



University of Baghdad

College of Medicine

2024-2025



Work Shop

Title: Teaching Practices in Anatomy Education

Speaker: Prof. Dr. Malak Akram Taha

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Objectives



- Define & Evaluate the Teaching tools that were used Anatomical curricula
- State & Evaluate the teaching tools of Gross Anatomy in Department of Anatomy/
College of Medicine/ University of Baghdad



- **Anatomy** is considered one of the **cornerstones of medical curricula** and it is on that clinicians develop their clinical skills.
- ✓ Understanding anatomy is essential to understand how the human body functions, as the structure and function of the human body are related and dependent. It has an integral role in promoting basic as well as clinical information to which students will be exposed all through their learning.
- ✓ A deep understanding of anatomy is fundamental for safe clinical practice, particularly in the discipline of surgery

Teaching Anatomy



is a process that undergoes
constant evolution,

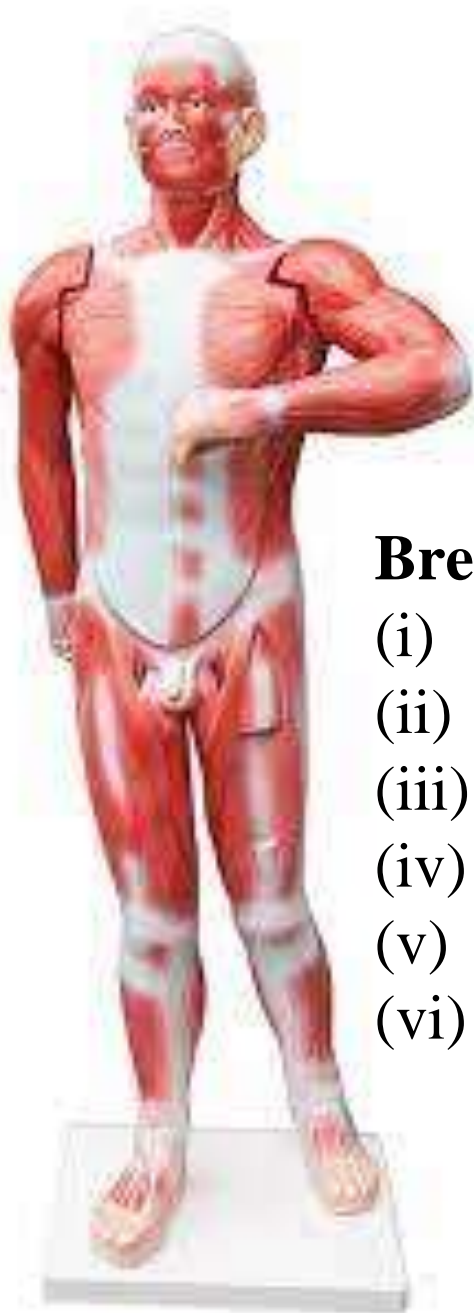
adjusting to various external
factors,

producing revised
approaches that improve the
learning method



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- The teaching of human anatomy, like that of any course, requires **constant revision and analysis** to determine the teaching tools and approaches that best suit the learning process
- Many previous publications have examined anatomy curricula, may be more than any other aspect of the medical curricula e.g. pharmacology, biology, biochemistry or physiology (Pabst, 2009).



Brenner et al. describe six categories of teaching tools:

- (i) dissection by students,
- (ii) inspection of prosected specimens,
- (iii) didactic teaching,
- (iv) use of models,
- (v) computer-based learning (CBL) and
- (vi) teaching of living and radiological anatomy (Brenner et al., 2003).

