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Study of Human Anatomy for Pre-medical and Pre-nursing
Undergraduate Students**

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Undergraduate Students**

ABSTRACT

As an Instructor of Human Anatomy for over twenty years at the college and junior college levels, I have discovered that human cadaver dissection is a critical component to this study, especially as it relates to the future pursuit by a select group of my students of careers in the fields of medicine and nursing. I will first focus on a historical account of cadaver dissection from early Greek and Roman times to the 21st century. Then I will not only justify my contention that cadaver dissection is the most important ingredient in teaching this course, but also demonstrate how it intensifies students' passions for achieving a greater understanding of the anatomy of the human body. Having taught Human Anatomy for twenty years to classes with and without access to the use of human cadavers for dissection, I firmly believe that the addition of this technique has piqued the fervor for learning of my more gifted students, has given them a greater incentive to pursue careers in medicine or nursing, and has, by their own accounts, greatly improved their performances in subsequent postgraduate medical and nursing school career studies. To substantiate this thesis, I will provide brief descriptions of follow up conversations that I've had with a select group of students who've completed my course and are now on their way to applying to enter medical or nursing school, as well as one student who completed my course and who is now about to graduate from nursing school.

My concluding portion of this paper will emphasize the fact that in addition to supplying students with essential anatomical knowledge, the human dissection room can serve as an ideal ground for cultivating humanistic values among college, premedical, and pre-nursing students, as well as postgraduate medical and nursing students. The human cadaver dissection lab experience provides instructors like myself with an immediate opportunity to not only teach but also to encourage humanistic qualities of respect, empathy and compassion among college, and the same would apply to first semester medical or nursing students. Sensitizing the students to develop an emotional attachment

with the cadaver can help him/her to understand the psychosocial factors contributing to a patient's illness. These humanistic values must be combined with a clear sense of empathy by the students, and for them to develop empathy, it is critical for them to understand that empathy cannot be based on detached reasoning because it involves emotional skills, including associating with another person's images and spontaneously following another's mood shifts. Therefore, emotional reasoning must replace detached reasoning as the core of clinical empathy. (77)

Introduction

Human cadaver dissection has been used as the core teaching tool in anatomy for centuries. This paper will first focus on a brief description of the significant events in the history of human cadaver dissection. I begin with the inception of human dissection in ancient Greece during the 3rd century BC; next I will outline the factors leading to its disappearance in the Middle Ages and subsequent revival in the early 14th century in Italy; then I will delineate the gradual change in attitude of religious authorities towards human dissection, after which I will underscore events leading to the acceptance of human dissection for teaching anatomy. I will also outline the evolution of the means of cadaver procurement, which began with dissecting bodies of executed criminals, at a time when human dissection was synonymous with capital punishment. Thereafter, anatomists had to depend on illegal means such as grave robbing, body snatching and even murder for human bodies, which led to legalization of the use of unclaimed bodies, most of whom were poor people stationed in workhouses. Eventually in the 21st century, there has been a reliance on body donation programs as the primary source of human bodies for anatomical dissection in medical schools and subsequently in colleges.

Finally, my paper will emphasize the relevance of human dissection in the 21st century, when researchers are coming up with findings affirming that human dissection contributes not only to the improvement of anatomic knowledge, but also to the development of humanistic values in premedical and pre-nursing students. These two factors combined could be the key to safe medical and nursing practice (1,2). In conclusion, I will discuss how my anatomy dissection lab demonstrates the potential to cultivate humanistic values among premedical and pre-nursing students which could possibly contribute invaluablely towards the making of more empathetic physicians and nurses of tomorrow. This will include some quotes from my students.

Inception of Human Dissection

The introduction of human cadaver dissection was an extraordinary event in the history of science. For many years, physicians such as Hippocrates of ancient Greece gained considerable information about the human body and health without the use of human cadaver dissection (3). The development of Greek medicine culminated in the establishment of the school of Greek medicine in Alexandria during the 3rd century BC (4). In Alexandria, the practice of human cadaver dissection was the dominant means of learning anatomy, and it was here that Herophilus of Chalcedon and his younger student Erasistratus of Ceos, under the guidance of Hippocrates, became the first ancient Greek physicians to perform systemic dissections of human cadavers in the first half of the 3rd century BC (5).

Before these two legendary Greek physicians made their appearance, relatively superficial surgical incisions and excisions prompted by pathological

conditions made up the extent of the exploration human bodies. Available literature intimates that religious moral and esthetic taboos prevented ancient physicians from opening the human body for anatomical purposes (6). The factors that could have encouraged Herophilus and Erasistratus to overcome the deeply held beliefs and cultural habits against dissection included royal patronage, whereby bodies of executed criminals were handed over to these anatomists for their scientific endeavor. It was clear that the ambition of Greek rulers was to establish Alexandria as a shining center of literary and scientific learning.

