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VIEWPOINT

Engaging With Plastination and the Body Worlds Phenomenon: A Cultural and Intellectual Challenge for Anatomists

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Body Worlds, the international plastination phenomenon, has proved immensely popular with audiences worldwide. Never before has the human body been exposed to public gaze in such an accessible and intriguing manner. Dissected body parts feature alongside whole-body plastinates with their life-like poses ranging from those with Renaissance motifs to others with highly contemporary themes. However, the exhibitions and their creator, Gunther von Hagens, have astounded many, including anatomists, some of whom find the unconventional display of human bodies unethical and offensive. The voyeuristic nature of *Body Worlds* and the uneasy balance between entertainment and education have proved problematic for anatomists. Von Hagens himself is a polarizing figure, pursuing his dream of ''democratizing anatomy'' with little regard for the conventions of academia. While valid ethical objections can be raised against some aspects of the exhibitions, we argue that wholesale rejection of them is unwarranted. In arriving at this conclusion we assess the ethical and educational issues involved. We divide the whole-body plastinates into four categories, ranging from those illustrating structural and functional relationships to those with artistic and humanistic aspirations rather than anatomical ones. We conclude that anatomists need to face up to the opportunities and challenges posed by the *Body Worlds* phenomenon, utilizing what is being presented to the general public and adapting this in teaching and research. Clin. Anat. 22:770–776, 2009.

Key words: anatomical exhibitions; anatomy art; dissection; Gunther von Hagens; whole-body plastinates

INTRODUCTION

Anatomists have reacted with considerable ambivalence toward the *Body Worlds* phenomenon, and in particular toward the founder of plastination and the driving force behind the exhibitions, Gunther von Hagens. Rarely has an exhibition of this nature been staged with such panache and forthrightness. As it broke many unspoken conventions, it astounded and angered one group after another, chief among which were anatomists. However, while some anatomists scorned *Body Worlds* and its creator, others have embraced them.

The German Anatomical Society attempted to prevent the initial German exhibition in Mannheim in 1997 and later censured *Body Worlds* as severely violating the principles of its society (Kühnel, 2004). Representatives of the Anatomical Society of Great Britain and Ireland, and the British Association of Clinical Anatomists expressed their concern that *Body Worlds* would ''sensationalise and trivialise

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[human dissection] as a mere spectacle'' ''to the detriment of medical education'' (Boyde et al., 2002). In their view ''the display of dissected bodies and body parts is appropriately restricted by law to designated educational areas and to those taking designated educational programmes.''

In contrast, one anatomist described her delight at the life-likeness of the plastinates and approved of the exhibition's general audience by not denying the public the opportunity to satisfy the ''fundamental human curiosity to know what lies beneath our skin'' (Morriss-Kay, 2002). In 2008, the American Association of Anatomists officially supported the *Body Worlds* exhibitions on condition that the body donors had given informed consent (Burr, 2008).

The exhibitions have almost nothing in common with the dissecting room, and the contrast has taken anatomists by surprise suggesting they were unprepared for dealing with the manner in which human cadavers are displayed in *Body Worlds*. This presents anatomists with a major dilemma, since cadavers are the tools of their trade, and yet here are displays that appear to contravene the essential features of their discipline. Not only this, the mission of these exhibitions is claimed to be health education, the target of which is lay audiences and the aim of which is to provide them with an opportunity to better understand the human body and its functions. However, the exhibits also aim to demonstrate the naturalness, individuality, and anatomical beauty of the human body (Institute for Plastination, 2007c), aims that may owe more to artistic aspirations than scientific ones.

With the growing commercial success of *Body Worlds*, the literature devoted to an assessment of the movement has increased exponentially, resulting in a flourishing interdisciplinary debate on its meaning. This has involved a plethora of contributions, including the historical (Simon, 2002), ethical (Schulte-Sasse, 2006; Burns, 2007; Preuss, 2008), legal (Leiboff, 2005), philosophical (Stern, 2003), feminist (Kuppers, 2004), sociological (Hirschauer, 2006; Leiberich et al., 2006; Stephens, 2007), and the anthropological (Walter, 2004a,b; Linke, 2005; vom Lehn, 2006). It is noticeable, however, that few anatomists have contributed in any significant way to this debate (for an example of an anatomist who has, see Moore and Brown, 2004, 2007).

