University of Central Lancashire
UCLan

Anatomical Society Winter Meeting

6th – 8th January 2025

Anatomical Education & Imaging

Conference Abstract Book

Hosted by the University of Central Lancashire

Welcome

We would like to welcome you to the University of Central Lancashire, where we are proud to host the Anatomical Society Winter Meeting.

The theme of this conference is Anatomical Education & Imaging, two things which are integral to us here at the University. We are not a cadaveric institute, so we focus on a multi-modal approach to teaching anatomy which includes living anatomy, especially from an imaging perspective.

We have tried to make this conference as engaging as possible, with multiple points where, instead of sitting in a lecture theatre, you will be involved in workshops, artwork and poster showcases, alongside networking and engaging with our sponsors.

On hand to assist you at the University we have our Student Ambassadors who will be able to help you with any questions you have about your visit, as well as escorting you around the venue and making sure you're in the right place at the right time.

We very much hope you enjoy your time here and take at least one thing away from your conference attendance. Feel free to ask any questions of us or your fellow delegates, and especially if it is your first time at an Anatomical Society conference: get involved, chat to people, and be curious.

Thank you.

Kris, Liam, & Colin.

Social Media

Please do share your thoughts and photos of the conference, and engage across our Social Media, using the hashtag #AnatSocUCLan.

X (Twitter): @Anat_Soc
BlueSky: @anatsoc.bsky.social
Instagram: @anatomicalsociety
Facebook: @Anatomical Society

Conference Sponsors

Thank you to our sponsors:

PRIMAL PICTURES
POWERING ANATOMY.TV

ELSEVIER

enatom

Wolters Kluwer

Adam,Rouilly
SERVING MEDICAL EDUCATION WORLDWIDE

MDI Medical

AnatomyStuff
Supplying the NHS, universities and schools for over 25 years

bm Ballater Medical

Invited Speakers

Dr Josh Lauder
University of Central Lancashire & East Lancashire Hospital Trust

Prof. Scott Border
University of Glasgow

Dr Vincent Fernandez
ESRF – The European Synchrotron, France

Puck Mulder, MSc.
Amsterdam UMC location University of Amsterdam & Amsterdam Reproduction and Development Research Institute

Dr Oliver Sparasci
University of Manchester & Lancashire and South Cumbria NHS Foundation Trust

Prof. Cindy Chew
University of Glasgow

Dr Caroline Erolin
University of Dundee

Prof. Bogdan J. Matuszewski
University of Central Lancashire

Pre-Conference Workshops

Visualising Anatomy: Exploring the Use of 2D and 3D Imaging Modalities Across Different Anatomy Teaching Settings & Imaging Analysis Software for Research Purposes

- Organised by Maryam Rajid (University of Central Lancashire) and Elena Patera (University of Liverpool)

Evaluating Teaching and Learning in Anatomy Education

- Organised by Dr Lauren Clunie (Hull York Medical School), Dr Sarah Channon (Royal Veterinary College), and Dr Michelle Welsh (University of Glasgow)

In-Conference Workshops

CT Imaging & Education

- Dr Josh Lauder (University of Central Lancashire & East Lancashire Hospital Trust)

Trauma Resuscitation: Tips on Using Anatomy When Interpreting Plain Radiographs

- Prof. Peter Driscoll (University of Central Lancashire)

EDI Workshop – Showcasing Anatomical Society Education Resources to Support Diverse and Inclusive Anatomy Teaching

- Organised by Dr Michelle Welsh (University of Glasgow), Dr Lily Evans (University of Plymouth), & Dr Hope Gangata (University of Exeter)

Aging Cell Best Paper Prize 2023

Antiretroviral Protease Inhibitors Induce Features of Cellular Senescence That Are Reversible Upon Drug Removal – Dr Chisaka Kuehnemann (Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University, Boston, USA)

Journal of Anatomy Best Paper Prize 2023

Synchondrosis Fusion Contributes to the Progression of Postnatal Craniofacial Dysmorphology in Syndromic Craniosynostosis – Dr Miranda Steacy (University College London)

Oral Presentation

All Oral Prestation slides should be sent to the conference organisers by Friday 3rd January 2025. They will be a mixture of Oral Talks, Flash Talks, and Pecha Kucha style presentations.

Poster Presentation

Posters will be displayed for viewing throughout the conference. A dedicated Poster Session will be held during the Drinks Reception (sponsored by Primal Pictures) on the Monday evening.

Anatomical Society Young Investigator Oral Presentation Prize

Awarded for the best oral presentation by an attendee, normally of relatively junior status at the AS winter meeting. The work presented shall have been carried out while the first author was an undergraduate or postgraduate student and presented within 1 year of the award of the Doctorate.

Early Career and Student Social

There is an early career and student social following on the first evening of the conference, hosted by the early career team at Anatomical Society at The Adelphi in Preston at 7:30pm. Casual drinks and a few fun social activities to help you get to know others in a similar position in their careers. Everyone is welcome.

Gala Dinner

Tuesday 7th January 2025, 7pm at Bistrot Pierre in Preston. Bistrot Pierre is a short walk from the conference venue and most recommended hotel accommodation. It is located less than 5 minutes' walk from Preston Train Station.