Disappearance of Human Dissection

After the death of Herophilus and Erasistratus, human dissection went into hiding not only in Alexandria but also in all ancient Greece (6). This was attributed to the emergence of a new rival school of medical thought, probably founded by a renegade pupil of Herophilus, Filinos of Cos. His followers were referred to as "empiricists" who deemed that human dissection had no scientific utility in anatomy teaching, and that desirable clinical results could only be obtained by the empirical collection of non-invasive, even random observations (5). In the generations after Herophilus and Erasistratus, physicians in Alexandria turned their attention to detailed clinical analyses of past texts as an educational alternative while discontinuing human dissection (6). Galen was a Greek who became the Roman empire's greatest physician, which included attending to injuries sustained by gladiators fighting to their deaths, and who authored more books still in existence than any other Ancient Greek: about 20,000 pages of his work survive. He was a prominent anatomist five centuries after Herophilus and Erasistratus, was the personal physician to Rome's Emperors for decades, and is considered by many as the "father of Anatomy". Despite these advances, the bright light of human dissection was completely eradicated with the burning of Alexandria in 389 AD (3).

Following the widespread introduction of Christianity in Europe during the Middle Ages, the development of rational thought and investigation was paralyzed by church authorities; consequently, physicians could only repeat the works of eminent figures from the past such as Aristotle or Galen, without questioning their scientific validity (7). During this period, human dissection was considered sacrilegious and therefore was prohibited (8). For hundreds of years, the European world valued the sanctity of the church more than scientific endeavors, and it was not until early 14th century that human dissection was resurrected as a tool for teaching anatomy in Bologna, Italy after a lapse of over 1,700 years (9).

Revival of Human Dissection and its Rise in Popularity

In Medieval Europe, “considerable advances in the field of science were achieved during the 12th and early 13th century, with the setting up of universities in Paris (1150), Bologna (1158), Oxford (1167), Montpellier (1181) and Padua (1222)” (10). The Holy Roman emperor Frederick II (1194-1250) took significant measures towards the advancement of science, which reflected his free-thinking outlook, by issuing in 1231a decree “which mandated that a human body should be dissected at least once in every five years for anatomical studies, and attendance was made compulsory for everyone who was to practice medicine or surgery” (11).

This initiative was a giant step towards revival of human dissection in the arena of anatomical sciences. The realization that human anatomy could only be taught by the dissection of the human body resulted in its legalization in several European countries between 1283 and 1365 (12). This newly found enthusiasm in human dissection ended for a short period around 1299, when Pope Boniface VIII issued a Papal Bull entitled, "*De sepolturis*" which “forbade manipulation of corpses and their reduction to bones”. The Bull, though not meant to prevent human dissection, was aimed at stopping the dismemberment of cadavers and prohibiting the trade that had developed involving bones from soldiers killed in Holy wars (13). By the end of the 13th century, the University of Bologna emerged as the most popular institution in Europe for learning medicine, which attracted students from all of Italy and many other countries (13). The status of Bologna was further supported when it was granted a Bull by Pope Nicolas II in 1292, stating that all students having graduated in medicine from the University were permitted to teach all over the world (14).

All these events ultimately culminated in “the first officially sanctioned systematic human dissection since Herophilus and Erasistratus, which was performed in full public display by Mondino de Liuzzi (1275-1326) in 1315 in Bologna” (9). Although there is a possibility that human dissections may have been performed prior to De Liuzzi, most authors suggest that all those cases involved autopsies and post-mortems. During the early 14th century, the religious restraints imposed on dissection and autopsy relaxed significantly, as exemplified by the mediating role of the church whereby religious authorities gave permission for as well as articulated proper boundaries around the practice of human dissection. (15).

From De Liuzzi's time human dissections were performed on bodies of executed criminals, both male and female, provided to the medical school of Bologna by the local public authorities (9). These public dissections were strictly standardized as they required the presence of the Lector (lecturer), who read from an authoritative text; usually the Lector was De Liuzzi who referred to Galen's text; and at a later time, other eminent anatomists referred to De Liuzzi's text *Anathomia Mondini*, and at the dissection were both the Ostensor who pointed to the part of the body to be dissected and the Sector (surgeon/barber) who performed the dissection (Fig. 1). During this period, unofficial

dissections were also carried out in private houses, which involved informal anatomy teaching between a lecturer and his small group of students. Procurement of cadavers for such private dissections was difficult and may have led to some malpractice, as in 1319 four students of Master Alberto, who was a lecturer at the University of Bologna, were indicted for robbing a grave and bringing the corpse to the house where Alberto lectured (16).

