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# Human Anatomy: A Review of the Science, Ethics and Culture of a Discipline in Transition

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David Gareth Jones

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## Abstract

Anatomy has undergone radical changes over its history, and even now its appearance varies between audiences. Within academia, it has frequently been seen as the bastion of medical teaching, even as a handmaid of surgery. To the general public over recent years, it is represented by the enormously popular public exhibitions of plastinated cadavers and body parts. Increasingly within medical teaching, it has acquired a far more humanistic face, epitomized by ceremonies at the start and end of dissection to connect the dead body with the once living individual and his/her families. Modern anatomy has also developed a strong research ethos. These movements can be traced in the many editions of *Gray's Anatomy*, from 1858 to the present day. However, the humanistic side of anatomy reminds us that anatomy is not merely a science, since its ethical dimensions are legion as it has transformed from a dubiously moral and barely legal activity to one that now aims to manifest the highest of ethical standards. Nevertheless, it continues to have challenging dimensions, such as its ongoing dependence upon the use of unclaimed bodies in many societies. These challenges are reminders that anatomy does not remain stationary.

**Keywords:** *Gray's Anatomy*, culture of dissection, humanistic face of anatomy, commemoration ceremonies, plastination, *Body Worlds*, ethical guidelines

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## 1. Introduction

For some, the discipline of anatomy is characterized by formalin cadavers in sterile dissecting rooms and very large amounts of detailed anatomy. Within academia, it has frequently been seen as the mainstay of medical teaching, even as a handmaid of surgery. To others, it has a far more humanistic face, as demonstrated by ceremonies at the start and end of dissection to connect the dead body with the once living individual and their families. To the general

public, it is represented by the enormously popular public exhibitions of plastinated cadavers and body parts. However, these descriptions amount too little more than facets of what constitutes anatomy in modern guise, with its strong research ethos and broad scope from biological anthropology and clinical anatomy to molecular biology and genetics. The one unitary theme across this broad swathe of biomedical endeavor is structure or organization, the fundamental thread that ties together all these approaches within modern anatomical science. These movements can be traced through the many editions of *Gray's Anatomy*, from 1858 to the present day.

However, the humanistic side of anatomy reminds us that anatomy is more than merely a science. Its ethical dimensions are as numerous as its scientific credentials as it has transformed from a questionably moral and legal activity to one that now aims to manifest the highest of ethical standards, even though in many societies it continues to have challenging dimensions, such as its ongoing dependence upon the use of unclaimed bodies. In these and other ways, anatomy has entered uncharted territory with previously unexplored ethical dimensions.

## 2. Setting the scene: *Gray's Anatomy*

The anatomists' core text, *Gray's Anatomy*, reflects the many dimensions of anatomy. The 41st edition of the English version, published in 2016, 156 years after the first edition, is both impressive and near exhaustive in its coverage. Its major sections range from Cells, Tissues and Systems, and Embryogenesis, to the regional subdivisions of the human body [1]. The visual impression made on the reader is of high-quality illustrations, with their dependence upon a range of contemporary techniques, from classic histology to immunofluorescence and immunolabelling. This is the traditional anatomists' approach in contemporary form. But much of the detail is worlds removed from what was available 50 years ago, let alone 150 years ago. The moniker, 'The Anatomical Basis of Clinical Practice' appeared first in 2005 with the 39th edition, emphasizing that anatomy is to be viewed within a health sciences context, since this is a major driver for understanding and appreciating the anatomical organization of the human body. It is also important to note that from the 1973 edition onwards, there has been a willingness to admit that there are gaps in our knowledge of anatomy, including gross anatomy, and that our understanding of the human body is far from all-knowing [2]. In other words, ongoing research is vital if anatomy at all levels is to keep abreast of developments in allied biomedical disciplines, a thrust that subsequent editions of *Gray's Anatomy* have attempted to continue.

While it is easy to be captivated by a modern edition of this classic text, its beginnings lay in the 1850s in mid-Victorian London. That was an era of immense cultural ferment in both literary and scientific fields [2]. Surgery, too, was making great strides now that anesthesia was becoming increasingly available. It was a time of excitement and ferment, when two young medical men, Henry Gray and Henry Vandyke Carter, who was also an accomplished artist, were getting together on the project that was to result in the publication of *Anatomy Descriptive and Surgical* [3]. Little is known about Gray himself, except that he was an up-and-coming surgeon, who died from smallpox 3 years after the publication of his *Anatomy*, at the age of 34.

Two points are worthy of note. The first is that Gray was a researcher [4]. He had published papers on the histology, embryology and comparative anatomy of the anatomical origins of the optic nerves, and later on the spleen. This latter work was published as his first book: *The Structure and Functions of the Human Spleen*. It is clear that research was an important foundation for the work he did a short time later on his magisterial text.

Second, Gray and Carter themselves carried out the dissections of bodies at St. George's Hospital in London. The bodies would have been those of the poor from workhouses, prisons, and hospitals, whose remains had not been claimed by relatives. They were unclaimed, although since misconduct was rife and few formal records were kept, in all likelihood it was deception that led to some ending up as unclaimed. Nowhere in *Gray's Anatomy* is their origin or predicament mentioned. While this is typical rather than atypical of anatomy texts, both in the mid-nineteenth century and much later, it points to a gap between the stunning illustrations of normal human anatomy and the sources of the bodies that provided the raw material for the illustrations. Historian Ruth Richardson [4] has commented: "In *Gray's*, the legally sanctioned bodies of people utterly alone in the metropolis were the raw material for dissections that served as the basis for illustrations that were rendered in print as wood gravings. As mass-produced images, they have entered the brains of generations of the living—via the eyes, the minds, and the thoughts of those who have gazed at them." (p. 139) There is no memorial to those whose bodies provided so much for generation after generation of anatomists and students of anatomy.