Venue Details

The conference will mostly be held in the Foster Building on our Preston Campus. It is a short 5-minute walk from the Legacy Hotel and Premier Inn.

It is labelled 'FB' on the Preston Campus map on the next page and can be accessed from Kendal Street, just off Corporation Street.

The street entrance is diagonally opposite the Student Centre and University Square, and between the Engineering Innovation Centre (tall glass building) and Harris Building (red brick building).

Google Maps for walking may not be reliable, as it may take you a longer route.

All oral presentations and the AGM will take place in the Foster Building Lecture Theatre 1 – The Mitchell & Kenyon Cinema.

All posters, artwork, sponsors, breaks, and wine reception will be based in the Foster Social Space.

All in-conference workshops on Monday afternoon will take place in the Harrington Building (Medical School). Our Student Ambassadors will escort you to and from there.

If you are attending a pre-conference workshop, you will be escorted there and back by a Student Ambassador or another member of staff.

The Gala Dinner will be held in Bistrot Pierre on Fishergate in the city centre. It is directly behind the Premier Inn and a short walk from the Train Station.

Parking

If you are planning to drive, you are welcome to use any Pay & Display car parks nearby or park for free in the University's Fylde Road Car Park (the orange star – number 8 on the Preston Campus Map). Signs may say permit only, but this Car Park has had ticketing suspended for the conference days.

All other University Car Parks are permit only.

University of Central Lancashire
UCLan

Preston Campus

Key

- Bus routes
- Bus stops
- Cafes
- Cash machine
- Cycle parking
- Dental Clinic
- Entrance to buildings
- Eye Clinic
- Gender neutral toilets
- Mailroom
- Main reception
- Medical Centre
- Motorcycle shelters (covered)
- Parenting room
- Pharmacy
- Physiotherapy Clinic
- Prayer Room
- Public car parks
- Security Control Centre
- Social Space
- Student Support
- Under construction

+44 (0) 1772 201 201 | uclan.ac.uk

Can't find what you're looking for?

You can also use the MazeMap app to navigate our campus. Scan the QR code above or download the app and search for UCLan.

Google Play

App Store

Buildings and outdoor spaces

AB	Adelphi Building
AL	Allen Building
BB	Brook Building
CB	Chandler Building
CM	Computing & Technology Building
DB	Darwin Building
ER	Eden Building
EB	Edward Building
EIC	Engineering Innovation Centre
FB	Foster Building
FS	Foster Square
GR	Greenbank Building
HR	Hanover Building
HA	Harrington Building
HB	Harris Building
HH	Heatley House
IW	The Ironworks
JBF	JB Firth Building
KM	Kirkham Building
LE	Leighton Building
LIB	Library and Learning & Information Services (LIS)
LH	Livesey House
MB	Maudland Building
ME	Media Factory
OFS	Oasis Faith and Spirituality Centre
PSC	Pre-School Centre
STF	Sir Tom Finney Sports Centre
AC	St Peter's Arts Centre
SPC	St Peter's Court
SPG	St Peter's Gardens
STU	Student Centre
SU	Students' Union
US	University Square
VE	Vernon Building
VTB	Vet School Building
VB	Victoria Building
WB	Wharf Building
33ES	33 Edward Street
53	53 Degrees

University accommodation

DW	Derwent Hall
DR	Douglas Hall
PN	Pendle Hall
RI	Ribble Hall
RR	Roeburn Hall
WR	Whitendale Hall

