

## Teaching Gross Anatomy: Now and Then

Rafael Romero-Reverón<sup>1\*</sup>

<sup>1</sup>Professor Human Anatomy Department, School of Medicine J.M. Vargas, Faculty of Medicine, Universidad Central de Venezuela, San José de Cotiza, Caracas 1060, Venezuela

\*Corresponding Author: Rafael Romero-Reverón

Professor Human Anatomy Department, School of Medicine J.M. Vargas, Faculty of Medicine, Universidad Central de Venezuela, San José de Cotiza, Caracas 1060, Venezuela

Article History: | Received: 09.02.2025 | Accepted: 17.03.2025 | Published: 21.03.2025 |

**Abstract:** The teaching of macroscopic anatomy has changed a lot from ancient times until now, since the first human being observed the anatomical parts of other human beings or animals either during a healing action, a fight or a hunting. Later on the first documented systematic anatomical dissections on the human body were carried out around the third century B.C. in Alexandria, but soon was banned for about 16 centuries. Anatomical dissections were restored during late middle age and subsequently improved during the renaissance and following centuries. In the 21st century as complement to improve the medical education new technologies to the teaching of human anatomy are being incorporated. Nevertheless, anatomical dissection will continue to be essential in medical education because cadavers impart a real-time three-dimensional perspective about human body complexities and improve medical practical skills.

**Keywords:** Anatomical dissection, education, history of medicine, human anatomy, technological innovations, teaching/learning.

**Copyright © 2025 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

## INTRODUCTION

The history of human anatomy teaching, from the earliest examinations of dead bodies in the ancient to the high-level analyses of the human body carried out in the 21st century is characterized by a repetitively developing understanding of the structures and functions of the human being. In medical education, human anatomy is considered one of the keystone course. Gross anatomy is pondered an undoubted core component of the medical syllabus (Harmon *et al.*, 2024). Anatomical knowledge is indispensable for adequate physical examination of patients, regardless of medical specialty, but it is also a foundation of the language of medicine. Teaching gross anatomy is essential for understanding the physiology and pathological processes that affect the human being. Human anatomy is a real basic science, because all the other later medical subjects are dependent on the knowledge of what are the different parts of the human body (Nurani *et al.*, 2024). But teaching gross anatomy showed a decrease in the absolute and relative time in terms of curricular hours and in time students spend studying human anatomy (Chang Chan *et al.*,

2022). The aim of this paper is to show a brief review over the teaching gross anatomy thru the history.

### From the ancient to 20th century

On the history of the teaching of gross anatomy in western civilization in antiquity, more precisely in Ancient Egypt (3th century BC), there was a desire to preserve the bodies intact, through the religious practice of mummification, which required the teaching of a basic knowledge of human anatomy. Alcmaeon of Croton (5th century BC) provided the oldest records of anatomical observations, through dissections carried out in animals. But the first documented systematic anatomical dissections on the human body were carried out around the third century B.C. in Alexandria by Herophilus and Erasistratus. Later on, the anatomical dissection was banned for about 16 centuries. In the meantime, Claudius Galen (130 years AD) wrote a large number of medical treatises, which were based on the dissection of animals and the application of the results to human anatomy. However, the ideas of Galen were preserved for a long time, which erroneously followed the doctrine of the humor of Hippocrates. Although anatomy is not officially banned by the Christian church, social