Cadaver Dissection



Studying with human cadavers has innumerable advantages, including



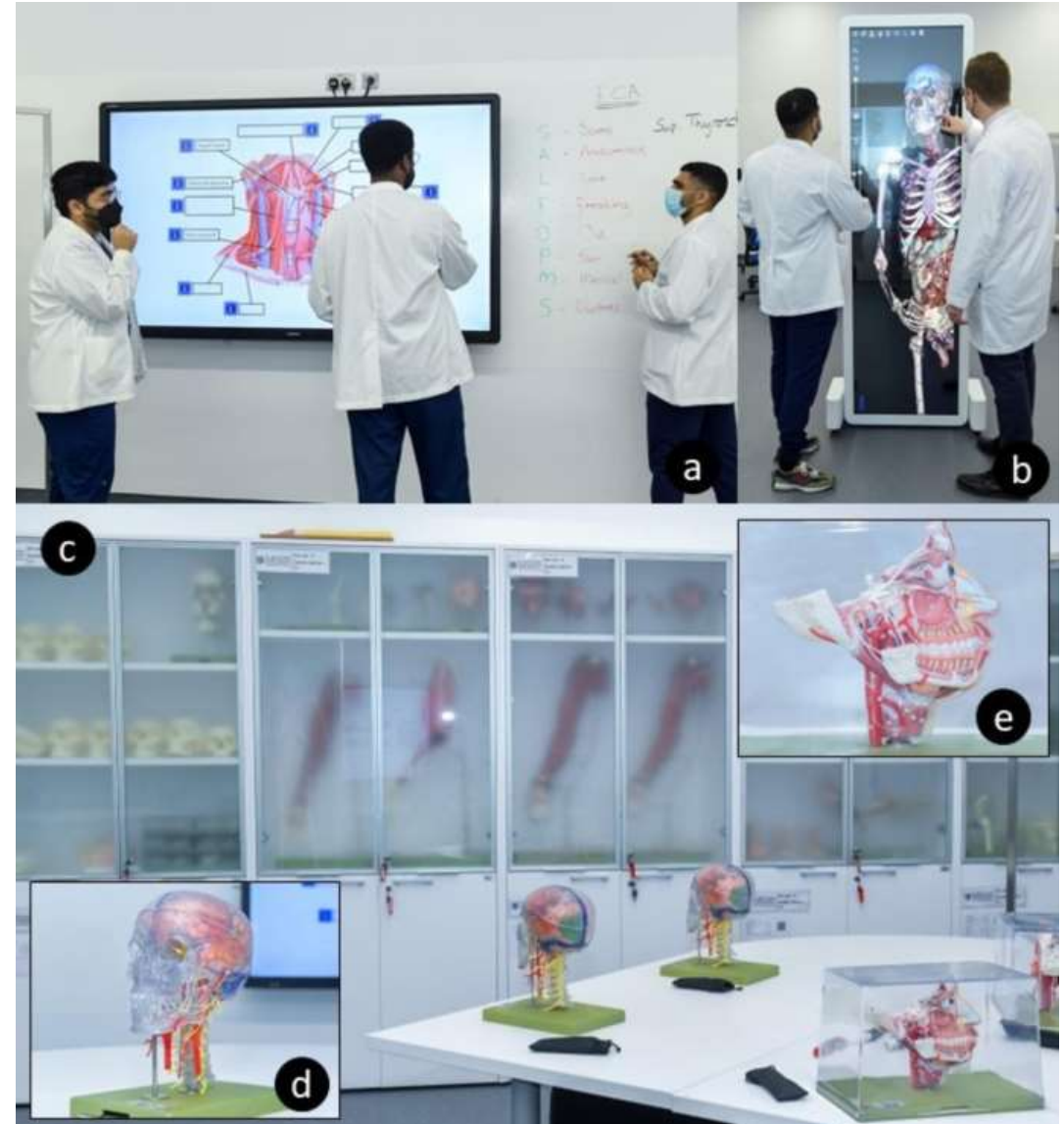
- ✓ enhancement of effective learning
- ✓ preparing students for their clinical training,
- ✓ preparation for death news,
- ✓ mastering manual skills, and
- ✓ having a firm knowledge of the association between symptoms experienced by the patient and the pathology
- ✓ It also develops medical professionalism, such as empathy, strategies for coping with stress, and teamwork competency
- ✓ Compared to plastination, teaching with cadavers and doing dissections provide the much-needed element of surprise when the student identifies an anatomical variant
- ✓ shows finer details, and maintains the texture close to that of a living body, giving the students the feeling of being in an operating theatre
- ✓ Without a doubt, the dissection of the cadaver plays a very important role in anatomy education as well as the training of future doctors