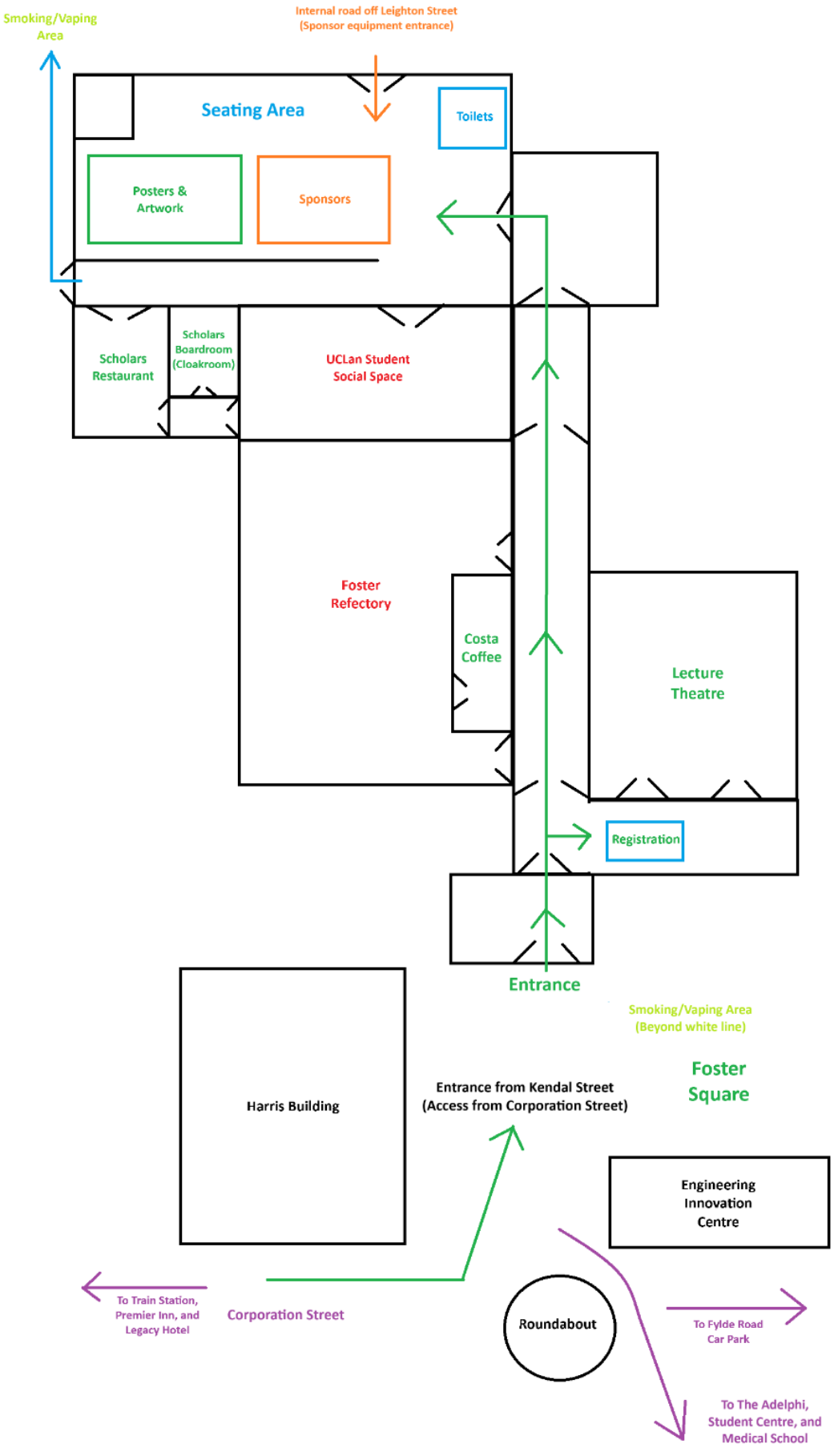
University car parks

1	Adelphi / 53 Degrees
2	Askew
3	Beattie
4	Brook
5	Computing & Technology
6	Darwin
7	Douglas
8	Fylde Road
9	Hanover
10	Harrington (Pay and display)
11	Harris
12	Heatley
13	Hope Street
14	Leighton
15	Livesey
16	Pendle
17	Pollard Street
18	Ribble
19	Roeburn I (Pedder Street)
20	Roeburn II (Pedder Street)
21	Vernon (Berkeley Street)
22	Vernon (Moorbrook Street)
23	Victoria I (reserved spaces for visitors)
24	Victoria II (Pay and display)
25	Whitendale

(Please note: University car parks require permits)

13795 05/24

Foster Building Map



Conference Programme

Day 1 – Monday 6th January 2025

Those arriving early for the pre-conference workshops can register before going to their workshop, please arrive slightly before the start time.

Timing	Content Information	Talk Type
10:00-12:00	**Pre-Conference Workshops (Pick one)**	
	Visualising Anatomy: Exploring the Use of 2D and 3D Imaging Modalities Across Different Anatomy Teaching Settings & Imaging Analysis Software for Research Purposes • *Organised by Maryam Rajid and Elena Patera*	Workshop
	Evaluating Teaching and Learning in Anatomy Education • *Organised by Dr Lauren Clunie, Dr Sarah Channon, and Dr Michelle Welsh*	Workshop
11:00	**Registration Opens**	
12:00-12:45	**Lunch**	
12:45-15:00	**Session 1: Anatomical Education** • Chaired by Kris Phillips	
12:45-13:00	**Welcome & Introduction** • *Kris Phillips & Liam Young* • *Prof. Alison Carr* – Dean of the School of Medicine & Dentistry	Welcome
13:00-13:30	**The Best Way to C(T) Anatomy** • *Dr Josh Lauder* – University of Central Lancashire & East Lancashire Hospital Trust, England	Invited Speaker 1
13:30-13:45	**An Innovative Multi-Tool Teaching Approach to Improving Anatomical Spatial Awareness/Orientation** • *Anthony Bright & Sadia Khan* – University of Nottingham, England	Oral Talk 1
13:45-14:00	**Learning Human Anatomy in Forensic Science: Can a Diverse Range of Pedagogic Resources Provide Better Access for Students on the Fringes of Anatomy?** • *Georgina Goodison* ***(YI)*** – University of Keele, England	Oral Talk 2
14:00-14:07	**Physician Associate Students' Perceptions of a Collaborative Approach to Human Radiographic Anatomy Teaching Sessions** • *Tanya Chamberlain & Michelle Ellwood* – University of Leeds, England	Flash Talk 1