There is no evidence of wrong doing on the part of these two men. Nevertheless, they serve as a reminder that the culture in which modern clinical anatomy was born was far removed from the expectations of the twenty-first century. By the same token, they were also far removed from the culture in which anatomy as a modern enterprise was born three centuries earlier during the European Renaissance [5]. Anatomy is, therefore, an evolving discipline, much like any other. Anatomy today should look different from 50 years ago, and it will be different again in 50 years' time. Anatomy also assumes different forms in different countries.

### 3. Anatomy and the culture of dissection

Anatomy as a science emerged during the Renaissance, as it strove to attain its own niche within the spectrum of emerging academic disciplines. If the verb 'anatomize' and the noun 'anatomization' were to be employed today, they would be used in a scientific sense. This is because the anatomization or dissection of a body reduces it to its component parts in an effort to construct a new body of knowledge. In light of that which is learned about specific bodies, the intention is to strengthen and broaden the science of anatomy in general [6].

Although the term 'body,' in its primary usage, refers to the body of human beings or of animals, it is an abstraction. We move continually between a particular body, *somebody's* body, and the body in general [7]. Cadavers, body parts, tissues and bony remains always come from particular individuals, and even when these individuals lived in the distant past, they can never be completely dehumanized.

In sixteenth- and seventeenth-century Europe, the culture of dissection emerged out of a bewildering array of competing cultural forces. Prior to the modern, dispassionate, scientific approach to the human body, anatomy was part of a popular culture fascinated by the interior of the body but unable to delve into this largely uncharted domain [5, 6].

There was widespread fascination with the body, and this led to morbid curiosity with dissection, since this was the only way of exploring the interior of the body. However, since the bodies had come directly from the gallows, there was a close association between the anatomist and the executioner. The end result was that the criminal, the executioner, and the anatomist, each had a role to play in what has been termed 'the culture of dissection' [5]. The three were interlocked in this macabre process, in which there was neither the notion nor hint of clinical detachment.

Anatomists, therefore, found themselves active participants in the execution process, even appearing to be accomplices of the executioners. This was essential if the supply of human bodies was not to dry up. But this was a problem, since it sent a clear message to the general public that anatomists were much closer to criminals than to the respectable members of society. To overcome this, their activities were bestowed with divine significance, and so as they investigated the usually unapproachable realm of the interior of the body, they were looking into what was in effect a sacred temple [5]. In this manner, the status of anatomists was placed on a par with divine activities thereby elevating them above the level of criminals.

A related phenomenon was the category of self-dissection, epitomized by Andreas Vesalius among others [8]. As the name suggests, the dead body was depicted as being actively involved in the dissection process itself. This hinted that the body may not be as dead as one would suppose, since anatomy was animating the body and endowing it with a life of its own. The end result was the impression that knowledge of the (dead) body was actually knowledge of the living, thereby stressing the naturalness of dissection [5].

In spite of these subtle moves, the dissection of cadavers remained problematic. It still existed on the edge of living society, with dissected cadavers being seen as a disturbing community of the dead. In depicting cadavers like this, Vesalius and others were claiming that the anatomist was not disrupting the body, but was assisting the natural process of decay [5]. In their different ways, all were attempts to eliminate the gulf between the dead and the living, moves that have reappeared in recent times in the public displays of plastinated bodies (see *Anatomy exposed to public gaze—plastination*). This suggests that societies' unease at dissection and the use of the dead body continues to manifest itself, no matter how much the circumstances surrounding it have changed.

Creative as were these attempts to overcome concerns about the work of anatomists during the Renaissance period, doubts remained. The whole process of dissection was accompanied by horror and fascination, especially on the part of writers and poets. The result was the morbid eroticism of some Renaissance poetry and theatre, in which writers sought to explore the unknown mysteries of the body's interior, with erotic dreams of dissection (such as the 1659 poems of Richard Lovelace; see Ref. [9]). Strange as these works appear to contemporary anatomists, they point to an abiding truth, namely, that anatomy is never carried out in a cultural



and philosophical vacuum, regardless of the culture implicated (See Ref. [5] for examples from the Renaissance period in Europe, especially Chapters 3, 4 and 5).

The transition from these fascinating but perplexing times to the late eighteenth and early nineteenth centuries was fraught, as the demand for bodies for dissection continued to outstrip the legal means of supply. The stage was set for the unsavory next stage in the questionable beginnings of modern anatomy: use of the bodies of executed criminals, body snatching and occasionally murder [10]. The world of the so-called resurrectionists and the host of macabre stories about the indecent haste with which the recently buried were transported from graveyard and poorhouse to anatomy dissecting room are ethically foreign and deeply embarrassing to the world of contemporary anatomy [11, 12].

The pivotal 1832 Anatomy Act in England proved ground breaking by introducing into the anatomical lexicon the concept of unclaimed bodies. It was both revolutionary and disconcerting, since it made available large numbers of otherwise inaccessible bodies, but in doing so ensured that most of these would be those of the poor [10]. The lack of any incentive to revisit this decision, by not considering the alternative of soliciting bequests, ensured that for many years into the future, there was widespread willingness among anatomists to make use of the bodies of the disadvantaged and dispossessed. This lack of ethical reflection legitimized the unclaimed paradigm as the normal source of bodies for anatomical investigation. This, in turn, opened the doors to widespread use of the bodies of the mentally ill, of African-Americans, and of those executed in concentration camps during the Nazi era [13–15].