In recent times,

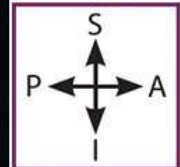
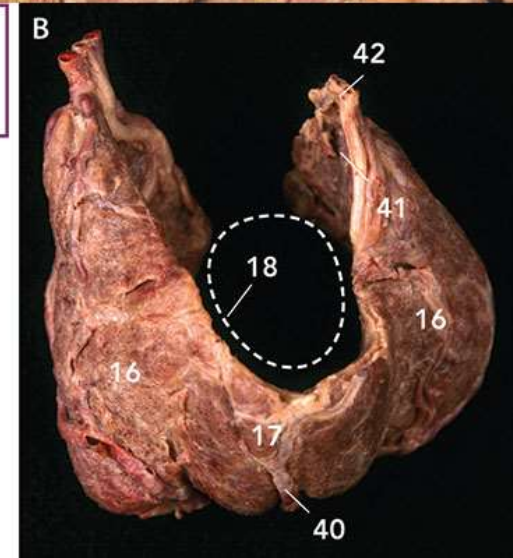
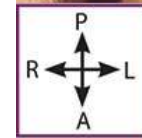
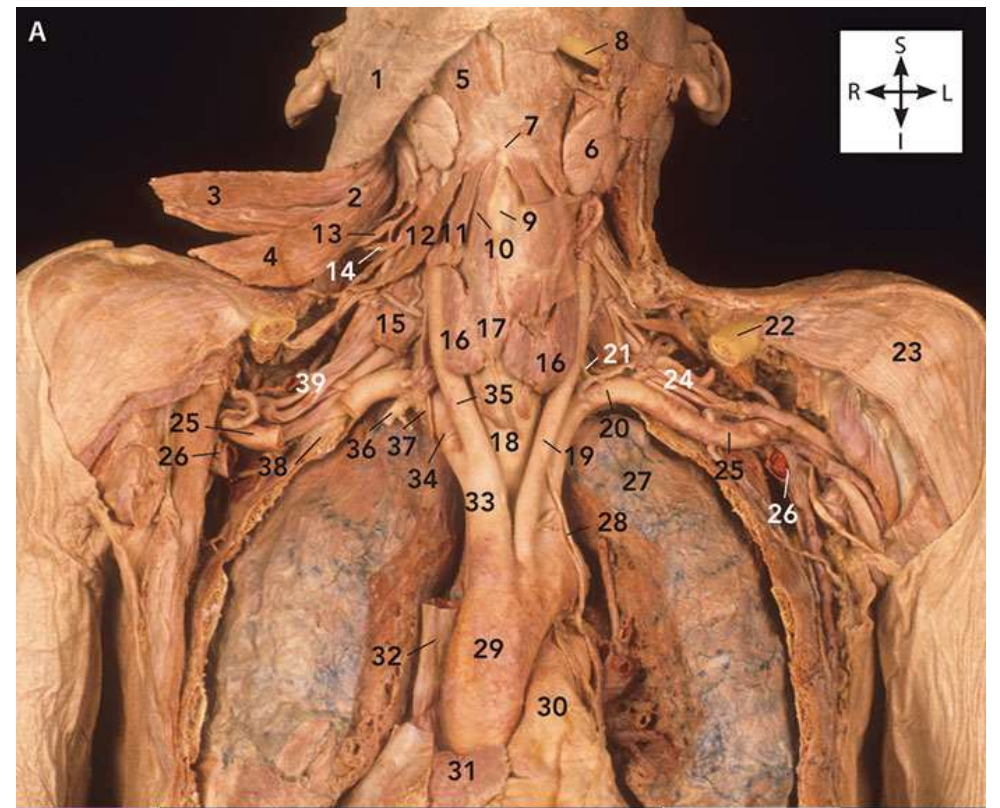


- ❑ **there has been a reduction in traditional, cadaver-based, anatomy teaching,**
- ✓ in some cases driven by **a shift towards an integrated and/or system-based curriculum.**
- ✓ **Religious belief,**
- ✓ **cost and time factors** have also played a role in this reduction. This is supported by reports that the amount of time devoted to anatomy teaching is not adequate

In the same way, **anatomists share the opinion** that **cadaveric teaching** is of course **mandatory for ideal education**, even if used alongside computer-based learning resources such as the **3D technology** and **medical simulations**



Prosections



- A cadaveric prosection is defined as a **previously dissected specimen**, which is occasionally plastinated .
- Prosections have been a key part of anatomical teaching since the Middle Ages as well as the early Renaissance period
- With **reduced teaching time for anatomy** in an integrated curriculum as well as a **shortfall in the number of bodies donated**, many programs have resorted to prosections



The advantages offered by prosection include

- ✓ flexibility,
- ✓ time-efficiency and context,
- ✓ considering that it is easy to observe the structures and their relations, and not many cadavers are needed, as the prosections can be utilized by more than one student cohort. By studying from prosected specimens, medical students are imbued with the ability to identify anatomical variants in many specimens, compared to those who dissect cadavers



Plastic Models in Learning Anatomy

Plastic Models



- ✓ easy-to use teaching methods that may not need supporting facilities or maintenance,
- ✓ having a good outcome and to improve the long-term retention of knowledge.