Timing	Content Information	Talk Type
14:08-14:15	**Diagnosing the First Patient: Integrating Histopathology into an Undergraduate Gross Anatomy Course** • *Megan Kruskie* ***(YI)*** – Indiana University School of Medicine, USA	Flash Talk 2
14:15-14:45	**Don't Waste Their Action Potential: How to Unlock Your Student's Anatomy Learning Superpowers** • *Prof. Scott Border* – University of Glasgow, Scotland	Invited Speaker 2
14:45-14:55	**Elsevier Sponsor Talk** **The Value of Digital Resources in Teaching Anatomy** • *Mattias Bandilla – Elsevier*	Sponsor Talk 1
14:55-15:00	**Workshop Introductions**	Information
15:00-15:30	**Afternoon Break**	
15:30-18:00	**Conference Workshops**	
15:45-16:45 Or 16:45-17:45	**CT Imaging & Education** • *Dr Josh Lauder* – University of Central Lancashire & East Lancashire Hospital Trust, England	Workshop
15:45-16:45 Or 16:45-17:45	**Trauma Resuscitation: Tips on Using Anatomy When Interpreting Plain Radiographs** • *Prof. Peter Driscoll* – University of Central Lancashire, England	Workshop
18:00- Onwards	**Drinks Reception – Sponsored by Primal Pictures** • Poster Session	
19:30-Late	**Early Career Social – The Adelphi** • Pub Quiz & Socialising • *Organised by Danya Stone, Caitlynn Hudlow, and Rachel Jones*	

Day 2 – Tuesday 7th January 2025

Timing	Content Information	Talk Type
08:00-09:00	**Morning Refreshments & Breakfast**	
09:00-10:25	**Session 2: Micro-CT 1** • Chaired by Liam Young	
09:00-09:10	**Day 2 Introduction & Education Committee Information** • Liam Young & Hannah Shaw	
09:10-09:40	**Synchrotron X-ray CT in Natural and Cultural Heritage** • *Dr Vincent Fernandez* – ESRF – The European Synchrotron, France	Invited Speaker 3
09:40-09:55	**3D Imaging of Clitoral Anatomy Across Primate Species (Pan troglodytes, Lemur catta, Saimiri sciureus, Aotus lemurinus, Eulemur flavifrons and Homo sapiens): Insights from microCT and MRI Scans** • *Betzy Manners* ***(YI)*** – University of Liverpool, England	Oral Talk 3
09:55-10:10	**Current Challenges in the Education of Animal Anatomy Using MicroCT-Derived Digital Models** • *Alice Leavey* – University College London, England	Oral Talk 4
10:10-10:25	**Shape and Internal Structure of the Baculum in the Recently Rediscovered Northern Pygmy Loris (Xanthonycticebus intermedius)** • *Federica Spani* – University Roma Tre, Italy	Oral Talk 5
10:25-11:00	**Morning Break** • Anatomical Society Mentorship Mixer	
11:00-12:10	**Session 3: Micro-CT 2** • Chaired by TBC	
11:00-11:15	**The Use of Microcomputed Tomography for Human Trabecular Bone Microstructure Analysis within the Centre for Anatomy and Human Identification: A Twenty-Year Review** • *Rebecca Reid* – University of Dundee, Scotland	Oral Talk 6
11:15-11:30	**Highly Vascular Bone Induced by Cantering Exercise in Thoroughbred Racehorse Metacarpals** • *Alan Boyde* – Queen Mary University, England	Oral Talk 7
11:30-12:00	**The Dutch Fetal Biobank: Advancing Research Opportunities in Human Development** • *Puck Mulder* – Amsterdam UMC location University of Amsterdam & Amsterdam Reproduction and Development Research Institute	Invited Speaker 4
12:00-12:10	**Primal Pictures Sponsor Talk** **Primal Pictures: Accelerating Anatomy Learning** • *Alexis van Breda – Primal Pictures*	Sponsor Talk 2

Timing	Content Information	Talk Type
12:10-14:00	**Lunch** • Anatomical Society AGM (12:30-14:00)	
14:00-15:40	**Session 4: Microstructural Imaging** • Chaired by Lyndsay Murray	
14:00-14:30	**Exploring Brain Microstructure – Diffusion Weighted MRI of the Grey Matter and its Relationship to Cognitive Performance** • *Dr Oliver Sparasci* – University of Manchester & Lancashire and South Cumbria NHS Foundation Trust	Invited Speaker 5
14:30-14:40	**Immunofluorescence and Lineage Tracing in the Mouse Reveals Secrets of a Novel Structure in Therian Mammals** • *Luke A. Barlow* ***(YI)*** – King's College London, England	Pecha Kucha 1
14:40-14:50	**Towards Understanding the Canine Myotendinous and Osteotendinous Interfaces: A Biomaterial Perspective** • *Shaz A. Raja* ***(YI)*** – Trinity College Dublin, Ireland	Pecha Kucha 2
14:50-15:00	**A Histomorphometric and Histopathological Analysis of the Human Acetabular Labrum Enthesis** • *Yasmin Day* – University of Edinburgh, Scotland	Pecha Kucha 3
15:00-15:10	**Microscopic Changes in the Multifidus Muscle in People with Low Back Pain Associated with Lumbar Disc Herniation** • *Shilpa Purushotham* ***(YI)*** – University of Birmingham, England	Pecha Kucha 4
15:10-15:30	**Aging Cell Best Paper Prize 2023** **Antiretroviral Protease Inhibitors Induce Features of Cellular Senescence That Are Reversible Upon Drug Removal** • *Dr Chisaka Kuehnemann* – Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University, Boston, USA	Prize Talk 1
15:30-15:40	**Wolters Kluwer Sponsor Talk** **Experience the BioDigital Human in Virtual Reality for the Best Experience in Anatomy Education** • *Stewart Fields – Wolters Kluwer*	Sponsor Talk 3
15:40-16:45	**Afternoon Break** • Artwork Showcase & Sponsors • EDI Workshop (15:50-16:35)	
15:50-16:35	**EDI Workshop – Showcasing Anatomical Society Education Resources to Support Diverse and Inclusive Anatomy Teaching**	Workshop

