

**LETTER TO THE EDITOR**

# Teaching anatomy with dissection in the time of COVID-19 is essential and possible

To the Editor,

Dr Saverino's letter (Saverino, 2020) addresses important issues in anatomy education, both perennial and current. We are writing to present our own perspectives, some of which support Dr Saverino's position and some of which are in respectful disagreement.

Anatomy, including gross anatomy, histology, embryology, and medical imaging, is the fundament of medical education: it is not possible to learn the practice of medicine without understanding the structure and function of the human body. Anatomical education provides the solid foundation upon which all subsequent clinical courses and practice will build. Every disease process and every pathology happens to a piece of anatomy. We believe that anatomy is best learned using the tools that physicians, physical therapists, physician assistants, dentists, and other providers will employ in their practice: eyes, hands, surgical instruments, electronic resources, and teams. All of these tools are deployed, experienced, and mastered in dissection based anatomy courses, which should be at the heart of any medical or health science anatomy curriculum.

Dr Saverino is correct that technology has an important role to play in anatomy education. This includes the e-books, models and simulations that he mentions: it extends to customizable 3D printed models that students can manipulate in their hands and explore; digital media to integrate medical imaging with cadaveric dissection at the dissection table; and online learning tools for self-assessment and delivery of histological and medical imaging material. Anatomy education is by nature multi-modal, innovative, and engaging. However, just as CT scans, MRIs, electronic medical records, and histopathological preparations are deployed at the service of actual patients, technology should serve as an adjunct to, not a surrogate for, dissection. Medical students should dissect real cadavers, not electronic ones, simply because patients are real people, not virtual ones.

We are not aware of any studies showing that medical students make better physicians if they do not dissect, but there are many showing that dissection results in superior comprehension and performance (Chytas, Piagkou, Salmas, & Johnson, 2020). As Estai and Bunt conclude: "The best way to teach modern anatomy is by combining multiple pedagogical resources to complement one another, students appear to learn more effectively when multimodal and system-based approaches are integrated" (Estai & Bunt, 2016).

Why is it better for physicians to learn anatomy using cadavers than electronic tools? There are many good answers to this question; here we focus our brief comments on three key things:

dissection provides hands-on experience with three-dimensionally complex anatomical structures and relationships; dissection confronts our students with variation and diversity; and dissection develops compassion and empathy.

Human anatomy is complex. No matter the quality of the resource, simulations and online instruction do not provide the same level of understanding of complex anatomical relationships as studying human bodies. Dissection steps like reflecting layers to see deeper structures, tracing neurovasculature along its pathways, and even removing fascia provide a deeper understanding of anatomical complexity. Actively working to reveal structures while problem-solving with their lab group provides students with a greater depth of anatomical understanding and experience in a team-based approach to medicine. Similarly, while numerous high quality atlases exist and can guide students through their learning of anatomy, the translation of a two-dimensional book, website, or app into a real patient requires some imagination.

One of the most important concepts for our students to learn is that variation and diversity are the natural order of the human species. Human beings vary because of their backgrounds, their age, their sex, their medical history, and their personal experiences. By learning anatomy from numerous, diverse cadavers in the lab, our students can sample a small part of that variation, but more importantly, they develop the ineffable understanding that people vary, they come to expect their patients to vary: they learn to see their patients as individuals, and to treat them accordingly. We strive to educate providers who generate unique and customized treatment plans, and understand that there is no one-size-fits-all treatment modality for each condition. We know of no software that captures the sense of the unpredictability of the human physical experience. Paradoxically, dissection also teaches us that people are also very similar to each other in ways that skin color, hair color, tattoos, age, sex, and medical history, for example, cannot mask. In this way, dissection reveals some important basic truths about humanity that cannot be conveyed any other way.

Just as our students need to see their patients as individuals, they also need to learn to nurture their compassion for them. For many students the cadaver is the first stranger that they are entrusted with, the first stranger they form an intimate relationship with. For many, the donor is their first "patient." Confronted with a donor who selflessly volunteered to be studied intimately so that they could learn and grow, our students express compassion, gratitude and empathy for their experience. Thus, dissection is an important antidote to the

worrying decrease in empathy in medical students as they progress through the curriculum (Hojat et al., 2004).

In light of the importance of dissection for medical training, we were concerned to read Dr Saverino's assertion that "the study of anatomy with cadaver dissection has become almost nonexistent in most medical schools." A similar assertion precedes the otherwise excellent movie "Donated to Science," produced by our colleagues at the University of Otago in New Zealand. Although some countries, including the United Kingdom and Canada, have witnessed a decrease in use of dissection in anatomy education, dissection is still performed at various stages of medical education in these countries, and is almost universal in medical schools in the United States, New Zealand, and many other countries.