The result for anatomists has been tension between the legitimate scientific desire to work on high-quality material (fresh material obtained shortly after death), and the ethical imperative of soliciting informed consent from a donor prior to death. While all uses of unclaimed bodies do not fit into the outrageous categories referred to above, and while there is ongoing debate about the precise nature of informed consent [16, 17], lack of any reference to the centrality of informed consent has cast a pall over the ethical environment of anatomy as a discipline. This will only be rectified as anatomy explicitly argues for, and implements, the ethical superiority of body bequests over unclaimed bodies [18].

These historical allusions all attest to the assertion that anatomy, and especially gross anatomy, is not a self-justifying regime. It is not carried out in a cultural and philosophical vacuum, and this affects every aspect of human anatomy. Research on human embryos may be regarded as the face of this debate today. Subjecting human embryos to research procedures requires the assent of the communities in which these are being conducted [19]. This work is no more self-justifying than is the use of human cadavers as a source of organs.

#### **4. The humanistic face of anatomy**

The discussion so far has been concerned with the way in which anatomy has gained a foothold in the scientific arena, giving it a legitimate stake in investigations on the structure of

the human body. This underlies its potential contributions in both research and teaching terms. Avenues open to anatomists in research investigations are entirely dependent upon its scientific credentials, and until more recent times, this has also been the case in teaching the fundamentals of anatomy, at both the gross and microscopic levels. However, it has become evident that to confine anatomy to its scientific dimensions in teaching health science students have limitations, since these students will be entering professions in which empathy with patients is paramount.

As this realization has increasingly taken root in the thinking of educators, there has been a major move in the direction of seeing anatomy as much a humanistic discipline as a scientific one [20]. This is not a rejection of the scientific basis of anatomy, but an attempt to place it within a patient-centered health science context. One manifestation of this is in the emergence of commemorations and memorials in association with the donation of bodies for medical education [21–24].

Holding ceremonies to acknowledge and thank the families of those who have donated their bodies to anatomical education is recognition that anatomists are an integral part of their communities and are dependent upon the goodwill of others [25]. This sends the message that anatomists are human beings dealing with the remains of fellow human beings, and that anatomy as a discipline takes account of this relationship. These ceremonies explicitly acknowledge that the bodies available for study have been donated for this purpose by people who gave their fully informed consent. This, in turn, emphasizes the centrality of body bequests in ethical thinking within anatomy [18, 26].

The variety of terms used to convey the essence of these ceremonies include commemoration, thanksgiving, ceremony, service, and memorial ('memorial ceremonies' [23, 27]; 'Convocation of Thanks' [22]; 'Thanksgiving Service' [28]; 'cremation/burial ceremony' [29]). In their different ways, each conveys the notion of remembrance, and of paying tribute to those who in their death have donated their bodies to a worthy cause, that of medical teaching and research [25].

The donors are remembered for what they have given, and a ceremony is one public manifestation of this gift of inestimable value. Their altruism is recognized and saluted, and their families are thanked for the support they have provided in enabling the giving of this gift. Giving something closer to oneself than anything else also signifies trust in the anatomy staff and students, in the expectation that their bodies will be treated with respect and dealt with it in a manner worthy of the donor's memory.

Ceremonies point toward the humanistic face of anatomy, and the unacceptability of treating cadavers merely as research and teaching tools. Their social and cultural context frames all facets of anatomical study and of the display of human remains. If this is now recognized as a central feature of anatomy, it becomes important to ask where the large public displays of plastinated dissected human bodies fit. These, after all, have become an indelible face of anatomy but what message do they convey about the character of anatomy? Do they have a humanistic face as I have been arguing, or is their rationale purely scientific *a la Gray's Anatomy*?

## 5. Anatomy exposed to public gaze: plastination

These vast plastinated exhibitions and their place within the world of anatomy have been described and assessed by numerous commentators (see Ref. [30] for references). They are directed at the general public and not at medical and other health science academics and students. They are intended to take anatomy out of the secretive dissecting room and into the public arena. This is what has been referred to by Gunther von Hagens, the founder of the *Body Worlds* empire, as the 'democratization' of anatomy [6, 31], the release of anatomy from its privileged position within the halls of academia and into the wider world. Knowledge of one's own body is seen as something that everyone should have access to, and displaying the body in its dissected state is the ideal way of accomplishing this. It is only in this way that people can begin to appreciate what organs look like, how they relate to each other, along with the vessels and nerves that supply them. But how is this to be done, since a replica of the dissecting room with its smell of formalin-impregnated death and lifeless preserved cadavers on slabs would hardly attract a wide audience?

The breakthrough came when von Hagens devised a new method of preservation of human tissues, plastination, in which tissue fluids are replaced with plastic [32, 33]. This was a major step forward for use in teaching human anatomy to health science students, where it is used to preserve previously dissected body parts. Additionally, it proved beneficial for research purposes with the use of body slices. These uses of course are confined to academia.

The move to public displays came with the preservation, not of body parts, but of whole bodies that are referred to as 'plastinates.' But more significantly, rather than being displayed horizontally, they are shown vertically. Not only this, they can be depicted in a variety of stances, and to give the impression of running, walking and jumping, playing a variety of sports, and even having sexual intercourse [34]. Using these devices they appear to be 'alive,' far removed from the lifeless inactivity of the dissecting room. They may be dissected, but they give the impression of participating in the vigorous life of everyday existence. The effect is frequently dramatic and awe inspiring, and prompts reactions of wonderment at the beauty and complexity of the human body. For some, this positive side is matched by complete rejection on the ground that they are a travesty: disgusting, disconcerting, demeaning, and dehumanizing [30]. What has been fascinating is that initial objections to them have come mainly from anatomists [35, 36] and religious leaders [37–39]. While more in-depth analyses have dispelled some of this negativity [40–42], the impassioned responses of some individuals have uncovered wellsprings of unease [43].