	• *Organised by Dr Michelle Welsh, Dr Lily Evans, & Dr Hope Gangata*	
Timing	Content Information	Talk Type
16:45-18:00	**Session 5: Educational Imaging** • Chaired by TBC	
16:45-17:15	**The Role of Radiology in Teaching Anatomy** • *Prof. Cindy Chew* – University of Glasgow, Scotland	Invited Speaker 6
17:15-17:30	**An Inter-Institutional Assessment of Ultrasonographic Human Cadaveric Anatomy Structure Visibility Across Different Embalming Techniques** • *Ashley Durfee* ***(YI)*** – Trinity College Dublin, Ireland	Oral Talk 8
17:30-17:45	**Sound Advice: Developing a Multimedia Teaching Resource Providing Hands-On Ultrasound-Based Anatomy Education for Medical Students at Queen's University Belfast** • *Alexandra Carton* ***(YI)*** – Queen's University Belfast, Northern Ireland	Oral Talk 9
17:45-18:00	**The Creation of Low-Cost Breast and Aortic Ultrasound Phantoms for Anatomical Education – A Methodology Study** • *Emma Bailey* – University of Glasgow, Scotland	Oral Talk 10
18:00-19:00	**Go Get Fancy**	
19:00-22:00	**Gala Dinner – Bistrot Pierre**	

Day 3 – Wednesday 8th January 2025

Timing	Content Information	Talk Type
09:00-09:50	**Morning Refreshments & Breakfast**	
09:50-11:30	**Session 6: 3D Modelling** • Chaired by TBC	
09:50-10:00	**Day 3 Introduction** • TBC	
10:00-10:30	**3D Digital Models in Anatomy and Medical Education** • *Dr Caroline Erolin* – University of Dundee, Scotland	Invited Speaker 7
10:30-10:45	**An Exploration of Structured Light Scanning in the Anatomical Sciences: Accuracy, Repeatability, and Lessons Learning Along the Way** • *Stephen J Maclean* – University of Edinburgh, Scotland	Oral Talk 11
10:45-10:52	**Combining 3D Scanning and 3D Printing for Arts-Based Learning of Skeletal Anatomy** • *Jennifer Z Paxton* – University of Edinburgh, Scotland	Flash Talk 3
10:53-11:00	**A Novel and Accessible Method for 3D Scanning, Restoring and Digitally Preserving Human Cadaveric Specimens: Digital Plastination** • *Yusuf Furkan Ozaltay* ***(YI)*** – Marmara University & Bezmialem Vakif University, Turkey	Flash Talk 4
11:00-11:10	**Enatom Sponsor Talk** **Enatom: How Dutch UMCs Designed the Smart Dissection Room** • *Yourik van Overloop – Enatom*	Sponsor Talk 4
11:10-11:30	**Journal of Anatomy Best Paper Prize 2023** **Synchondrosis Fusion Contributes to the Progression of Postnatal Craniofacial Dysmorphology in Syndromic Craniosynostosis** • *Dr Miranda Steacy* – University College London, England	Prize Talk 2
11:30-12:00	**Morning Break**	

Timing	Content Information	Talk Type
12:00-13:00	**Session 7: Looking Forward** • Chaired by TBC	
12:00-12:07	**Assessing the Impact of Community Engagement in Anatomy: Insights from a World Anatomy Day Event in Birmingham** • *Paula García López* ***(YI)*** – University of Birmingham, England	Flash Talk 5
12:08-12:15	**The Art of the Brain: Creating an Online Exhibition of Public Anatomical Artwork** • *Jennifer Z Paxton* – University of Edinburgh, Scotland	Flash Talk 6
12:15-12:45	**Recent Advances in Medical Imaging: AI Demystified** • *Prof. Bogdan J. Matuszewski* – University of Central Lancashire	Invited Speaker 8
12:45-13:00	**Prizes & Closing Remarks**	
13:00	**Conference Ends** • Take-away Lunch provided	

Conference Workshops

Pre-Conference Workshops

Visualising Anatomy: Exploring the Use of 2D and 3D Imaging Modalities Across Different Anatomy Teaching Settings & Imaging Analysis Software for Research Purposes