We also take issue with Dr Saverino's assertion that cadaveric dissection is impossible in the time of COVID-19. In fact, anatomy teaching with cadaver dissection is proceeding at many medical schools, including our own. Three primary things are required for this to happen safely: noninfectious cadavers; mechanisms to meet the demands of social distancing; and institutional commitment to continue training physicians using the best possible methods.


Safe, noninfectious cadavers are easy to obtain from anatomical gift organizations, like our own, that enforce policies to refuse donations of people with infectious conditions. Additional safeguards, such as washing the oral cavity, nasal cavities, and oropharynx with antiviral solutions, preservation and fixation with standard embalming solutions, and testing cadavers before delivery to medical schools, ensure that cadaveric material is extremely unlikely to transmit corona viruses to students, instructors, and support staff.

Indeed, students, instructors, and staff are more likely to catch corona viruses from each other than from cadavers. The probability of infection from these viruses is significantly decreased by social distancing and, when team based methods are necessary, use of full PPE, including face masks, gloves, face shields, and regular hand washing before donning and after doffing PPE. Staggered access to the dissection lab to keep group sizes below recommended maxima can also minimize risk to our students and instructors. Moving tools and supplies from communal areas to each station can prevent congregation. Enhanced disinfection procedures within the laboratory can help minimize risks of transmission via fomites. Ventilation levels that are adequate for reducing exposure to embalming fumes should also reduce risks associated with corona viruses.

We share Dr Saverino's concern that, even before COVID-19, many institutions reduced investment in effective anatomy education by shortening teaching hours, limiting human resources, and eliminating cadaveric dissection from the curriculum. This approach strikes us as, at best, misguided. The possibility that more medical schools will

turn to methods of anatomy teaching that exclude cadavers in the face of the challenges of education in the time of COVID-19 is doubly concerning. The necessity and possibility of dissection in the time of COVID-19 should be acknowledged by universities and medical schools, and anatomy instructors need to be proactive in advancing plans and proposals for how dissection can proceed. We owe it to our medical students, to their future patients, and to our communities to continue providing dissection-centered anatomy education.

The authors serve on the Board of Directors of the Anatomical Gift Association of Illinois and as course directors for human anatomy courses at their home institutions. HFS is also the Director of Midwestern University's Body Donation Program.

Callum F. Ross<sup>1</sup> 

Maurice J. Pescitelli<sup>2</sup>

Heather F. Smith<sup>3</sup>

James M. Williams<sup>4</sup>

<sup>1</sup>Department of Organismal Biology and Anatomy, The University of Chicago, Chicago, Illinois

<sup>2</sup>Department of Anatomy and Cell Biology, College of Medicine, The University of Illinois at Chicago, Chicago, Illinois

<sup>3</sup>Department of Anatomy, Midwestern University, Glendale, Arizona

<sup>4</sup>Rush University Human Anatomy Laboratory, Rush Medical College, Chicago, Illinois

#### Correspondence

Callum F. Ross, Department of Organismal Biology and Anatomy, The University of Chicago, Chicago, Illinois 60637.

Email: rossc@uchicago.edu

#### ORCID

Callum F. Ross  <https://orcid.org/0000-0001-7764-761X>

#### REFERENCES

- Chytas, D., Piagkou, M., Salmas, M., & Johnson, E. O. (2020). Three-dimensional digital technologies in anatomy education: Better than traditional methods, but are they better than cadaveric dissection? *Clinical Anatomy*, 34, 1122–1123. <https://doi.org/10.1002/ca.23591>
- Estai, M., & Bunt, S. (2016). Best teaching practices in anatomy education: A critical review. *Annals of Anatomy*, 208, 151–157. <https://doi.org/10.1016/j.aanat.2016.02.010>
- Hojat, M., Mangione, S., Nasca, T. J., Rattner, S., Erdmann, J. B., Gonnella, J. S., & Magee, M. (2004). An empirical study of decline in empathy in medical school. *Medical Education*, 38(9), 934–941. <https://doi.org/10.1111/j.1365-2929.2004.01911.x>
- Saverino, D. (2020). Teaching anatomy at the time of COVID-19. *Clinical Anatomy*, 34, 1128–1128. <https://doi.org/10.1002/ca.23616>