As a result of the shortage of bodies available, the students attending the dissection in medical schools were required to pay for and also attend the subsequent funeral of the corpse after dissection to encourage other local families to donate their dead relatives for anatomical studies.

The atmosphere changed dramatically towards the end of the 15th century with a remarkable burgeoning of interest in human dissection, the reasons for which included the following: the revival of antique art in renaissance Italy with its interest in naturalism, and the rise of humanist faith in classical scholarship leading to rediscovery of Galen's anatomical discourse. There was an additional increased availability of printed and illustrated works of anatomy which revived in people an interest in medicine and the secrets of the natural world.

There ensued an even greater interest in human cadaver dissection during the 16th century. As a result, the demand for dissectable bodies quickly escalated beyond the meagre but regular number supplied by the local gallows and families influenced by the prospect of a free funeral (17).

Gradually these sources became insufficient, and the anatomists began to rely heavily on unofficial or extralegal sources of supply. Consequently, malpractice such as grave-robbing became increasingly common during the 16th century. Students were known to “attempt to remove corpses awaiting burial or to actually assault funeral processions” (18). Even the esteemed anatomist Andreas Vesalius (1514-1564) in his anatomical treatise *De humani corporis fabrica*, candidly admitted to resorting to such malpractice to ensure an adequate supply of cadavers for dissection (19). In one instance “his Paduan students stole a female corpse from her tomb and flayed the whole skin from the cadaver lest it be recognized by her relatives during public dissection” (20). Such unethical anatomical practices led to distasteful stories of actual criminal offences like vivisection (21). Vesalius was accused of performing a dissection on a Spanish aristocrat when the heart was still beating. Gabriele Falloppio (1523-1562) faced an allegation that he had vivisected Spanish twin brothers with syphilis (22).

Whether or not the hunger for cadavers among the 16th century anatomists actually put the living at risk, it certainly exposed the unprecedented links between anatomists and administrators of criminal justice who were influenced by these anatomists to name the time and mode of execution of criminals to suit their requirement of dissection (17). By the middle of the 16th century, there were clear signs of persistent public concern regarding the anatomical practices in Italy. Initially their reservations were based on traditional issues like funerary ritual and family honor, but eventually they emerged as a “public fear of being buried alive and coming under the anatomist's knife” (20).

However, such concerns in the public domain co-existed with the “well documented popular enthusiasm for the spectacle of human cadaveric dissection” (23).

Figure 2. A woodcut illustration from *Fasciculus medicinae* (1491) depicting human dissection in medieval Italy. The anatomist (*Lector*) over viewing the dissection, which is being performed by a barber surgeon (*Sector*) under directions from the *Ostensor*, who is ...



Figure 2. An anonymous engraving of an anatomical dissection session being conducted in full public view in the anatomical theatre in University of Leiden (the Netherlands) which was built in 1596. The illustration is based on a drawing by J.C. vant Woudt in 1609....



Development of Human Dissection as a Primary Tool for Teaching/ Learning Anatomy

By the beginning of the 15th century, cadaver dissection became a regular event for teaching and learning anatomy in French universities. In the 14th century France, the study of anatomy was mostly limited to the use of criminal bodies, however due to increased demand for cadavers by the turn of the 15th century, anatomical dissections on bodies meant for post-mortem autopsy became common in French universities.

Andreas Vesalius arrived at the University of Paris in 1533, after completing his studies in the University of Louvain (23) and stayed in Paris till 1536 and studied anatomy under Jean Guiterd'Andernach (1487-1574) and Jacques Dubois (1478-1555) before moving to Padua (24,25) Vesalius' assertion was that to learn anatomy, one had to dissect human cadavers by oneself. His efforts exposed the errors of Galen's theories which were based on animal dissections; this eventually led to the most significant change in anatomical studies in general: blind faith on ancient authoritative books was replaced by learning anatomy from dissected human cadavers (25). Therefore, Vesalius pioneered a paradigm shift from the concept prevalent till then, that dissection was being used as an

extension of illustrations in anatomy, to the acceptance of cadaver dissection as being the most significant tool from which students would learn anatomy.