authorities reject the dissection of human corpses until the 14th century (Dziedzic *et al.*, 2024). Then with the rise of the Renaissance, the limits of human learning were broken and the ideas of Greece and Rome were exchanged for information such as books and drawings as those of Andreas Vesalius (1514-1564), who transformed the rigidity of anatomical studies with dynamics in teaching, introducing illustrations of the human body and researches that reporting errors in Galen's ideas. Between the 15th and 20th centuries AD, the performance of anatomical dissection became a wide spread essential form of medical education. For more than 500 years, the whole idea of human anatomy teaching is all about anatomical dissection of the human body. Since then, human cadaveric dissection remains the primary channel of teaching gross anatomy to medical students. Traditional teaching consisted of lectures, anatomical dissection and endeavoring to understand the basic concepts with the help of textbooks and the accompanying illustrations, which was time-consuming but highly rewarding. The latter half of the 20th century showed a continuous decrease in the time devoted to teaching human anatomy in terms of curricular hours and in time students spend studying anatomy (Santana *et al.*, 2022). Moreover, in 1977, Gunther von Hagens developed a technique of tissue preservation called Plastination, which is a process of preservation of anatomical specimens by a delicate method of forced impregnation with curable polymers like silicone, epoxy or polyester resins with applications in teaching gross anatomy. On the other hand, given the rapid speed of development in the past decades of modern medical imaging techniques like Ultrasound, Computed tomography, Magnetic Resonance Imaging, and Nuclear Medicine, Dynamic three-dimensional (3D) images, with features of rotation, displacement, zooming, changeable transparency, and allowing virtual anatomical dissection, which reveal the gross anatomy of the living human body (Alghamdi *et al.*, 2024, Chytas *et al.*, 2023).

### First decades in the 21st century

Medical education is being transformed by the new digital technologies. And nowadays teaching gross anatomy by anatomical dissection are being complemented by the emerging technological innovations during the first decades in 21th century among them; Artificial intelligence algorithms can improve the accuracy and efficiency of the interpretation of anatomical images as well as contribute to improve the writing of content in the anatomical field. Augmented reality allows the presentation of anatomical models in 3D while preserving the user's awareness of their direct surroundings. Virtual reality can provide medical students with a new way of interacting with complex structures and systems that are impracticable with traditional resources, such as cadavers and anatomical atlases (Şişu *et al.*, 2024, Romero-Reveron 2024). The Anatomage Table and other virtual dissection systems can visualize internal and surface anatomy in 3D space dynamically, with high resolution and great accuracy, from performing cuts and exploring anatomical systems to

rendering volumes for 3D analysis (Koney *et al.*, 2024, Lee, *et al.*, 2024). Among social media; Instagram, X (former Twitter), YouTube and others can display pre-recorder lecture, didactic charts and diagrams and high resolution videos with real human anatomy images (Patra *et al.*, 2022, Romero-Reveron 2024). But a possible handicap of all these emerging technological innovations concerns the absence of tactile feedback.

## DISCUSSION

In medical education, human anatomy will always be the most essential of the basic sciences. But teaching gross anatomy has changed significantly from the ancient to now. The new technological innovations will not replace anatomical dissection but complement it (Dziedzic *et al.*, 2024). However, these emerging technological innovations can certain change the profile of human anatomy teaching. Nevertheless, anatomical dissection will continue to be essential in medical education because cadavers impart a real-time three-dimensional perspective about human body complexities and improve medical practical skills (Sangam *et al.*, 2024, Toral-Murillo *et al.*, 2024). Also inadequate knowledge about anatomical variations, which can only be learnt by doing anatomical dissection may have serious implications on patient safety. Perhaps the best human anatomy teaching practice will be a careful adaptation of resources and methods accessible in each medical school and country according to their financial resources available.

## CONCLUSION

Human anatomy is and will be the most essential of the basic sciences in Medicine. Since it is the science on which all other sciences concerning the human being, its diseases and treatment are based. A hybrid approach between traditional anatomical dissection and the use of new technologies will allow medical students to acquire a better learning of human anatomy.