Organised by:

Maryam Rajid
University of Central Lancashire

Elena Patera
University of Liverpool

This engaging workshop invites you to explore the transformative potential of both traditional 2D imaging methods (MRI, CT, ultrasound) and advanced 3D technologies like Augmented Reality (AR) and Mixed Reality (MR). Through interactive, hands-on activities, you'll consider practical ways to integrate these technologies into your teaching focusing on relevancy within different anatomy body regions. Subsequently, you will have the opportunity to receive a short demonstration on a powerful imaging analysis software (3DSlicer), designed to enhance research and streamline data analysis. Actionable tips to leverage these tools for creating richer, more engaging learning experiences for your students will be provided. This workshop is designed to be accessible and beneficial for participants at all levels, whether you're an educator, a researcher or a student enthusiast!

Click here to sign up

Pre-Conference Workshops

Evaluating Teaching and Learning in Anatomy Education

Organised by:

Dr Lauren Clunie
Hull York Medical School

Dr Sarah Channon
The Royal Veterinary College

Dr Michelle Welsh
University of Glasgow

This interactive workshop is designed for anatomy educators seeking to reflect upon and enhance their evaluation practices. The session will explore a range of methods for assessing both teaching effectiveness and student learning in the context of anatomy education. Through group discussions and hands-on activities, participants will be encouraged to reflect upon their evaluation goals and will have the opportunity to share challenges and successes from their own practice. This workshop will foster an environment where participants can examine their current practices and further explore evidence-based and holistic approaches to evaluation.

Click here to sign up

In-Conference Workshops

CT Imaging & Education

Time: Monday 6th January 15:30-18:00

Organised by:

Dr Josh Lauder
University of Central Lancashire &
East Lancashire Hospital Trust

Abstract TBC.

You don't need to sign-up; you'll be allocated a group on the day.

In-Conference Workshops

Trauma Resuscitation: Tips on Using Anatomy When Interpreting Plain Radiographs

Time: Monday 6th January 15:30-18:00

Organised by:

Prof. Peter Driscoll
University of Central Lancashire

Three reasons why you may think participating in this workshop could be useful.

Firstly, anatomical knowledge is used when interpreting plain chest and lateral cervical spine radiographs taken during a trauma resuscitation. This workshop explores this by reviewing a series of clinical cases. A systematic approach will be considered first, followed by its application in identify life threatening conditions.

Secondly, you will have the opportunity to practice the interpretation system by working in teams so that knowledge and experience can be shared. Our aim it this will help identify useful learning points for your own teaching and/ or clinical practice.

Finally, during the session the relevance and difficulties with integrating radiological anatomy into the undergraduate medical programme will be discussed. Again, this will be by sharing experiences and ideas from the community of anatomy educators.

You don't need to sign-up; you'll be allocated a group on the day.

In-Conference Workshops

EDI Workshop

Showcasing Anatomical Society Education Resources to Support Diverse and Inclusive Anatomy Teaching

Time: Tuesday 7th January 15:50-16:35

Organised by the Anatomical Society EDI Committee and:

Dr Michelle Welsh
University of Glasgow

Dr Lily Evans
University of Plymouth

Dr Hope Gangata
University of Exeter

In this workshop, members of the Anatomical Society Equality, Diversity and Inclusion (EDI) committee and Education committee will showcase examples of teaching resources they have been developing to promote diversifying our anatomy teaching, helping to make our subject more inclusive and demonstrating to learners the healthy and clinical anatomy of a diverse range of people from different cultures and communities. In doing so we hope to promote better patient experiences in future practice, increase visibility of diverse body images and promote a sense of belonging for all our learners. During this workshop we aim to gather feedback from conference attendees to shape the further development of these resources whilst offering an opportunity for members to become part of this project, developing resources in their own area of interest.

Click here to sign-up or sign-up on the day.