Vesalius was not satisfied with the traditional manner in which human dissections were carried out in those days, when the actual dissection was performed by the barber surgeons and the lecturer/anatomist orated from a text as they thought it was below their dignity to perform dissections on human cadavers by themselves. As a result, he began to dissect human bodies by himself, although opportunities were few as he was still a student (23). Nevertheless, his desire to gain knowledge through dissection of cadavers was so strong that he would raid the gallows of Paris for half decomposed bodies and skeletons to dissect. Sometimes he even found the courage to venture outside the walls of Paris, braving wild dogs and the stench of decomposed bodies, in order to steal cadavers from the mound of Monfaucon, where the bodies of executed criminals were hung until they disintegrated (26,27). However, his hunger for dissection during his stay in Paris may have contributed to his exceptional dissection skills which he displayed to the audience during only his second anatomical lecture in Padua, when he took the knife away from the barber-surgeon and began to dissect the cadaver himself (Fig. 3) (28). Vesalius' emphasis on the need for direct experience of dissection was instrumental in human cadaver dissection achieving the central role in medical training and research in those days.

During this early Renaissance period, human dissection emerged as a popular domain for scholarly pursuits as physicians considered it an effective medium to communicate their discoveries of the natural world in objective form (29). "Hence, human dissection proved to be critical in the dissemination of scientific knowledge in the field of medicine during this period of scientific revolution. Cadaveric dissection though was a messy business, requiring great physical strength and ability to withstand the smell of corpses as they decomposed. Due to natural decomposition, a cadaver was suitable for dissection in the first 3-4 days following death as after this the stench became too much for the dissector to bear. In warm or moist weather, the cadaver decomposed even faster, this is the reason that many medical schools preferred to dissect in winter months" (26).

From 1537, after Pope Clement VII accepted human dissection for anatomical studies, popularity of dissection started to spread beyond the boundaries of the universities among the general population, which lead to public dissection sessions being attended by huge crowds and the subsequent establishment of anatomical theatres (Fig.4) (17).

Figure 3. *Andreas Vesalius undertaking an anatomical lecture in Padua. A notable shift from the prevalent trend in medieval Italy as he is dissecting the human body himself. He is referring to Galen's text (prevalent textbook in anatomy in those days) which is ...*



Figure 4. *The anatomy lesson of Dr. Nicolaes Tulp, official city anatomist of the Amsterdam Guild of Surgeons, drawn by Rembrandt in 1632. Anatomical dissection sessions were social events in those days being attended by students as well as the general public on ...*



Diminution in Supply of Cadavers through Capital Punishment and Passage of the Murder Act in 1752

Human cadaver dissection was prohibited in England until the 16th century due to the overwhelming influence of the Catholic Church. However, during the early part of the 16th century, the Protestant Reformation started in England due to a major disagreement between King Henry VIII and Pope Clement VII (30). John Caius (1510-1573), an English physician who graduated from Cambridge and who was a student of Vesalius in Padua, was the President of the newly established Royal College of Physicians from 1555-1560 and again between 1562-1571, and it is generally acknowledged that he was the first to popularize the study of practical anatomy by human dissection in England (31).

By the onset of the 17th century, demand for human cadavers for conducting dissections rose sharply as printed books in anatomy from Italy and France became widely available (32).

It was from this period that anatomical studies in England started to come up with original contributions. The renowned English Physician, William Harvey (1578-1657), who graduated from Padua under the guidance of Fabricius and received his masters from Cambridge, published his anatomical treatise *De moto cordis et sanguinis* (on the motion of the heart and blood) in 1628 in which he documented his theory of the circulation of blood which was based on observations made during the course of dissecting several bodies including those of his own father and sister (33).

Until the middle of the 18th century, the Royal College of Physicians and the Company of Barber Surgeons were the only two groups permitted to carry

out dissections, and between them they had an annual quota of ten cadavers (27). In 1745, a disagreement appeared between the barber surgeons and the licensed surgeons, with the later breaking away and forming the Company of Surgeons (which was later granted a Royal Charter in 1800 to become the Royal College of Surgeons). During this period, due to pressure from anatomists in the rapidly growing number of medical schools in England, the Murder Act was passed in 1752 which legalized the dissection of bodies of executed murderers, who were sent to various medical schools for anatomical research and education (34). The Murder Act served a dual purpose; it was aimed at preventing the horrid crime of murder as it was associated with the apprehension of being dissected after hanging, and it also ensured a legal supply of fresh human cadavers for anatomical studies (35).

Moreover, to ensure adequate supply of human bodies, the government significantly increased the number of crimes punishable by hanging (34). However, all these measures proved insufficient due to considerable expansion in anatomical and medical training activities in 18th century England. As a result, a sizeable percentage of the required cadavers were procured illegally by exhuming them from graveyards during the night by men referred to as 'resurrectionists', which were then sold to the medical schools (36).