For others, it is their attractiveness and aesthetic beauty that have proved a drawcard for millions of people worldwide. Of these, *Body Worlds* is the best known on account of its leadership within the field, the high profile of its founder, Gunther von Hagens, its leading-edge technology and the very high quality of its dissections. Moreover, von Hagens' philosophical claims regarding the status of plastinates have been the driving force for much academic comment [43–46]. In line with this, the exhibitions have occasioned a considerable body of scholarly work from many different disciplines, touching on the haunting ways in which the



bodies are displayed, impressions left by the exhibitions, and the legitimacy of investigations on the human body as an object of scientific curiosity [47–50].

The question that looms large over plastinates is their nature. What are they? At one level, they are simply dead human beings, dissected in a variety of interesting ways. But this is a superficial response, since the method of preservation has fundamentally altered their tissue that now makes up no more than 30% of the body. The remaining 70% is plastic, raising the question of how this hybrid entity relates to the ‘normal’ human body. Ambivalence has crept in. The plastinate is more than a plastic model of a human body, as it still contains human tissue that mirrors important facets of that particular individual during life. No two plastinates are identical, any more than two individuals are identical. They have been modified to create a new entity, based on a human template but increasingly artificial [43]. The end result is an enigma, because while plastinates are allegedly about the dynamic and living body, the newly constructed plastinated body is far removed from that of the original living individual. They represent their own category of what may be described as ‘living deadness,’ occupying a ‘post-mortal world,’ part mortuary and part art gallery [43, p. 191]. They are dead, and yet the process of plastination ensures that they will not decay; they are frozen in some intermediate state [51].

These quandaries are made far more troublesome by the way in which they are exhibited for the general public, as though they are experiencing some ongoing existence, a form of post-mortal existence [42, 52–54]. How can you play basketball if you are dead, and yet some of these plastinates are depicted as doing just this? This can be dismissed as poetic license; this is merely an exhibition, and it is unlikely that any of those viewing them will think they are actually alive. That is true, and yet the apparent ‘immortality’ of plastinates has been plugged as an important aspect of the whole venture [52, 55], an emphasis that has proved immensely problematic for anatomists and others [56]. Even though ‘immortality’ is an exaggeration, it seems to represent a new category of human body, separate from both fresh corpse and decaying remains [6].

King et al. [30] argue that plastinates do not occupy standard cultural binary categories such as interior or exterior, real or fake, dead or alive, bodies or persons, and self or other. This is because they transgress the usual boundaries by which we describe and understand the world. They refuse to be pigeon-holed, no matter how hard we try. Even the simplest designation of dead or alive escapes us [30, 54]. They are representations of real bodies [46, 57], having been modified to produce something that is an artificial representation of perfected nature [48]. The artistic component is essential to the success of the end-product, but this removes it from the sphere of vulnerability and imperfection that characterizes human existence, a vulnerability resulting from biological, environmental and social factors as well as from moral and spiritual ones [58].

This lack of clarity regarding their categorization surfaces repeatedly and has enabled Von Hagens to employ the description ‘post-mortals’ [6, 53]. The lack of identification with the person who once lived, with no trace of their values, attitudes or ideas, reduces them to depersonalized bodies. Even the traces of memory by which someone lives on have been defaced, since in the absence of discernible external bodily features, there is no way in which relatives

and friends can recognize the plastinated remains [58]. For one commentator, the absence of a personality, friends, family and history leaves a gaping and eerie vacuum that forcefully calls into question what it is to be human and reminds us of what few of us like to dwell on—our mortality. They are ‘bodies with no soul’ [59].

What emerges very clearly from this discussion is the impression created by the exhibitions, namely that anatomy is science, no more and no less, with the bodies on display representing the generalized and abstracted body. It has nothing to do with the humanistic trends increasingly being manifested in contemporary anatomy. Neither the basketball and football players, nor the ballerinas, in the exhibitions are real people; they are representatives of these sports and activities. We do not know whether the individuals represented by these bodies ever indulged in these activities. They are being portrayed to tell a story that, in all probability, has nothing to do with the people prior to their death and plastination and subsequent display in these exhibitions. In other words, they tell us nothing about real people with real life histories. This is far removed from the humanizing trajectories that seek to enhance students’ relationships with the bodies they are dissecting [60]. Students cannot develop a relationship with a plastinate, no matter how useful it is in helping them follow nerves and blood vessels [61].

Far from humanizing the body, these public exhibitions appear to distance themselves from the people who have been plastinated, and in doing this, they objectify the body. They dislocate the body from a clinical and relational base, since they have removed them from the environment that nurtured them and of which they were an integral part. Plastinates do not represent the bodies of somebody, but have been generalized to represent bodies in general. This is acceptable as anatomy *per se*, the traditional anatomy of *Gray’s Anatomy*, presenting the data that medical students and others have to learn, but it fails to engender any humanistic element in the anatomy. It is misleading therefore to label any of the exhibitions as depicting ‘real’ people; they are real dissected bodies, useful in some ways but only part of the story of anatomy.

## 6. Anatomy and its ethical dimensions

The developments in anatomical thinking over many years, and especially over recent ones, have led to concerted efforts to raise the profile of ethical thinking as a basis for anatomical thinking and investigations. While this has been undertaken by individual anatomists, it has also been taken on board by anatomical societies representing anatomists from across the globe. These societies are represented by the International Federation of Associations of Anatomists (IFAA) that has formulated a set of ethical guidelines with a view to overseeing the donation of human bodies [62, 63].