As we have reflected on these exhibitions as anatomists, we have been struck by the manner in which they deviate from conventional anatomical expectations, both in technical and disciplinary terms. What has traditionally been private is made public, and the deadness of the cadavers appears to have been replaced by a disconcerting life-likeness. The cadavers have assumed an attraction at odds with the static formalin-based environment foundational to the culture of the scientifically sterile world of the modern dissecting room (Jones and Whitaker, 2009). This transposition of the anatomical experience from a protected academic environment into a readily accessible public one is a move of momentous proportions, the dimensions of which are barely recognized by the anatomical community and yet are dimly perceived as threats.

In previous publications, we explored the dimensions of ''Anatomy Art,'' an aspect of *Body Worlds* that predominated in the early exhibitions (von Hagens, 2000), and in that context we assessed the importance of attaining a balance between the educational and entertainment elements in *Body Worlds* (Jones, 2002, 2007; Jones and Whitaker, 2007). While recognizing the ambiguity of the exhibitions, we affirmed the potential of plastination as a technique with the immense opportunities and challenges it opens up for anatomists.

Our aim in this present article is to better define the positions taken by various anatomists when confronted by the *Body Worlds* phenomenon.

VON HAGENS, ANATOMIST

Plastination is the creation of Gunther von Hagens, who in 1977 developed the procedure, initially as part of his work as a scientific assistant at the Anatomical Institute of Heidelberg University. In seeking to improve the quality of renal specimens he began to experiment with a variety of plastics—the end result, after a great deal of trial and error on many tissues and organs, being plastination in the various forms with which we are familiar today (Whalley, 2007). With patenting of the plastination techniques, von Hagens established his own company, BIODUR, to make available the variety of chemicals through one supplier. In 1986, the International Society for Plastination was founded, with the inaugural issue of the *Journal of the International Society for Plastination* appearing in 1987. In 1993, he set up the Institute for Plastination at Heidelberg. This was followed in 1995 by an invitation from the Japanese Anatomical Society to participate in a well-received exhibition at the National Science Museum in Tokyo. The first *Body Worlds* exhibition in Germany was in Mannheim in 1997, and elicited considerable controversy.

While these developments had many positive aspects, and while they were accompanied by academic publications, they never fitted easily within the confines of an academic institution. Consequently, although von Hagens remained at Heidelberg University in various positions for 20 years, he eventually left in 1997 on account of growing controversy and a lack of official recognition within Germany of the Institute for Plastination as a research institute. It was this that led to his move to Dalian Medical University in China and a guest professorship there.

It is perhaps understandable that the commercial and, in the eyes of some, sensationalist nature of *Body Worlds* would alienate anatomists. Speaking of his early career in plastination, von Hagens has said, ''I courted the favour of my peers and found the approval of normal people'' (Biskup, 2007, p 220). Kriz (2007) has commented that von Hagens became increasingly fascinated by the attractiveness of the specimens for the layperson, and this became influential in the manner in which he formulated his

ongoing exhibitions. This, in turn, had significant implications for the nature of the plastinates he produced. It is evident that the trajectory along which von Hagens has moved for over 20 years has been driven by a commitment to plastination, and to exploring the potential of this technique in its various manifestations for speaking to the public and for promulgating the wonder and fascination of the human body. However, as has been noted, this has been achieved, on occasion, by unconventional promotional activities (Biskup, 2007) and media savvy approaches aimed at democratizing anatomy (Rathgeb, 2007).

THE *BODY WORLDS* EXHIBITIONS AS ANATOMICAL EXHIBITIONS

Von Hagens's plastinates have been on almost constant display since 1995, attracting over 26 million visitors (Institute for Plastination, 2008) to around 50 different exhibitions. This large number, along with the proliferation of copycat plastination exhibitions,[1] has uncovered a vast untapped market that one could argue is an indication of a profound interest in the human body. Whether or not this corresponds to a longing for increased understanding of the human body is a matter for debate.