Prevalence of Illegal Practices and the Anatomy Act of 1832

In England, the use of unclaimed bodies was not yet legalized by the beginning of the 19th century (37). By this time, an intimate understanding of anatomy and skill in dissection were the important components of medical education and surgical training. Doctors in England and surgeons in particular in their quest to enhance scientific expertise greatly emphasized the critical importance of anatomy and human dissection during medical training, resulting in a sharp increase in demand for cadavers. Such circumstances encouraged unethical practices like grave robbing, body snatching and even murder for dissection which became alarmingly frequent in 19th century England (38). Particularly at risk during grave robbing were the corpses of poor people due to their obvious inability to pay for secure coffins, superior burial sites and well-rewarded watchmen (39). The perpetrators of grave robbing were disgracefully referred to as "body-snatchers"; however, anatomists called them by the more dignified term "resurrectionists" (36).

The growing unrest among the people against the illegal trade involving human cadavers was evidenced by the fact that often fights and riots broke out when the family members of the dead tried to resist the delivery of corpses from funeral processions/graveyards to the anatomists (40)

In 1828, two Irishmen living in Edinburgh, William Burke and William Hare, murdered and sold the bodies of at least sixteen men and women to Robert Knox as dissection material for his anatomy classes. Burke and Hare crafted a method of murder, which became infamously known as 'Burking' (smothering a victim after intoxicating him/her with alcohol) This method for a

time went completely undetected by the doctors to whom they sold their prey. Burke himself was finally captured, charged and convicted, with resulting capital punishment, and ironically his corpse was given to a school for dissection (41).

This was not an isolated event as further rings of murderers were later unearthed in London, each of whom sold the bodies of their victims to doctors for anatomical studies. John Bishop and Thomas Williams formed a notorious gang of grave robbers in London and supplied bodies to prominent medical schools in London. In 1831, both were convicted for a murder using the same method as Burke and Hare and came to be known as "London Burkers." They were hanged on 5 December 1831, and subsequently their bodies were given to a medical school for anatomical dissection (42). In the same year, Elizabeth Ross was also executed for murdering Catherine Walsh and selling her body to surgeons (43).

In order to put an end to the ongoing malpractice which was causing panic among the general population, the British government passed the Warburton Anatomy Act in 1832, which allowed for unclaimed (which referred to bodies that remained within the workhouse 48 hours after death) bodies of the poor to be removed from workhouses and charitable hospitals and dissected at recognized medical schools by licensed anatomists. (39,44)

The anatomy Act of 1832 marked the onset of a paradigm shift in procurement of human cadavers for anatomical dissection: in accordance with human rights and dignity, it excluded the use of corpses of executed criminals for cadaver dissection and instead allowed for body donations. Hence the Anatomy Act of 1832 opened a new avenue for procurement of dead bodies for anatomical studies by the form of voluntary body donation, which replaced earlier illegal practices. (45)

The Anatomy Act was embraced in many parts of the world and provided for cheap legal cadavers to be sent to medical schools, thus reducing the price of illegally obtained corpses, eventually making unethical practices such as grave robbing neither profitable nor practically viable (45). Even though this Act was effective in curtailing the practice of grave robbing, it led to considerable differences in the attitude of the practice of dissection between the rich and the poor in the society. The elite wealthy class were in favor of anatomical dissections as they felt it was necessary for progress in scientific research. In contrast, the economically deprived section of the society were not in favor and were victimized as it was their corpses which eventually got dissected either voluntarily when the body was sold by desperately poor and grieving family members (46) or even against their wishes when death occurred in the workhouse or charitable hospital with the body being unclaimed (35). The Act effectively made poverty the sole criterion for dissection in England.

Overall the majority of the population still viewed human dissection negatively as evidenced by the social unrest and hostility of the general public towards the medical profession, as demonstrated during the Cholera outbreak in England in 1848-1849 (47).

Dark Period in the History of Human Dissection

Recent studies provide penetrating and discomfoting insights into the practices of anatomists in England and associated Commonwealth countries after the introduction of the Anatomy Act in 1832 (45). What emerges all too clearly from these studies is that although the Anatomy Act mandated that unclaimed bodies would play the central role in anatomical dissection, it was repeatedly manipulated or ignored after 1832 (48). Although grave robbing was curtailed, body snatching continued as bodies of the poor were diverted from the grave to the dissection table by unfair/illegal means adopted by the funeral directors and the owners of institutions housing the poor (49). Such unethical means of procuring bodies for dissection continued through the 19th century and early part of the 20th century.