Procedures of the highest ethical standards are required, in order to give donors full confidence in their decision to donate. This in turn demands trust on the part of the public. The guidelines are as follows. The underlying premise is that bodies have been bequeathed for teaching and research purposes.

1. Informed consent from donors must be obtained in writing before any bequest can be accepted. Consent forms should take into account the following:
  - a. Donors must be entirely free in their decision to donate, this excludes donation by minors and prisoners condemned to death.
  - b. Although not essential, good practice is encouraged by having the next of kin also sign the form.
  - c. Whether the donor consents to their medical records being accessed.
2. There should be no commercialization in relation to bequests of human remains for anatomical education and research. This applies to the bequest process itself, where the decision to donate should be free from financial considerations, and also to the uses to which the remains are put following bequest. If bodies, body parts, or plastinated specimens are to be supplied to other institutions for educational or research purposes, this may not yield commercial gain. However, charging for real costs incurred, including the cost of maintaining a body donation program and preparation and transport costs, is considered appropriate. Payment for human material per se is not acceptable.
3. There needs to be an urgent move toward the establishment of guidelines regulating the transport of human bodies, or body parts, within and between countries.
4. Specimens must be treated with respect at all times. This includes, but is not limited to, storing and displaying human and non-human animal parts separately.
5. The normal practice is to retain donor anonymity. Any exceptions to this should be formally agreed to beforehand by the bequestee and, if appropriate, the family.
6. Limits need to be placed on the extent to which images, or other artifacts produced from donations are placed in the public domain, including in social media, both to respect the privacy of the donor (and their surviving relatives) and to prevent arousing morbid curiosity. No individual should be identifiable in images.
7. A clear and rigorous legal framework should be established on a national and/or state level. This legal framework should detail:
  - a. The procedures to be followed in accepting bequests of human remains for anatomical examination, including who is responsible for human remains after death.
  - b. The formal recognition of institutions which may accept bequests, which in some jurisdictions may involve licensing.
  - c. The safe and secure storage of human remains within institutions.
  - d. The length of time such remains will be retained by the institution.
  - e. The procedures to be followed in disposing of remains once the anatomical examination is complete and they are no longer required for anatomical education and research.

8. Institutional procedures should be formally established by an oversight committee, which shall review the body donation program at regular intervals. Such procedures should include the following:
  - a. Copies of the bequest should be retained both by the donor and by the institution for whom the bequest is intended.
  - b. Records should be kept for a minimum of 20 years from the date of disposal to ensure that human material can be identified as originating from a specific donor.
  - c. Good conservation procedures should be employed throughout the entire period during which the human remains are retained to ensure that the most effective use is made of any bequest received.
  - d. Efficient tracking procedures should ensure that the identity and location of all body parts from an individual donor are known at all times.
  - e. Facilities where cadavers are used must be appropriate for the storage of human remains and secured from entry by unauthorized personnel.
9. There needs to be transparency between the institution and potential donors and their relatives at every stage, from the receipt of an initial enquiry to the final disposal of the remains. The clear communication of information should include but not necessarily be limited to the production of an information leaflet (hard copy and/or digital), which could also help publicize anatomical bequests and increase the supply of donors. This should set out the following:
  - a. The procedures relating to registering bequests, acceptance criteria, the procedures to be followed after death (including under what circumstances a bequest might be declined), and the procedures relating to disposal of the human remains. Sufficient grounds for rejection could include, but need not be limited to:
    - the physical condition of the body.
    - the virological or microbiological status of the donor in life.
    - the existence of other diseases (e.g., neurological pathology) that might expose staff or students handling the body to unacceptable risks.
    - body weight or height over a specified limit.
    - the possible over-supply of donations at that institution at that time.
    - place of death outside the designated area from which bodies are obtained.
  - b. The range of uses of donated bodies at that institution.
  - c. Possible costs, if any, that might be incurred by the bequestee's family in making a bequest, and the costs to be met by the institution accepting the bequest.
  - d. Whether the donor's anonymity will be preserved and whether their medical history accessed.

- e. Whether the body or body parts might be supplied to another institution.
  - f. The maximum length of time the body will be retained, including any legally sanctioned possibility of indefinite retention of body parts. The relatives of the donor should be given the option of being informed in due course of the date when the remains will be disposed of.
  - g. Donors should be strongly encouraged to discuss their intentions with their relatives to ensure that their relatives are familiar with their wishes and that as far as possible those wishes will be carried out after death.
10. Special lectures/tutorials in ethics relating to the bequest of human remains should be made available to all students studying anatomy. This is to encourage the development of appropriate sensitivities in relation to the conduct and respect that is expected of those handling human remains used for purposes of anatomical education and research.
  11. Institutions should be encouraged to hold Services of Thanksgiving or Commemoration for those who have donated their bodies for medical education and research, to which can be invited relatives of the deceased, along with staff and students.

The guidelines should not be regarded as having been set in concrete once and for all and are to be modified in light of ongoing ethical reflection. For instance, the anonymity of cadavers has been raised as a matter for discussion [64], while commercialization requires further nuancing in societies where there are for-profit groups alongside not-for-profit ones [65]. Similarly, the transport of human tissue across countries' borders remains a grey area.

Human Tissue Acts that govern the practice of anatomists when dealing with human material have been re-written over recent years in response to a series of organ and body parts scandals. These expectations are now set out in one Act after another and regard informed consent by appropriate parties as a crucial ethical driver (HTAs).