Poster Presentations

1. Applying Gamification Methods in Anatomage Series of Consolidation Sessions: Enhancing Engagement and Retention
2. Mandibular metric-based sex estimation in Asian populations (*Homo sapiens*): A novel OPLS-LDA framework
3. Stepwise visualisation of subcortical topographical anatomy via the Klinger technique and smartphone photogrammetry: a proof-of-concept study.
4. Multiple Anatomical Variations in extensor Tendons of the Posterior Forearm
5. Bringing the Past to Life: Pathology Lab Catalogue.
6. Can Gamification and Interactive Summaries Enhance Engagement and Knowledge Retention in Anatomy Education?
7. Anatomy, Anatomage, Ultrasound – Integrated Pre-clinical training
8. Forensic Analysis of the Human Clavicle: Evaluating the Accuracy of Structured Light Scanning
9. Extended reality tools: A replacement or an adjunct for anatomy education.
10. Thinking Materially: physical models as conceptual tools in assessing cellular forces
11. Analysis of hepatic venous circulation veins with three-dimensional (3D) reconstruction
12. Classification of fissure for round ligament and pons hepatis in human cadavers
13. Getting Started with Anatomage®: Early experiences with the Virtual Reality Anatomy Table as an adjunct to predominantly cadaveric prosection-based teaching.
14. The first 3D digital atlas of *Chamaeleo calyptratus,* a modern model organism for the education of reptile cranial anatomy and function
15. Investigating the effectiveness of different concentrations of Lugol's solution on visualising the facial musculature of the rhesus macaque (*Macaca mulatta*) using topical and perfusion staining.
16. Evaluating the Accuracy of Structured Light Scanning for Sex Estimation in Skeletonised Human Remains
17. Neural Connection Between Human Vagus Nerve and Sympathetic Trunk
18. Testing the Longevity of Painted 3D Printed Models in an Anatomy Teaching Laboratory: An Arts-Based Study
19. 'AnatoLingo': Can an Anatomy Linguistic Card Game Help Students Become Familiar with the Secret Language of Anatomy?
20. Biological Sex and Asymmetry: Normative Size Variations of the Basal Ganglia and Thalamus
21. 'Circus of Activities': Bridging the Gap through an Induction Session
22. Evaluating the Relationship Between Type 2 Diabetes, Popliteal Artery Circumference and Osteoarthritis in the Human Knee.
23. How does hip joint size and morphology influence the risk of avascular necrosis in the paediatric hip?
24. Transcriptomics meets histology: wound healing in Salmo salar skin through the lens of single-cell RNAseq and spatial transcriptomics
25. Exploring the Evolution of Dental Students' Professional and Technical Concepts: Progression and Change from BDS1 to BDS3 in the Dissection Room
26. Transforming Histology Education using a freely available virtual microscope software
27. Geometric Morphometric Analysis of Craniofacial Shape Variation in Mouse Models of Osteogenesis Imperfecta (OI) Type III
28. Student Perception of Virtual Cadavers at a New Medical School
29. Atrophy of the teres minor muscle in a human cadaver: Anatomical findings and clinical correlations
30. Engaging Minds: Enhancing Anatomy Education With Bingo Gamification
31. Digital Imaging In Histology: Balancing Innovation And Tradition In Modern Education
32. Construction of an immunological brain atlas using multiplexed immunofluorescence and transcriptomic data integration: Advancing brain imaging techniques.

Session 1: Anatomical Education

INVITED SPEAKER

The Best Way to C(T) Anatomy

Dr Josh Lauder
University of Central Lancashire and East Lancashire Hospital Trust, Lancashire, UK

Currently, the teaching of human anatomy in both medical and other health sciences schools is going through a critical transition as it seeks to assimilate innovations such 3D anatomical models as well as virtual and augmented reality.

In parallel with these developments, medical imaging has progressed significantly and 3D cross-sectional imaging techniques such as Computed Tomography (CT) and Magnetic resonance imaging (MRI) have become the main diagnostic investigation for numerous clinical conditions. Marrying together medical imaging and anatomy therefore has several advantages:

- Medical imaging is the purest form of deep tissue living anatomy, observing the body in its living state without any dissection or distortion.
- The high detail of modern CT and MRI allow interrogation of structures down to the millimetre scale.
- 3D reformatting is possible as are combinations with PET to get functional imaging.
- CT and MRI are used extensively in real practise by medical professionals. As a result, there is direct application to both the clinical phase of the programme and postgraduate training.
- All hospitals have access to thousands of normal and abnormal scans for learning. There are also excellent online resources available.
- It is significantly cheaper to set up and maintain than a cadaveric laboratory.

We will discuss the opportunities and challenges of vertically integrating CT into the anatomy curriculum from our experiences at The University of Central Lancashire (UCLan).

Session 1: Anatomical Education

An innovative multi-tool teaching approach to improving anatomical spatial awareness/orientation.

Mr Anthony Bright[1], Dr Sadia Khan, Dr Deborah Merrick, Miss Natasha Noel-Barker, Dr Rudolf Billeter-Clark, Mx Alex Impedovo,
University of Nottingham, Nottingham, United Kingdom

Spatial awareness is a fundamental objective of anatomical education for teaching anatomy. Whether it be through dissection, prosected specimens, or models; there is a psychological advantage to understanding anatomy in a 3D environment. At the University of Nottingham, we have developed an innovative teaching approach to improve the student experience of learning anatomy. This combines traditional teaching methodology (cadaveric dissection/prosections) with novel bespoke practical modelling tools, alongside incorporation of technology-based resources. *Physical Modelling*: In teaching musculoskeletal anatomy, we use muscle modelling as an activity designed to be both educational and active. To aid learner's awareness of muscular attachments and function, we use modelling wax to build 'life-sized' muscles on skeletons. Using prosections and in-house 3D models, the muscle's geometry, force lines, orientation and locations are mapped. Physically manipulating the joints, and the muscle attachments solidifies the students' knowledge in their memory for much longer. The approach works particularly well for anatomical structures that are difficult to model anatomical structures which are difficult to visualise in 3D space, for example the pelvic organs. Pelvic anatomy is one of the more difficult areas to understand conceptually from dissection and even prosection. It has limits within commonly used resources, especially on the diversity seen in the real world. Carefully designed pelvic modelling sessions see students using modelling wax on pelves to form the key structures seen in cis, trans and intersex individuals. This gives students a better grasp on the position of pelvis organs and vessels, and facilitates a wider EDI discussion, essential for healthcare-related students. *Technology-based:* 3D reconstruction alongside modelling is a large part of our anatomy teaching, whether it be using muscle models and their force lines digitally on MeshLab, or 3D printing flexible resin shoulder cartilage. This approach serves to fill gaps from existing models in the lab and is a constantly expanding resource for students. We use Artec scanners to 3D scan structures, creating further resources that we can display on 3D screens or VR headsets. Here we present a showcase of the ways we are trying to improve the spatial awareness students have for anatomy within their education.

