Hagens' Body Worlds: Pulse* Summary of Ethical Review Update 2016/2017 <https://bodyworlds.com/wp-content/uploads/2018/04/EthicsReport-CSC-update-2017.pdf>
- Monza F, Licata M. Ethical issues in paleopathological and anthropological research experiences. *Acta Biomed*; 2017; 88(3): 315-8.
- Cassman C, Odergaard N, Powell J. *Human Remains. Guide for Museums and Academic Institutions*. Lanham: Altamira Press; 2008: 262-3.

Correspondence:

Silvia Iorio

Unit of History of Medicine Department of

Molecular Medicine, Sapienza - University of Rome, Italy

E-mail: [silvia.iorio@uniroma1.it](mailto:silvia.iorio@uniroma1.it)