One might have hoped that scandals involving the misuse of dead human bodies would have been consigned to history. However, this has not been the case as epitomized in the most extreme fashion in Germany and allied territories during the Nazi regime [14] and in less extreme ways by organ donor scandals in pathology departments in a number of countries from the 1960s onwards and brought to light around the year 2000 [66–69].

In summarizing the findings to emerge from her magisterial study of anatomy during the Third Reich, Hildebrandt [14] referred to research on the 'future dead,' as one ethical value after another was dispensed with and the profession was converted into 'an agent of evil through the convergence of their own reductionist view of human life, the National Socialist exclusionary medical ethics, and the new "opportunities" provided by the regime' (p. 307). This trajectory involved what she describes as the 'destruction of memory' and the complete annihilation of any professional ethics. For Hildebrandt [14], the take-away message is that 'the benefit for the individual must remain at the center of medical ethics, not the potential benefit for the society as a whole. In that respect, the medical practitioner will always have to take a political stance' (p. 325).



Scandals, let alone rampant examples of evil tarnish the reputation of all who are dependent upon the goodwill and support of the public to obtain the material they require for both teaching and research. Hence, ethical practice assists the profession as a whole by cementing its standing in the eyes of society through recognizing the humanity and individuality of deceased individuals [70].

## 7. Future dimensions of anatomy

The pivotal contributions of Vesalius and Gray among many others need to be constantly recognized for their seminal contribution to what anatomy is today. And yet they were children of their times, who worked in vastly different environments from each other and from the ones encountered in the twenty-first century. We cannot understand either them or their contributions if we ignore their respective contexts. In the same way, we ourselves cannot be understood apart from our contexts, and we have the ability to change them in at least some respects.

Anatomy does not remain stationary, and neither can the expectations of any one society remain isolated from those of similar and very dissimilar societies. Further, the lessons of history may prove far more relevant to current challenges than could ever have been foreseen. For instance, today, it has to contend with the pressures and opportunities opened up by cyberspace.

One of my dominant concerns is the way in which the availability of anatomical dissections on media, such as YouTube, may normalize public perceptions of anatomy in ways over which the anatomical profession has no control [71]. Whether this will have an effect on the trust that is integral to the relationship between institutions, donors, families, and communities, and crucial for the existence of healthy donor programs, has to be seen. Technology is having profound implications for anatomy as it is for every other health science discipline. Among these are ethical implications, and if its practitioners at large fail to grasp this, the consequences could be deleterious to human welfare.

## Author details

David Gareth Jones

Address all correspondence to: [gareth.jones@otago.ac.nz](mailto:gareth.jones@otago.ac.nz)

Department of Anatomy, University of Otago, Dunedin, New Zealand

## References

- [1] Standring S, editor. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 41st ed. London: Elsevier; 2016. p. 1151

- [2] Richardson R. Historical introduction. In: Standring S, editor. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 40th ed. London: Churchill Livingstone, Elsevier; 2008. pp. xvii–xxi
- [3] Gray H, with drawings by Carter HV. *Gray's Anatomy: Anatomy, Descriptive and Surgical*. 1st ed. London: JW Parker and Son; 1858
- [4] Richardson R. The Making of Mr. Gray's Anatomy. Oxford: Oxford University Press; 2008. p. 322
- [5] Sawday J. *The Body Emblazoned*. London: Routledge; 1995. p. 327
- [6] Jones DG, Whitaker MI. Engaging with plastination and the Body Worlds phenomenon: A cultural and intellectual challenge for anatomists. *Clinical Anatomy*. 2009;**22**:770-776
- [7] Kass LR. Thinking about the body. *Hastings Center Report*. 1985;**15**:20-30
- [8] Vesalius A. *De Humani Corporis Fabrica*. 1543 [www.vesaliusfabrica.com/en/original-fabrica/the-art-of-the-fabrica/newly-digitized-1543-edition.html](http://www.vesaliusfabrica.com/en/original-fabrica/the-art-of-the-fabrica/newly-digitized-1543-edition.html)
- [9] Wilkinson CH, editor. *The Poems of Richard Lovelace*, Clarendon Press: Oxford; 1930. p. 132
- [10] Richardson R. *Death, Dissection and the Destitute*. 2nd ed. London: Phoenix Press; 2001. p. 426
- [11] MacDonald H. *Human Remains: Episodes in Human Dissection*. Melbourne: Melbourne University Press; 2005. p. 220
- [12] MacDonald H. *Possessing the Dead: The Artful Science of Anatomy*. Melbourne: Melbourne University Press; 2010. p. 289
- [13] Hildebrandt S. Anatomy in the Third Reich: An outline. Part 2. Bodies for anatomy and related medical disciplines. *Clinical Anatomy*. 2009;**22**:894-905
- [14] Hildebrandt S. *The Anatomy of Murder: Ethical Transgressions and Anatomical Science during the Third Reich*. New York: Berghahn; 2016. p. 374
- [15] Jones DG. The anatomy museum and mental illness: The centrality of informed consent. In: Coleborne C, MacKinnon D, editors. *Exhibiting Madness in Museums: Remembering Psychiatry through Collection and Display*. New York: Routledge; 2011. pp. 161-177
- [16] Wilkinson TM. Respect for the dead and the ethics of anatomy. *Clinical Anatomy* 2014;**27**:286-290
- [17] Jones DG. Using and respecting the dead human body: An anatomist's perspective. *Clinical Anatomy* 2014;**27**:839-843
- [18] Jones DG, Whitaker MI. Anatomy's use of unclaimed bodies: Reasons against continued dependence on an ethically dubious practice. *Clinical Anatomy*. 2012;**25**:246-254