Body Worlds features two types of plastinates.[2] The first is familiar territory to anatomists: dissected body regions illustrating the basic anatomical and physiological functions of the various body systems. Cross sections of the body display bones, muscles, organs, and vessels in precise and accurate detail, and specimens such as a smoker's lung demonstrate the effects of disease processes. Anatomists tend to have little concern over the principle of such displays.

In contrast, the whole-body plastinates are from another realm entirely. Though dissected the bodies remain a recognizable whole, ''revealing aspects of the body's interior while retaining the context of the whole'' (Morriss-Kay, 2002). The plastinates are molded in poses immediately familiar to the public. The gulf between these and anything traditionally anatomical is vast, and it is this gulf that drives concerns that an entertainment rationale has replaced an educational one as the main driving force behind these exhibitions. However, these modern themed whole-body plastinates could be seen as a supreme illustration of the democratization of anatomy—the popular face of anatomy in the twenty-first century. They should be viewed within the historical context provided by those other plastinates representing the historical roots of anatomy, and in particular the Renaissance figures that dominated anatomy during its crucial developmental phase (Jones and Whitaker, 2009). The question confronting anatomists today is whether this gulf between anatomy in its historical and contemporary guises is nearly as great as we tend to think.

While it is tempting to view the *Body Worlds* exhibitions as a single homogeneous phenomenon, this would be simplistic. There is no doubt that the thrust of the various exhibitions is the same, and yet their variety is an important element within the overall phenomenon itself. The original exhibition, now referred to as *Body Worlds 1*, consisted mainly of what would now be regarded as relatively static and lifeless exhibits that struck some viewers as disturbing and frightening (Weiss, 2006). As the science of plastination has been refined and developed, von Hagens's vision has evolved and expanded and the style of the whole-body plastinates and the exhibitions as a whole has undergone a transformation. Compared to the original exhibition, *Body Worlds 2* is described as ''more exhilarating and dynamic'' (Institute for Plastination, 2007d), with the whole-body plastinates placed in more sportive poses and engaged in familiar activities. In contrast, *Body Worlds 3* is ''a return to the Renaissance'' (Institute for Plastination, 2007d), with the poses recognizable from the Middle Ages and the Renaissance anatomical works. They have also emphasized different facets of human anatomy: the brain (*Body Worlds 2*), the heart (*Body Worlds 3*), and development and ageing (*Body Worlds 4*).

As we survey the various iterations of *Body Worlds*, it is evident that the intention has been to get away from presenting dead bodies in their ''deadness'' (Skulstad, 2006). The later exhibitions are designed to be less about dead bodies and more about the dynamic and living body. This move has had the effect of giving to the dead plastinates a welcoming, almost life-like visage. By incorporating into the plastinates elements with which we are familiar from everyday life, it becomes far easier for onlookers to empathize with them and recognize them as ''one of us.'' This is accentuated by the serene facial expressions, as if the plastinates are fulfilled by the ''life'' they are now living. While these developments may readily appeal to many of those visiting the exhibitions, and while they should not be too readily dismissed as nothing more than entrepreneurial foibles, for anatomists who need no such allures they present one more stumbling block to acceptance.

As the exhibitions entered North America there was a change in venue from large all-purpose exhibition halls to respected science museums. The advertizing methods have also changed from sensationalistic promotions, such as a float in the Berlin Love Parade (Whalley, 2007), to being firmly embedded in an educational museum context supported by ancil-

[1]The two principal copycat exhibitions, *BODIES... The Exhibition* and *Bodies Revealed* are promoted by Premier Exhibitions and run in the US and England, respectively. Other copycat exhibitions include *The Amazing Human Body* in Australia, *Our Body: The Universe Within* in the US, *Mysteries of the Human Body* in South Korea, *Jintai Plastonomic: Mysteries of the Human Body* in Japan, and *Cuerpos entrañables* in Spain.