In the early years of the 20th century, the poor houses/workhouses began to close down in a number of countries leading to decrease in the availability of unclaimed corpses (50). Such a transition led to widespread use of unclaimed bodies of the mentally incapacitated who died in psychiatric asylums (51). This was followed by exploitation of members of the marginalized sections of the society including the colored people and impoverished immigrants (52,53). During this time slave owners used to sell the bodies of deceased slaves to medical schools as these slaves could be delivered for dissection without the consent of the family (54).

The use of unclaimed bodies reached its moral nadir in Germany and its occupied territories during the National Socialist regime between 1933-1945. The corpses of those executed, mostly political prisoners, were made available to Anatomical Institutes for scientific use (55,56). Recent literature does suggest that during this period, anatomists in Germany utilized the prolific supply of human bodies, mostly victims of atrocities performed by the National Socialist regime, for both research and teaching (56). It may not be an overstatement that the imbalance between scientific aspirations of anatomists on one hand and ethical considerations on the other, which is clearly evident throughout the history of human cadaver dissection, reached monstrous proportions during the National Socialist regime in Nazi Germany. Historical incidents like these should serve as a reminder for present day anatomists that disregard of moral values cannot be justified by the quest for scientific glory.

Human Dissection in the United States and Enactment of the Uniform Anatomical Gift Act in 1968

The history of human cadaver dissection in the United States followed an almost identical course as the one in Europe. Until the 18th century the bodies of executed criminals served the sole source of cadavers for anatomists in United States. In 1790, a federal law was passed which permitted federal judges to add dissection to a death sentence for murder. However, the demand for human cadavers was increasing, possibly contributed to by the beginning of

the first formal course in anatomy at University of Pennsylvania in 1745 (57). Grave robbing was continued as a source of bodies for dissection, and even medical students and doctors themselves indulged in grave robbing. Societal injustice was clearly evident as the bodies dissected were mostly those of African-Americans, prisoners and the poor (58).

Massachusetts became the first state to enact laws in 1830 and 1833 that allowed unclaimed bodies of people who died in public institutions, hospitals, asylums and prisons to be used for anatomical dissection, with the exception of the unclaimed bodies of soldiers as they had already served the state during their lifetime. Over the course of next few decades, many other states followed the example and introduced similar legislations, which successfully curtailed the practicality of grave robbing.

During the early part of the 20th century, prejudice against dissection remained high, and body donations were relatively few.

The supply of human cadavers to medical schools was further exacerbated by United States Welfare Legislation and better health care for the poor, leading to a sharp decline in the availability of unclaimed bodies between 1930 and 1960 (59). The development of transplant surgery and consequent rise in demand for anatomical material led to the National Conference of the Commissioners on Uniform State Laws which approved the Uniform Anatomical Gift Act (UAGA) in 1968 (10). UAGA was a turning point in terms of body donation as it established the human body as a property of the donor whose wish now superseded those of next of kin in court. A second act was signed in 1987, which served to clarify the donation process further. Together these two acts, often together referred to as the UAGA, were instrumental in standardizing and streamlining the process of body donation in the United States

The Increase in Body Donation Programs Worldwide

During the latter part of the 20th century, initiatives were undertaken in different parts of the world to promote body donation for the purpose of anatomical studies. UAGA's successful promotion of body donation led to stabilization of willed-body programs towards the end of 20th century (64). The rise in body donation could be attributed to changes in social beliefs and practices as well as changing cultural landscapes in the United States. Social awareness also played a crucial role in enhancing body donation programs, as medical professionals frequently donated their own bodies because they had seen first-hand the value of human dissection as a learning tool for medical students. Further doctors in US have been actively involved in discussing body bequest with their patients thereby encouraging them to donate their bodies (64).

The UK government passed the Anatomy Act in 1984, which aimed to simplify the process of body donation; the act stated that body donation would be allowed if a person either in writing or orally in the presence of two or more

witnesses expressed a request that his/her body be used after death for anatomical studies. To complicate matters, there was a provision for the surviving spouse or any other surviving relative of the deceased to object to the body being used for anatomical dissection (65).

Since the introduction of the Anatomy Act in 1984, most of the medical schools in the UK rely heavily on donated human cadavers for anatomical activities. Body donation constitutes the chief source of human cadavers in the medical schools of most of the European countries, and the European Federation for Experimental Morphology (EFEM) recommended certain measures in 2005 to ensure good practice in the domain of body donation. It stresses the need for informed consent, with donors being given clear information to ease the decision-making process. In addition, the federation encourages medical schools/anatomy departments to hold services of commemoration for those who have donated their bodies. Finally, the EFEM recommends special lectures in ethics related to the bequest of human remains to be offered to all students studying anatomy to encourage development of appropriate sensitivities relative to the expectations expected regarding conduct and respect while handling human remains for anatomical education and research (66).