- [19] Jones DG. Where does New Zealand stand on permitting research on human embryos? *The New Zealand Medical Journal*. 2014;**127**(1399). <http://journal.nzma.org.nz/journal/127-1399/6236/>
- [20] Strkalj G. *Humanistic Anatomy: A New Program for an Old Discipline*. New York: Nova Science Publishers; 2016. p. 69
- [21] Hildebrandt S. Developing empathy and clinical detachment during the dissection course on gross anatomy. *Anatomical Sciences Education*. 2010;**3**:216
- [22] Pawlina W, Hammer RR, Strauss JD, Heath SG, Zhao KD, Sahota S, Regnier TD, Freshwater DR, Feeley MA. The hand that gives the rose. *Mayo Clinic Proceedings*. 2011;**86**:139-144
- [23] Jones TW, Lachman N, Pawlina W. Honoring our donors: A survey of memorial ceremonies in United States Anatomy programs. *Anatomical Sciences Education*. 2014;**7**:219-223
- [24] Bolt S. Dead bodies matter: Gift giving and the unveiling of body donor monuments in the Netherlands. *Medical Anthropology Quarterly*. 2012;**26**:613-634
- [25] Jones DG. Bioethical aspects of commemorations and memorials. In: Strkalj G, Pather N, editors. *Exploring the Human Face of Anatomy: Commemorations and Memorials in Anatomy Programs*. World Scientific Publishing. 2017, in press
- [26] Jones DG. Use of bequeathed and unclaimed bodies in the dissecting room. *Clinical Anatomy*. 1994;**7**:102-107
- [27] Zhang L, Wang Y, Xiao M, Han Q, Ding J. An ethical solution to the challenges in teaching anatomy with dissection in the Chinese culture. *Anatomical Sciences Education*. 2008;**1**:56-59
- [28] University of Queensland. UQ body donor Thanksgiving Ceremony [Internet]. 2015. Available from: <https://www.uq.edu.au/sbms/thanksgiving-ceremony> [Accessed: 2015-09-02]
- [29] Lin SC, Hsu J, Fan VY. "Silent virtuous teachers": Anatomical dissection in Taiwan. *British Medical Journal*. 2009;**339**:b5001
- [30] King MR, Whitaker MI, Jones DG. I see dead people: Insights from the humanities into the nature of plastinated cadavers. *Journal of Medical Humanities*. 2014;**35**:361-376
- [31] Institute for Plastination. Donating Your Body for Plastination [Internet]. 2007. Available from: [http://www.bodymbil.de/Downloads/Englisch/BD\\_brochure\\_ENG\\_low\\_120208.pdf](http://www.bodymbil.de/Downloads/Englisch/BD_brochure_ENG_low_120208.pdf) [Accessed 2008-10-01]
- [32] von Hagens G. Impregnation of soft biological specimens with thermosetting resins and elastomers. *The Anatomical Record*. 1979;**194**:247-256
- [33] von Hagens G, Tiedemann K, Krit W. The current potential of plastination. *Anatomy and Embryology*. 1987;**175**:411-421

- [34] Body Worlds images [Internet]. 2016. Available from: [https://www.google.co.nz/search?q=body+worlds+images&ie=utf-8&oe=utf-8&client=firefox-b&gfe\\_rd=cr&ei=pfS8V4T-Fc\\_r8AemoYKoCA](https://www.google.co.nz/search?q=body+worlds+images&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&ei=pfS8V4T-Fc_r8AemoYKoCA) [Accessed 2016-08-24]
- [35] Boyde A, Fraher P, Morris JF, Moxham BJ, Bennett JP, Newell R, Soames RW, Dangerfield P. Letter: Dissections in display [Internet]. The Independent, 16 March 2002. Available from: [http://findarticles.com/p/articles/mi\\_qn4158/is\\_20020316/ai\\_n12600707](http://findarticles.com/p/articles/mi_qn4158/is_20020316/ai_n12600707). [Accessed: 2009-01-21]
- [36] Kuhnel W. Statement by the Anatomische Gesellschaft on the Infamous Body-World Show of Dr Gunther von Hagens. Plexus: Newsletter of the International Federation of Associations of Anatomists, December 2004. Available from: [http://www.ifaa.net/PLEXUS\\_DECEMBER\\_2004-FINAL.pdf](http://www.ifaa.net/PLEXUS_DECEMBER_2004-FINAL.pdf) [Accessed: 2009-01-21]
- [37] Dolce L. Injustice perpetrated on the dead. The National Catholic Bioethics Quarterly. 2010;**10**(4):667-676
- [38] Coulson C. Cadaver art: A chamber of horrors, The Colson Center Library. 1998. Available from: <http://www.colsoncenter.org/bpcommentaries/breakpoint-commentaries.../13/12904> [Accessed: 2016-05-16]
- [39] Metaxas E. Ghoulish 'Art': The Body Worlds Exhibit, The Christian Post. 2012. Available from: <http://www.christianpost.com/news/ghoulish-art-the-body-worlds-exhibit-75158/> [Accessed: 2016-05-16]
- [40] Morriss-Kay G. Bodyworlds: Exhibition at the Atlantis Gallery London. Journal of Anatomy. 2002;**200**:535-536
- [41] Burr DB. Congress considering plastination import ban. American Association of Anatomists News. 2008;**17**:2-5
- [42] Rudolph JN, Perlov D. Body Worlds: An anatomical exhibition of real human bodies, Summary of ethical review [Internet]. 2009. Available from: [http://www.bodyworlds.com/Downloads/englisch/Media/Press%20Kit/BW\\_LA\\_SummaryofEthicalReview.pdf](http://www.bodyworlds.com/Downloads/englisch/Media/Press%20Kit/BW_LA_SummaryofEthicalReview.pdf) [Accessed: 2016-05-16]
- [43] Jones DG. The Peril and Promise of Medical Technology. Oxford: Peter Lang; 2013. p. 280
- [44] von Hagens G, Whalley A. Anatomy Art – Fascination Beneath the Surface. Heidelberg: Institute for Plastination; 2000. p. 284
- [45] Moore CM, Mackenzie Brown C. Gunther von Hagens and Body Worlds part 2: The anatomist as priest and prophet. The Anatomical Record Part B: The New Anatomist. 2004;**277B**:14-20
- [46] Stern M. Dystopian anxieties versus utopian ideals: Medicine from *Frankenstein* to *The Visible Human Project* and *Body Worlds*. Science as Culture. 2006;**15**(1):61-84
- [47] Scott R. Body Worlds' plastinates, the human/nonhuman interface, and feminism. Feminist Theory. 2011;**12**(2):165-181

