

Clin Neurol Neurosurg

. 2021 Nov;210:106948.

doi: 10.1016/j.clineuro.2021.106948. Epub 2021 Sep 23.

New neuroanatomy learning paradigms for the next generation of trainees: A novel literature-based 3D methodology

[Federico Nicolosi](#)¹, [Federico Pessina](#)¹, [Clarissa Ann Elisabeth Gelmi](#)², [Francesco Belotti](#)³, [Dominic Edward Mahoney](#)⁴, [Edoardo Agosti](#)⁵, [Simona Seriola](#)⁶, [Giorgio Saraceno](#)⁶, [Anatoli Dimitrov](#)⁷, [Zefferino Rossini](#)¹, [Giannantonio Spena](#)⁸

Affiliations expand

- PMID: 34619649
- DOI: [10.1016/j.clineuro.2021.106948](https://doi.org/10.1016/j.clineuro.2021.106948)

Abstract

Background: An appreciation for complex three-dimensional relationships in neuroanatomy forms a fundamental tenet of neurosurgical education. The value of experience in the cadaver lab is indisputable; however, it is expensive and often inaccessible. The wide availability of 3D technologies has opened new possibilities, although scientific inaccuracy has hitherto limited their use.

Objective: In the present study, we aim to describe a novel, literature-based process of scientific 3D modeling for the creation of neuroanatomical models adapted for mobile technology.

Methods: A systematic literature review regarding current resources in neuroanatomy education was performed according to PRISMA guidelines. The composition of the team and the workflow behind the 3D Head Atlas app are also described.

Results: A total of 101 manuscripts were reviewed, and 24 included. Cadaveric dissections improve the learning process, although high costs limit their availability. Digital advancements have partially overcome the limitations of dissection, and have been associated with improved knowledge retention. Nevertheless, 3D models are often inaccurate, poorly adapted to mobile hardware, and expensive. Recent technological advances provide a new way to widely

disseminate complex 3D models, with a revolutionary impact on learning. The approach behind the 3D Head Atlas app, based on the synergistic work of scientific and development teams, facilitates the creation of interactive 3D scientific material with high accuracy and wide accessibility.

Conclusion: The study of neuroanatomy is intimately related to the evolution of digital technology. Traditional methods (i.e. cadaveric dissections) have undisputed value but high costs. High-fidelity 3D scenarios and mobile devices may revolutionize learning if based on a sound evidence-based approach.

Keywords: 3D models; Learning; Literature-based; Neuroanatomy; Scientific modeling.