[2]Pictures of selected *Body Worlds* plastinates can be viewed online at http://www.bodyworlds.com/en/media/picture_database.html.

lary lectures and supplementary educational programs (Moore and Brown, 2007). This seemingly more legitimate context has contributed to North American anatomists being more supportive of *Body Worlds* than their European counterparts.

FOUR CATEGORIES OF PLASTINATES

While the whole-body plastinates are clearly the most controversial specimens in *Body Worlds*, within this group there is a wide variety of dissections, poses, and accessories. There is no definitive line where the plastinates move from the familiar tenets of education into the realm of pure entertainment. Instead, there is an unsteady balance between anatomy and art that differs in emphasis for each specimen. However, the whole-body plastinates can be divided into four broad categories, ranging from what may be regarded as straightforward and acceptable to fanciful and objectionable.

The first grouping, *Category A*, comprises the ''sporting'' plastinates: those engaged in physical activity, for example, the Hurdler, The Ballet Dancer, The Archer, and the Football Playing Duo. *Category B* encompasses those plastinates whose exceptional dissections reveal anatomy in a spectacular way. These include the Drawer Man whose body compartments have been opened as if so many drawers, and the Star Warrior who has been dissected in horizontal strips demonstrating the compactness of tissue. *Category C* encompasses historical plastinates that mimic poses familiar from the Renaissance anatomy artists. For example, the Skin Man, with his flayed skin held aloft, is recognizable as St Bartholomew from Michelangelo's work in the Sistine Chapel (1508–1512). This motif was used by Juan Valverde de Amusco, the Spanish anatomist, in his 1560 anatomy textbook (*Anatomia del corpo humano*). The plastinates in *Category D* are the most problematic, since they fit into none of the previous groupings. The Caller clutches his cellphone, the Guitarist plays his Fender Stratocaster, the Mythical plastinate flies astride his entrails as if some plastinated Harry Potter, while the Poker-playing Trio even featured in the 2006 Bond Movie *Casino Royale*. However, not every plastinate falls neatly into one of these categories; some, such as the Badminton Player, are in a sporting pose but the quality of the dissection is exceptional (in this case split into three planes).

These four categories move from the least challenging to the most problematic. In *Category A* plastinates structure is closely tied to function as their positioning demonstrates the muscles used to perform the activity in question. Von Hagens states that ''The traditional pose of the reflective chess player, for example, is ideal for illustrating the nervous system, whereas a dancer would lend itself well to showing a particularly powerful female foot.'' (Institute for Plastination, 2007b). The pose can be justified from an educational perspective, even if it is considered an extreme measure for such a goal.

In *Category B*, the pose is secondary to the dissection. Here, the outstanding skill of the dissectors and von Hagens's vision are apparent. Various anatomical structures and their relationship to each other are displayed in an outstanding way. Though the use of whole-body plastinates for this end may be questionable, the educational imperative is evident.

Category C plastinates are dominated by references to the anatomy artists with whom von Hagens identifies. The Praying Skeleton is recognizable as a plastinated version of the pose used in the 1733 picture by William Cheselden. The Angel plastinate, whose back muscles have been everted to form wings, is familiar from Jacques Fabian Gautier d'Agoty's ''Flayed Angel'' of 1746.[3] The Thinker plastinate, an arterial corrosion cast that leans on a pedestal contemplating a head, almost precisely mimics the pose of one of Vesalius's skeletons. This distinguished ancestry legitimizes to some degree the plastinates, and the poses can be justified on the ground of historical precedent. However, Vesalius and his counterparts used pen and ink and not human material.

Plastinates from *Category D* are more recent accretions. It is difficult to legitimize these from an anatomical educational angle as the pose does not demonstrate how structure relates to function in any significant way. These plastinates are more art than anatomy.

Categories C and *D* plastinates, therefore, have far more in common with general humanist themes than those with any health-related educational imperative. As the plastinates give the impression of performing music, utilizing technology, philosophizing, and even contemplating their own death, they demonstrate the transcendence of humanity at the same time as grounding humanity's consummate achievements in our physicality. The question is whether such philosophizing justifies this use of human remains. As anatomists we remain to be convinced.