- [48] Jespersen TC, Rodríguez A. Forced impregnation and masculinist utopia. In: Jespersen TC, Rodríguez A, Starr J. editors. *The Anatomy of Body Worlds: Critical Essays on the Plastinated Cadavers of Gunther von Hagens*. Jefferson, NC: McFarland & Co; 2009. pp. 166-175
- [49] Hirschauer S. Animated Corpses: Communicating with Post Mortals in an Anatomical Exhibition. *Body & Society*. 2006;**12**(4):25-52
- [50] Linke U. Body Shock: The political aesthetics of death. *Social Analysis*. 2010;**54**(2):80-98
- [51] Linda S-S. Advise and consent: On the Americanization of Body Worlds. *BioSocieties*. 2006;**1**:369-384
- [52] von Hagens G. Gruselleichen, Gestaltplastinate und Bestattungszwang (On gruesome corpses, gestalt plastinates and mandatory interment). In: Wetz FJ, Tag B. Schöne, editors. *Neue Körperwelten: Der Streit um die Ausstellung (Brave New Body Worlds—The Question of the Exhibition)*; Stuttgart: Klett-Cotta; 2001. pp. 260-282
- [53] PRNewswire. Anatomist Dr. Gunther von Hagens Reiterates His Mission of Public Health Education to Press Corps in Guben, Germany. 30 November 2006. Available from: [www.prnewswire.co.uk/cgi/news/release?id=185453](http://www.prnewswire.co.uk/cgi/news/release?id=185453). [Accessed 2010-09-20]
- [54] Jones DG, Whitaker MI. Engaging with plastination and the Body Worlds phenomenon: A cultural and intellectual challenge for anatomists. *Clinical Anatomy*. 2009;**22**:770-776
- [55] Stern M. Shiny happy people: 'Body Worlds' and the commodification of health. *Radical Philosophy*. 2003;**118**:2-6
- [56] Linke U. Touching the corpse: The unmaking of memory in the body museum. *Anthropology Today*. 2005;**12**(5):13-19
- [57] Desmond J. Postmortem exhibitions: Taxidermied animals and plastinated corpses in the theaters of the dead. *Configurations*. 2010;**16**(3):347-378
- [58] Jones DG. The artificial world of plastination: A challenge to religious perspectives on the dead human body. *The New Bioethics*. 2016;**22**(3):237-252. DOI: 10.1080/20502877.2016.1238580
- [59] Nicholls EH. Selling anatomy: The role of the soul. *Endeavour*. 2002;**26**(2):47
- [60] Montross C. *Body of Work: Meditations on Mortality from the Human Anatomy Lab*. London: Penguin Books; 2007. p. 295
- [61] Riederer BM. Plastination and its importance in teaching anatomy. Critical points for long-term preservation of human tissue. *Journal of Anatomy*. 2014;**224**:309-315
- [62] IFAA. Recommendations of good practice for the donation and study of human bodies and tissues for anatomical examination. *Plexus* (Newsletter of the International Federation of Associations of Anatomists). Available from: <http://www.ifaa.net/index.php/plexus/viewdownload/3-plexus/7-plexus-2014> [Accessed 2014-08-20] See also: Ifaa.net [Accessed 2017-02-20]



- [63] Jones DG. Searching for good practice recommendations on body donations across diverse cultures. *Clinical Anatomy*. 2016;**29**:55-59
- [64] Jones DG, King MR. Maintaining the anonymity of cadavers: Historic relic or educational and ethical necessity? *Anatomical Sciences Education*. 2017;**10**:87-97
- [65] Champney TH. The business of bodies: Ethical perspectives on for-profit body donation companies. *Clinical Anatomy*. 2016;**29**:25-29
- [66] Bristol Royal Infirmary Inquiry. Learning from Bristol: The Report of the Public Inquiry into Children's Heart Surgery at the Bristol Royal Infirmary 1984-1995. Bristol: Crown Copyright; 2001
- [67] Department of Health. The Removal, Retention and Use of Human Organs and Tissue from Postmortem Examination. London: Her Majesty's Stationary Office; 2001
- [68] The Royal Liverpool Children's Inquiry. The Royal Liverpool Children's Inquiry Report. London: House of Commons; 2001
- [69] Retained Organs Commission. A Consultation Document on Unclaimed and Unidentifiable Organs and Tissue, a Possible Regulatory Framework. London: National Health Service; 2002
- [70] Jones DG, Whitaker MI. Speaking for the Dead: The Human Body in Biology and Medicine. Farnham, Surrey, UK: Ashgate Publishing; 2009. p. 296
- [71] Jones DG. YouTube anatomy education: Source of ethical perplexity. *Anatomical Sciences Education*. 2016;**9**:500-501