Plastination



- ❑ **Plastination** is one of the relatively new methods which were first introduced by Professor Gunther von Hagens in 1977 in which water and fat in the freshly dead body or body parts are replaced by certain resins, yielding dry and odor less specimens that give a real-life appearance.
- ❑ The plastinated specimens have gained a broad acceptance across the world.



- ❑ **Plastination** is highly recommended as
 - ✓ it does **not produce any health hazards** and
 - ✓ is **easy to handle**.
 - ✓ it is a cost-effective method that has the advantages of easy preservation, handling, and mimicking fresh specimens.
 - ✓ Has the ability to link between different disciplines as students could link human anatomy with possible gross pathology and their being able to correlate these specimens with radiographical images of different body parts.

Students usually prefer plastinated specimens as they find them easier to handle than wet specimens



❑ **Plastinated specimens have their limitations.**

- ✓ They are **inflexible to some extent**, and structures cannot be easily manipulated.
- ✓ **some anatomical gross structures and features may not appear**, and
- ✓ **dissection after plastination is difficult.**
- ✓ constructing plastinated specimens necessitates skills and is a time-consuming procedure that requires special financial resources



Plastination

is not a replacement for traditional dissection, but it provides an **additional learning tool to facilitate the understanding of complex human anatomy**

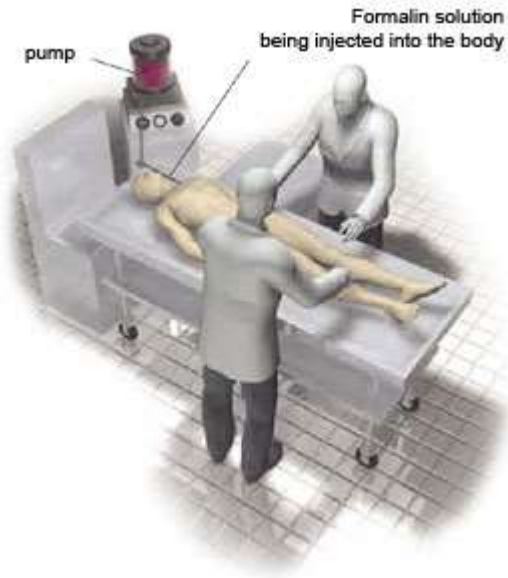
TECHNIQUE STEP BY STEP

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• FIXATION & ANATOMICAL DISSECTION

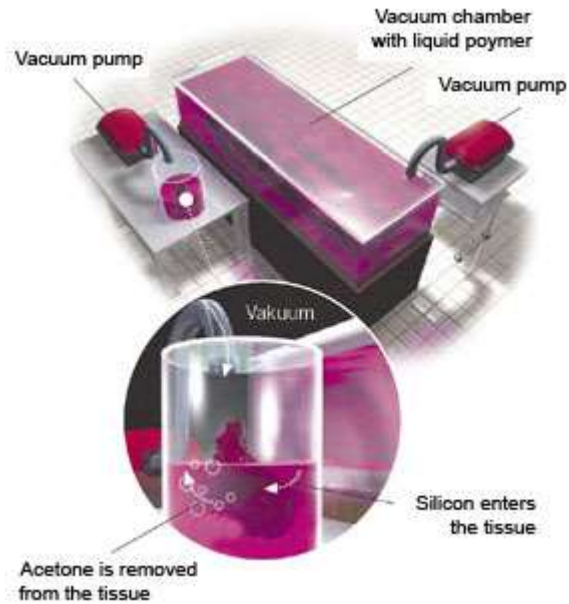
- ✓ Formaldehyde is pumped through the arteries to kill all bacteria and to prevent the decomposition of the tissues. This process **takes about 3-4 hours.**
- ✓ Skin, fatty and connective tissues are removed in order to prepare the individual anatomical structures and elements



• REMOVAL OF BODY FAT AND WATER

- ✓ the acetone draws out all the water and replaces it inside the cells.