Memorial services at the end of anatomy courses began in UK in 1965 and in the United States in the 1970s to sensitize students towards their cadavers (67).

The success of body donation programs has not been uniform across the world. This is an area where the society as such can collectively contribute towards advancement of medical education. Persistent efforts need to be undertaken to sensitize the medical community as well as the general population to promoting voluntary donation of dead bodies, which is critical to the human anatomy training for health professionals.

The Relevance of Human Dissection in the 21st Century

To reiterate, human cadaver dissection has been the primary medium of teaching gross anatomy to medical students for centuries. However, in recent times, teaching anatomy by dissection has been replaced in some schools by virtual dissection in cyberspace, as an alternative due to economic factors as well as ethical concerns. (68,69), however, recent literature suggests that the dissected cadaver remains the most powerful means of delivering fundamental regional, relational and topographical anatomical knowledge to medical students, which is indispensable to ensure safe and efficient clinical practice (70,71).

Evidence suggests that learning anatomy by active exploration through cadaver dissection significantly contributes to improvement of anatomic knowledge, as exemplified by researchers having recently documented that decreased use of dissection as a teaching tool has had a negative influence on the anatomical knowledge of medical students (72).

Medical students have stated that cadaver dissection deepens their understanding of anatomical structures, provides them with a three-dimensional

perspective of structures, and helps them to recall what they learned. It is noteworthy that the innovative modes of learning anatomy such as the interactive multimedia resources have not replaced student's enthusiasm about the importance of cadaveric dissection (73). Despite its important strengths, radiologic imaging technique style teaching, which in some schools is used as a replacement for cadaver dissection, cannot simply replace cadaver dissection. In addition to its value as an anatomic teaching modality, cadaver dissection provides students with deep insights into the meaning of human embodiment and mortality and represents a profound rite of passage into the medical profession (74).

Reports of patient mistakes by physicians leading to malpractice due to inadequate anatomical knowledge have prompted researchers and authors to postulate that a long-term consequence of a shortage of anatomical knowledge, by cutting the number of hours students are required to spend in the cadaver lab, could only decrease patient safety, and that medical schools should make dissection the core method for teaching gross anatomy [2].

In addition to supplying students with essential anatomical knowledge, the human dissection room can serve as an ideal ground for cultivating humanistic values among medical students. Medical training usually begins in the first semester of year one with cadaver dissection, and nearly all clinicians remember the details of their first interaction with a human cadaver.

My task as an undergraduate college Human Anatomy teacher is to encourage my premedical and pre-nursing students to develop humanistic qualities of respect, empathy and compassion as they move through the cadaver dissection experience (75). There is hope that by doing so, this cultivation of humanistic values in our cadaver labs could possibly contribute invaluablely towards the creation of more empathetic physicians and nurses of tomorrow.

Sensitizing the students to develop an emotional attachment with the cadaver can help him/her to understand the psychosocial factors contributing to a patient's illness, which can positively contribute to the development of more emotionally empathic physicians and nurses. Without the development of this type of empathy, healing cannot begin. In some parts of the world, students get the opportunity to interact with the families of the deceased persons whom they are dissecting (75,76).

The University of Oklahoma College of Medicine has introduced the unique concept of "Donor Luncheon," whereby medical students meet the families of the donor prior to dissection in the anatomy course. Findings suggest that such an opportunity enables the students to maintain humanistic attitudes at the beginning of their medical career (75). Interaction with the donor family and subsequent identification of the donor in the dissection room allows the student to gain perspective and reflect upon their emotions, as well as to gain new understanding of the inevitability for all of death.

Attention to concepts of humanistic care is a challenge in present day medical education curricula, when physicians and other professionals involved in medical care are becoming mechanized with increasing focus on procedures

and technical aspects. The rise of the body donation programs has been instrumental in fostering social responsibilities among medical students.

“The students can use the dissection lab experience to better prepare themselves for the stress of the medical world, especially issues surrounding death and dying” (78). Human cadaver dissection has survived many millennia, and to date the importance of the student-cadaver encounter remains paramount in medical education. The dissection room provides multifaceted educational experiences while accomplishing the traditional objectives within the allotted time. In other words, in the dissection lab, medical students can learn to do their scheduled work without neglecting their emotions or developing an attitude of detached concern. Accordingly, anatomists have presented arguments in favor of continuation of the use of cadaver material in anatomical sciences education which would be beneficial to future physicians and pivotal in strengthening a close and symbiotic association between anatomists and all physicians, especially surgeons.