## REFERENCES

- Alghamdi, M. A., Bu Saeed, R., Fudhah, W., Alqarni, D., Albarzan, S., Alamoudi, S., & Khan, M. A. (2024). Perceptions of medical students regarding methods of teaching human anatomy. *Cogent Education* 11(1). doi.org/10.1080/2331186X.2024.2340836
- Chan, A. Y. C. C., Stapper, C. P., Bleys, R. L., van Leeuwen, M., & Ten Cate, O. (2022). Are we facing the end of gross anatomy teaching as we have known it for centuries?. *Advances in Medical Education and Practice*, 13, 1243-1250. doi.org/10.2147/AMEP.S378149
- Chytas, D., Salmas, M., Noussios, G., Paraskevas, G., Protogerou, V., Demesticha, T., & Vassiou, A. (2023). Do virtual dissection tables add benefit to cadaver-based anatomy education? An evaluation. *Morphologie*, 107(356), 1-5. doi.org/10.1016/j.morpho.2022.01.002
- Dziedzic, M., Ostrowski, P., Ghosh, S., Balawender, K., Koziej, M., & Bonczar, M. (2024). Exploring the evolution of anatomy: From historical foundations to modern insights. *Translational Research in Anatomy*, 35, 100286. doi.org/10.1016/j.tria.2024.100286

- Harmon, D. J., Hankin, M. H., Martindale, J. R., Niculescu, I., Aschmetat, A., Hanke, R. E., ... & Koltun, K. (2024). A survey of essential anatomy from the perspective of anesthesiology, emergency medicine, obstetrics and gynecology, and orthopedics resident physicians. *BMC medical education*, 24(1), 1194. doi.org/10.1186/s12909-024-06185-5
- Koney, N. K. K., Ansah, A. O., Asaku, B. N. A., Ahenkorah, J., Hottor, B. A., Adutwum-Ofori, K., ... & Arko-Boham, B. (2024). Anatomage virtual dissection versus traditional human body dissection in anatomy pedagogy: insights from Ghanaian medical students. *BMC Medical Education*, 24(1), 1059.
- Lee, J. W. Y., Susanto, J., Lai, S. H., Cheow, P. C., Low, L. X. T., & Bello, F. (2024). What Faculty and Students Value When Evaluating Human Digital Anatomy Platforms: A Mixed-Methods Study. *Journal of Medical Education and Curricular Development*, 11. doi.org/10.1177/23821205241256043
- Nurani, K., Kipkorir, V., Njoroge, J., Ongeti, K., & Ogengâ, J. (2024). The evolving application of human anatomy pedagogy and research. *Anatomy Journal of Africa*, 13(1), 2549-2552. doi:dx.doi.org/10.4314/aja.v13i1.2
- Patra, A., Pushpa, N. B., Ravi, K. S. (2022). Future of cadaveric dissection in anatomical science education. *Natl J Clin Anat*, 11, 123–125.
- Romero-Reveron, R. (2024). The relevance of anatomical dissection-based in 21st century. *Hell J Surg*, 94(2), 107–109. doi: 10.59869/24035
- Romero-Reveron, R. (2024). Human anatomy teaching/learning process in the early 21st century. *Scholastic Case Reports*, 1(2), 1.
- Sangam, M. R., Deka, R., Vinay, G., Praveen, K., Kaur, A., & Wahengbam, M. (2024). Perception of First-Year MBBS Students Toward Virtual Dissection in Learning Anatomy: A Comparative Study Between High and Low Academic Achievers. *Cureus*, 16(10), e72508. doi: 10.7759/cureus.72508
- Santana, L. I., Buchaim, D. V., Hamzé, A. L., Reis, C. H. B., de Souza Bueno, C. R., de Marchi, M. Â., ... & Buchaim, R. L. (2022). The history of anatomy, its importance and new trends in the teaching/learning process. *Archives of Anatomy and Physiology*, 7(1), 001-004. doi: 10.17352/aap.000018
- Şişu, A. M., Stoicescu, E. R., Bolintineanu, S. L., Faur, A. C., Iacob, R., Ghenciu, D. M., Dănilă, A. I., & Haţegan, O. A. (2024). Blending Tradition and Innovation: Student Opinions on Modern Anatomy Education. *Education Sciences*, 14(11), 1150. doi:10.3390/educsci14111150
- Toral-Murillo, M. V., Lara-Palazuelos, N., Ossandón Rocha, C. D. E., & Rodríguez-Flores, E. (2024). Comparison of the Effect of Motivation in Medical Students with the Use of Virtual Reality and Non-Immersive Digital Resources. *Educ Sci*, 14, 1288. https://doi.org/10.3390/educsci14121288