THE VALUE OF PLASTINATION FOR TEACHING AND RESEARCH

Anatomists find themselves in a quandary; however much some of them may object to many or all facets of the *Body Worlds* exhibitions, the plastination technique represents a major breakthrough in the teaching of anatomy and is increasingly emerging as a remarkably useful research tool. And both the technique and the exhibitions owe their existence to the same individual, Gunther von Hagens.

Plastination has established itself as an indispensable contributor to the teaching armamentarium of clinical anatomists (Jones, 2002; Reidenberg and Laitman, 2002; Latorre et al., 2007). As numerous anatomy teachers have discovered, plastinated human specimens are far superior to anatomical models, on account of their ability to reflect anatomical variations and hence the variability found in life. Plastinated specimens also offer the benefits of models in the way in which they can be conveniently stored;

[3]Myologie complètte en couleur et grandeur naturelle, plate XIV, Paris, 1746.

additionally, they are remarkably durable and easy to handle (O'Sullivan and Mitchell, 1995). Von Hagens has reportedly recently developed a technique to produce flexible plastinates, including muscles, vessels, and nerves. Ultimately, these new flexible plastinates could replace the messy and inconvenient wet prosections currently in use. Additionally, body part slices can be correlated with computed tomography (CT) and magnetic resonance imaging (MRI) scans for reference and radiological teaching. In listing their advantages in this manner, we are reminded that it is their faithfulness in portraying human anatomy that is crucial, and this shines through in the dissecting room, just as it does in the *Body Worlds* exhibitions. In other words, the value of the technique of plastination ushers in innumerable benefits for both traditional anatomists and the entrepreneurs behind the plastination exhibitions.

The place of plastination as a research tool is being increasingly appreciated. The potential of plastination lies in its ability to preserve delicate structures and their interconnections, enabling them to be traced microscopically (Jones, 2002). Even ultrathin plastinated slices can be obtained and have been used to construct precise three-dimensional computer models of anatomical structures (Sora et al., 2007). To date, plastination techniques have featured in studies of anatomical organization in the female urethra (Fritsch et al., 2006), esophageal muscles (Wang et al., 2007), the carpal tunnel (Sora and Genser-Strobl, 2005), and skin ligaments (Nash et al., 2004). Their great advantage over traditional histology techniques lies in the ease with which it is possible to move between the macroscopic and the microscopic. However, it appears that many anatomists have not yet realized the revolutionary significance of plastination for anatomical research.

THE EDUCATIONAL IMPERATIVE

The explicit paramount mission of the *Body Worlds* exhibitions is health education (Institute for Plastination, 2007c). Specifically, "provid[ing] opportunities for *lay people in particular* to gain a greater understanding of the human body and its functions" (Institute for Plastination, 2007b, p 21, emphasis ours). Von Hagens calls this "democratizing anatomy."

The stated objectives of the Institute for Plastination are to improve overall anatomical instruction; to improve awareness of medical issues, particularly among the general public, and to popularize and develop plastination techniques; and producing and supplying anatomical specimens to universities and natural history museums for the training of students and surgeons in particular (Institute for Plastination, 2007b). Recently, Warwick University Medical School has emerged as the first UK University to purchase plastinated specimens from the Institute for Plastination (Dunn, 2008). The New York University College of Dentistry has embraced plastination and von Hagens, appointing him as a visiting professor and eschewing dissection to exclusively teach anatomy through the use of plastinates (Institute for Plastination, 2007a).

Some contend that von Hagens's claims of educational value are inflated (McCullough, 2007). However, it is unreasonable to expect lay visitors to depart with detailed anatomical knowledge; an impression of the complexity of the human body may be sufficient (Preuss, 2008). The exhibition can also be considered a public health initiative as the diseased specimens in particular raise visitors' health consciousness by illuminating our physical frailty (Institute for Plastination, 2007b). In one survey (Leiberich et al., 2006), most exhibition visitors claim to be considerably better informed about their own bodies, although less than half intended to pay better attention to their future physical health.