Conclusion

The evolution of ancient Greek medicine in the time of Hippocrates paved the way for the beginning of human cadaver dissection as a tool for teaching anatomy in 3rd century BC. Regrettably, the practice of human dissection was prohibited in Europe during the Middle Ages due mainly to the influence of the church. However, from its revival at the beginning of 14th century, human dissection has been an integral part of anatomy teaching in medical schools worldwide. In the early 15th century, cadaveric dissection re-emerged as a regular event in European universities, and the supply of criminal bodies, used for many years for dissection, proved insufficient.

Starting in the latter part of the 15th century, human dissection became extremely popular as the wave of European Renaissance started to influence the domain of anatomical sciences. Dating to the middle of 16th century, after Papal approval of human dissection was granted for anatomical studies, formal university dissection sessions assumed a tremendous public character being attended by large audiences, eventually leading to the establishment of permanent anatomical theatres across Europe. Proving inadequate in the face of unprecedented demand, conventional sources of human cadavers were replaced by extralegal sources which involved grave-robbing, body snatching and even murder to procure bodies for anatomical dissection. In response to the strong public outcry against these ongoing malpractices, many European countries passed legislations during the 18th and 19th centuries, legalizing the procurement of unclaimed bodies of the poor from workhouses and charitable hospitals for dissection in medical schools. The most pronounced among these legislations was the Anatomy Act (1832) passed by the British government which not only allowed the use of unclaimed bodies but also prohibited the tradition of using corpses of executed criminals for anatomical dissection. Although this Anatomy Act was successful in curtailing the illegal practice of grave-robbing, it led to

great societal division between the rich and poor classes about their attitude towards practice of human dissection, as in most cases it was the bodies of individuals from the economically deprived sections of the society that underwent dissection.

Unethical practices continued to plague the domain of human dissection even after the introduction of the Anatomy Act, which involved the procuring of bodies of poor/mentally ill/colored people/and impoverished immigrants. Incidentally, the Nazi regime (1933-1945) in Germany set a disgraceful example of neglecting human rights and dignity by providing the bodies of victims that they had put to death to anatomists for research and education.

Even in the first part of the 20th century, voluntary body donation, which had begun to replace all previous sources of procuring bodies, was very sparse as socio-cultural prejudice against human dissection remained high.

However, in the second half of the 20th century, the approval of the UAGA in the United States of America in 1968 ensured a steady supply of human bodies to the medical schools through body bequest. Presently, body donation constitutes the sole source of human bodies for dissection in medical schools in most parts of the world. Although the number of hours devoted to human dissection have been reduced in most medical schools over the past few decades, research findings clearly emphasize the absolute necessity of dissection in anatomical sciences.

Finally, the anatomy dissection lab has the potential to cultivate humanistic values among premedical, pre-nursing, medical and nursing students which could possibly contribute invaluablely towards the creation of more empathetic physicians and nurses of tomorrow. The lab also forces the students to deal with idea of death, something they will have to master and deal with every day of their medical careers. To succeed at the highest humanistic level, students must either innately use their inherited empathy, or learn to acquire it; and empathy cannot be based on detached reasoning because it involves emotional skills, including associating with another person's images and spontaneously following another's mood shifts. Therefore, emotional reasoning must replace detached reasoning as the core of clinical empathy. (77)

As an addendum, I would like to include a brief description of a few comments made by my anatomy students regarding the importance of human cadaver dissection:

- “There was the slightly disconcerting reality that what lay before me was the first dead body I had ever seen. Each time I went into the cadaver room, I would examine the body and imagine what this person might have been like before death. At first the **empathetic part of me** disliked looking at the blanched tissue that showed her age.”
- “When first looking at the cadaver, it made me wonder what her family felt about strangers opening her up for studies; I mean I know if that were my relative, I would want to keep her body and not have random people open her up. How the body functions leaves me in complete awe!”

- “While everyone else was cutting, I stood next to the table and wondered what made someone want to donate their body to science, then I wondered what this person’s life was like, I’m not sure why but that brought up memories of loved ones I have lost.”
- “You have the teaching abilities to help students going into the medical field succeed. I’m not sure if the characteristics that you demonstrate are mostly innate or can be learned over time. As a result of taking your class, the human body seems less mysterious, especially after engaging in cadaver dissection. I am inspired to learn more about the body’s innate ability to heal itself and find myself looking up more information on physiology.

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