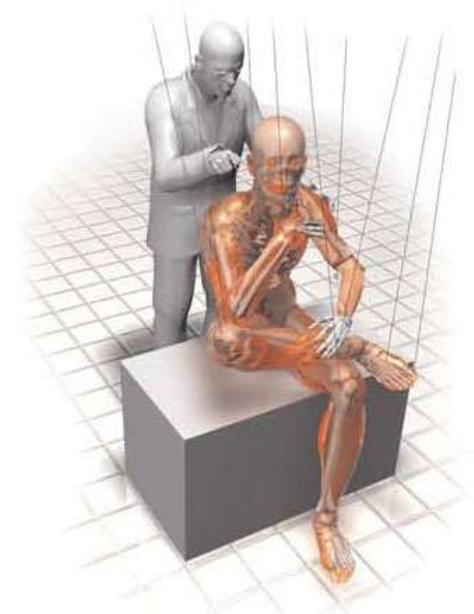
• FORCED IMPREGNATION

- ✓ is the central phase of the Plastination process
- ✓ specimen is placed in a bath of liquid polymer, such as silicone rubber, polyester or epoxy resin.
- ✓ By creating a vacuum, the **acetone boils at a low temperature.**
- ✓ As the acetone vaporizes and leaves the cells, it draws the liquid polymer in so that the **polymer can penetrate every last cell.** This **process lasts 2-5 weeks.**



• POSITIONING

- ✓ Every single anatomical structure is properly aligned and fixed with the help of wires, needles, clamps, and foam blocks.
- ✓ Positioning requires a lot of anatomical knowledge and a defined sense of aesthetics. This step can take **weeks or even months.**





CURING (HARDENING)

depending on the polymer used, this is done **with gas, light, or heat.**

Dissection and Plastination of an entire body requires about **1,500 working hours and normally takes about one year to complete.**

Computer-Based Learning



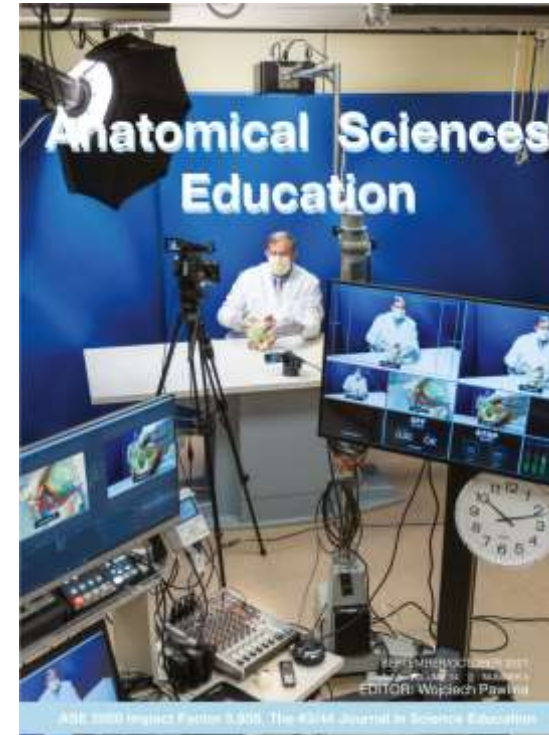


❑ **Resources for computer-based learning are used more in anatomy teaching to help the student understand the subject**

- ✓ With recent technological advances,
- ✓ high costs of cadaver-based teaching,
- ✓ increase in class size, and
- ✓ reduced teaching time,