Myser (2007) draws a distinction between von Hagens "formal *Body Worlds* curriculum (e.g., education) and his possible *Body Worlds* hidden curricula (e.g., art, entertainment, showmanship, personal and professional self-actualization or self-aggrandizement, reaping financial rewards)." However, this tension is not uncommon. As Youngner (2007) points out, education, art, and money-making have never been successfully compartmentalized in museums.

What does "education" constitute? Must it, as some argue, consist solely of learning functional morphology or physiology (McCullough, 2007), or can it also include more "general humanist lessons" (Maienschein and Creath, 2007)? A narrow interpretation of "worthwhile" education that comprises only the former would limit access to the human body, excluding large sections of society, a posture that von Hagens denies in the name of democratized anatomy.

It is the humanist lessons of *Body Worlds* that prove problematic from an anatomical perspective. The whole-body plastinates point to the beauty and complexity of the human body and the transience of life. Thus *Body Worlds* serves as "a shrine to the worship of the body" (Walter, 2004a) and "a celebration of human potential" (Institute for Plastination, 2008). As the skin (or "exterior face") of the plastinate is removed revealing an anatomy common in both its beauty and frailty, the exhibitions promote "a sense of community among all humankind" (Moore and Brown, 2007). In addition, visitors are "compelled to ponder deep assumptions about their own personal and social identity, their relationship to the universe and/or to God, and to the meaning and purpose of life" (Moore and Brown, 2007). Von Hagens clearly has such philosophical reflections in mind as the exhibitions are peppered with quotes from philosophers and poets such as Goethe, Nietzsche, Kant, Descartes, Shakespeare, and Seneca. For him the plastinates exemplify the "postmortal body," having been transformed and moved beyond death, which suggests that von Hagens's thinking and aspirations cross many disciplinary boundaries. While anatomists are comfortable with the use of plastination as a learning tool, they are perhaps less familiar with the categories of reverence, enlightenment, and appreciation (Jones and Whitaker, 2009).

Though von Hagens no longer uses the term "edutainment," it is obvious that *Body Worlds* is an

uneasy fusion of education and entertainment. In one survey (Leiberich et al., 2006), three-quarters of the visitors admitted that curiosity about this controversial show was one of their main motivators in attending the exhibition. The engaging, and even sensational, nature of the exhibitions is necessary to attract the interest of the general public. While medical students are extrinsically motivated to learn by looming assessment, visitors to the exhibition have to depend upon intrinsic motivation alone (Myser, 2007). In addition, society now demands graphic images; media must be arresting for it to be noticed at all. The entertainment factor has infiltrated even as far as the previously restrained conventions of public health education, the graphic health warnings on cigarette packets serving as one example.

The undoubted visual impact of the whole-body plastinates is crucial for drawing an audience (Tanassi, 2007). Education does not demand them, but entertainment and attendance do (Jones and Whitaker, 2009). Exhibition specimens primarily have to be engaging and appealing, and only secondarily do they need to convey precise factual anatomical information. The converse is necessary for the instructional specimens anatomists are familiar with, and it is this point of difference that has ignited much of the controversy around *Body Worlds*. The appropriate balance between entertainment and education is something on which von Hagens and the anatomical profession will probably never agree.

CONCLUSION

Von Hagens is an anatomist in the old-fashioned sense, his motivation being the beauty of anatomy rather than its science. Allied with this is a well-honed entrepreneurial sense that exploits to the full the beauty and the artistic side of the human body. Anatomists may not feel comfortable with many facets of these drivers, but they would do well to remember the origins of their discipline (Jones and Whitaker, 2009). While anatomy as a science has to go beyond esthetic appreciation alone, neither should it act as though this does not exist. And this is where the research potential of plastination enters the picture. Even those who wish to criticize the *Body Worlds* side of plastination would do well to remember that von Hagens has also opened up exciting new vistas for research.

We conclude that anatomists have to face up to the challenges posed by *Body Worlds*. There is an urgent need for anatomists to utilize what is being presented to the general public in these exhibitions and build upon this in their own teaching and research.

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