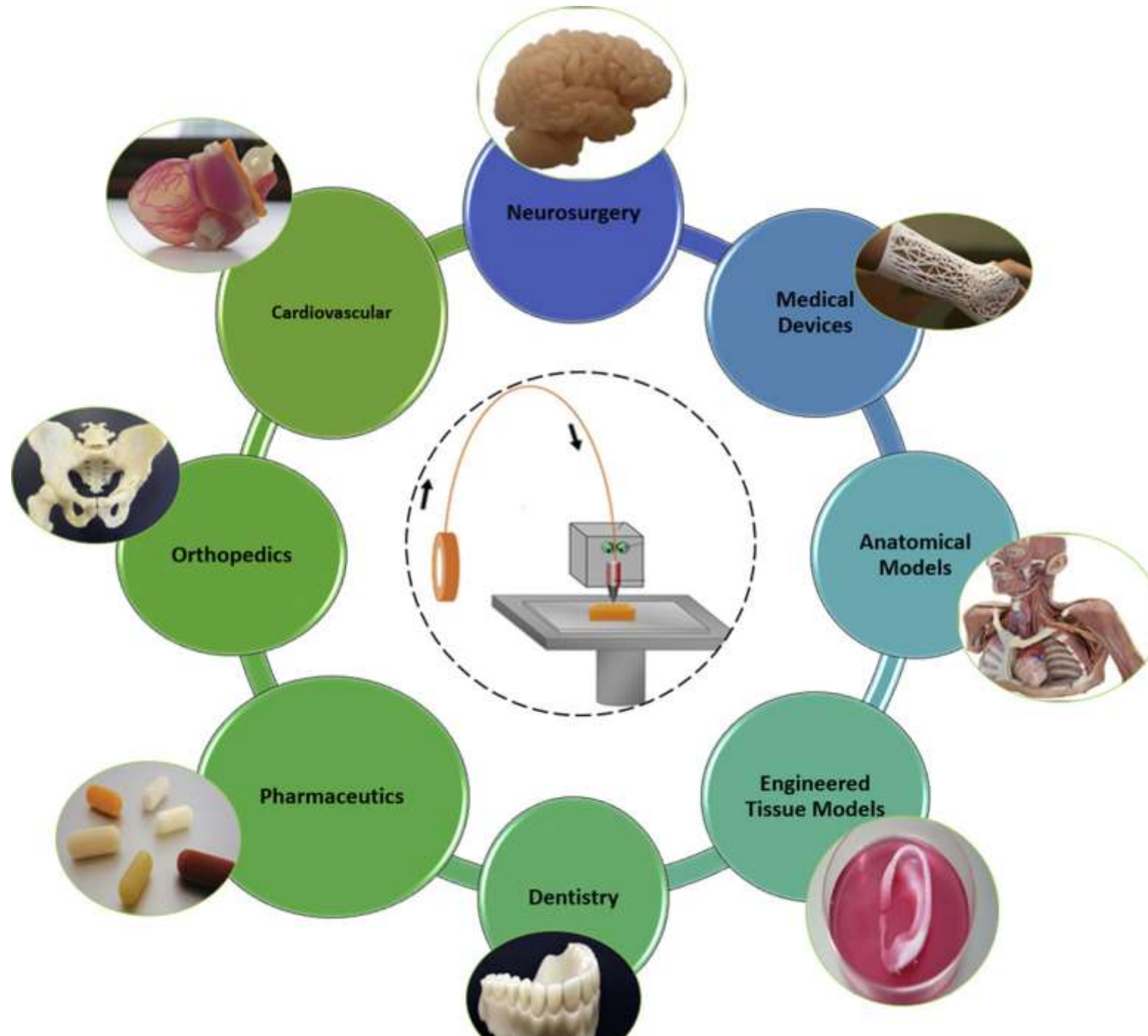
• **The use of computer-based learning**

- ✓ augments the teaching of anatomy,
 - ✓ encourages independent learning,
 - ✓ provides flexibility, and
 - ✓ enhances problem-solving
- studies suggest that computer-based learning of anatomy enhances learning through supplementation, compared to conventional teaching methods





- **Three dimensional learning applications**
 - ✓ are an efficient learning method for studying gross anatomy, since it allows students to identify 3D atlas applications, including 2D applications.
 - ✓ allowing the students to observe, and interact with the specimen, provide haptic feedback to understand the texture and correlation between various structured in three dimensions





✓ Another aspect in 3D technology that is increasingly being considered in almost all fields of science and technology is **3D printing**.

- 3D printing has **recently become increasingly popular in medical use.**
- Examples include
 - ✓ custom-made prosthetics,
 - ✓ models for pre-surgical planning,
 - ✓ tissue and organ engineering, and
 - ✓ models for patient and health professional education

Three-dimensional (3D)-printed models have become increasingly popular as an alternative to the traditional method of cadaveric dissection in teaching anatomy.



- 3D models can be reconstructed from computed tomography (CT) and/or magnetic resonance imaging (MRI) patient or volunteer data.
- 3D-Printed Models as a Learning and Teaching Tool for Abnormal or Uncommon Anatomy
- This may be especially useful for more senior medical students who are now more familiar with the normal anatomy.
- ✓ One example is **fetal anatomy**, which is usually difficult to access for educational purposes. Young et al. described a method to manufacture 3D-printed models of human embryonic and fetal specimens using data collected from CT scans
- ✓ Another example is **the anatomy of bony fractures**. 3D-printed models of bony fractures (spine, pelvis, upper and lower limbs) were shown to provide better understanding than teaching using traditional radiographic images



3D printing was a **useful tool for studying normal, uncommon and pathological anatomy**. However, **limitations** include **low fidelity in replicating the colour and textural physical properties of soft tissues** and the **trade-off between cost and fidelity**.

Estai and Bunt (2016) summarized, that the current best practices to teach anatomy in a medical curriculum is to **combine various teaching resources,**



e.g.,

- ✓ plastic models,
- ✓ plastinated human specimens,
- ✓ computer-assisted learning modalities,
- ✓ dissection,
- ✓ prosected specimens, as well as
- ✓ ultrasound, radiographs, CT and MRI images



The teaching tools of Gross Anatomy in our department are:

- ✓ plastic models,
- ✓ plastinated human cadavers & specimens,
- ✓ computer-assisted learning modalities,
- ✓ radiographs, CT and MRI images



References



- Brenner, E.; Maurer, H.; Moriggl, B.; Pomaroli, A. General educational objectives matched by the educational method of a dissection lab. *Ann. Anat.* 2003, 185, 229–230
- Tam, M.; Hart, A.R.; Williams, S.M.; Holland, R.; Heylings, D.; Leinster, S. Evaluation of a computer program ('disect') to consolidate anatomy knowledge: A randomised-controlled trial. *Med. Teach.* 2010, 32, 138–142.
- McBride, J.M.; Drake, R.L. Use of unembalmed/fresh cadavers in anatomy teaching. In *Teaching Anatomy*; Chan, L.K., Pawlina, W., Eds.; Springer International Publishing: New York, NY, USA, 2015; pp. 223–226.
- Bhandari K, Acharya S, Srivastava AK, Kumari R, Nimmagada HK. Plastination: a new model of teaching anatomy. *Int J Anat Res.* 2016;4(3):2626–2629. <https://doi.org/10.16965/ijar.2016.256.5>. Haque AE, Haque M, Than M, Khassan LHBM, Ishak AMB, Azmi ADBN, Rezal MADB. Perception on the use of plastinated specimen in anatomy learning among preclinical medical students of UNIKL RCMP. *Malaysia J Glob Pharm Technol.* 2017;9(9):25–33.



- ✓ Riederer BM. Plastination and its importance in teaching anatomy. Critical points for long-term preservation of human tissue. J Anat. 2014;224(3):309–315. <https://doi.org/10.1111/joa.12056>
- ✓ Mitrousias V, Karachalios TS, Varitimidis SE, Natsis K, Arvanitis DL, Zibis AH. Anatomy learning from prosected cadaveric specimens versus plastic models: a comparative study of upper limb anatomy. Anat Sci Educ. 2019;13(4):436–44. <https://doi.org/10.1002/ase.1911>.
- ✓ Estai M, Bunt S. Best teaching practices in anatomy education: a critical review. Ann Anat - Anat Anzeiger 2016 Nov 1;208:151–7.
- ✓ L Allen, R Eagleson, Effect of Spatial Ability on Enhancing Neuroanatomy Education with an 148 Interactive 3D E-learning Module. The FASEB Journal, 30(1 Supplement)(2016) 570-6.



- Michalski MH, Ross JS. The shape of things to come: 3D printing in medicine. JAMA. 2014;312(21):2213–4. <https://doi.org/10.1001/jama.2014.9542>.
- Balestrini C, Campo-Celaya T. With the advent of domestic 3 dimensional (3D) printers and their associated reduced cost, is it now time for every medical school to have their own 3D printer? MedTeach. 2016;38(3):312–3. <https://doi.org/10.3109/0142159X.2015.1060305>.
- YoungJC, Quayle MR, Adams JW, Bertram JF, McMenemy PG. Three-dimensional printing of archived human fetal material for teaching purposes. Anat Sci Educ. 2018;12:90–6. <https://doi.org/10.1002/ase.1805>.
- WuAM, Wang K, Wang JS, Chen CH, Yang XD, Ni WF, et al. The addition of 3D printed models to enhance the teaching and learning of bone spatial anatomy and fractures for undergraduate students: a randomized controlled study. Ann Transl Med. 2018;6(20):Y. <https://doi.org/10.21037/atm.2018.09.59>.