Session 1: Anatomical Education

YOUNG INVESTIGATOR

Learning human anatomy in Forensic Science: Can a diverse range of pedagogic resources provide better access for students on the fringes of anatomy?

Georgina A Goodison, Christopher Aris
University of Keele, Staffs, UK

The teaching of anatomy has for centuries been attributed to medical sciences and the ability to treat the living. It is only within the last 200 years that anatomy has become used more widely, for the purposes of archaeological education, and forensic anthropology. Many institutions can solely provide replicated material for learning skeletal anatomy within a forensic setting, whilst usually only those with archaeology departments, or loans from good contacts, can offer their students access to real skeletal material. There is even less access to gross anatomy and the use of donor material. With the diverse range of anatomical teaching aids, including Anatomage Tables, SynDavers etc, the understanding of gross anatomy could be extended to forensic students. This could allow for a better knowledge of how the human body is composed above the internal skeletal structure, for any instances in the field where they might encounter more than just skeletal remains. By creating workshops using a variety of anatomical resources, and surveying student participants, it could be determined which materials allow for a better understanding of human anatomy, and thus what students would prefer to have access to as part of their education. One such series of workshops, on the use of skeletal material, determined that both real and replicated material had desirable aspects for understanding skeletal anatomy, suggesting that access to both types of resources provided a more rounded understanding for students. Continued PhD research will further investigate the impact of pedagogic resources on student learning. Ethics Statement: All workshops were conducted on second-year undergraduates at Keele University, with permission given by the department. Workshops included the use of real and replicated skeletal material. Ethics Reference: 2024-0716 815

816

Session 1: Anatomical Education

Physician Associate Students' Perceptions of a Collaborative Approach to Human Radiographic Anatomy Teaching Sessions

Michelle Ellwood, Tanya Chamberlain,
Worsley Building, University of Leeds, Clarendon Way, Leeds, LS2 9NL

Supportive co-teaching practice is the contribution of two or more teachers within a single collaborative teaching session and reflects social constructivist learning theories. Whilst this is not a new concept, in certain subject areas, this can be hard to facilitate and can evoke various responses from students. This pilot aims to determine the perceptions of MSc Physician Associate students of a Radiographic Anatomy collaborative teaching session. 21 MSc Physician Associate students were recruited from Year 1 at the University of Leeds MSc Physician Associate Programme. Participants were randomly divided into 2 groups. Group 2 took part in regular scheduled anatomy practical class, whilst group 1 took part in the collaborative teaching session with a Diagnostic Radiographer and Anatomy Teaching Fellow. After 1 hour of teaching the groups swapped over and the teaching was repeated. Each collaborative teaching session consisted of a brief introduction to radiographical images from the Radiographer and immediate translation into Cadaveric Anatomy by the Anatomist. It included clinical scenarios and anatomical sciences. Students completed a 27-statement Likert questionnaire encompassing 4 themes: Engagement and Interaction (EI), Integration of Theory and Practice (ITP), Supportive and Inclusive Environment (SIE), and General Satisfaction (GS). These were converted into quantitative data to provide a score; 1 = extremely dissatisfied, and 5 = extremely satisfied to quantify a mean response. 21 students responded to the questionnaire. Overall satisfaction of the co-teaching scored 4.4, which was constructed of the 4 themes: EI = 4.1 SIE = 4.2 ITP = 4.6 GS = 4.8 (n = 21). Students identified that it was useful to have cadaveric remains that directly link to the anatomy as seen on radiographs. They also found it thought-provoking and relevant to real-life scenarios and reflected the working environment. They thought that co-teaching opportunities should be incorporated into other areas of the programme. Students commented on mixing theory and practice, and it aided in consolidating knowledge. Physician Associate students were satisfied with a co-teaching approach to radiographic anatomy. Students found it to be engaging and reflective of the work environment and found the environment to be supportive. No Ethics approval was undertaken for this Pilot Study.

796

Session 1: Anatomical Education

YOUNG INVESTIGATOR

Diagnosing the First Patient: Integrating Histopathology into an Undergraduate Gross Anatomy Course

Megan Kruskie [1], Jessica Byram [1], Kyle Robertson [2]

[1] Department of Anatomy, Cell Biology, & Physiology, Indiana University School of Medicine, Indianapolis, Indiana, USA ; [2] Department of Anatomy, Cell Biology, & Physiology, Indiana University School of Medicine, West Lafayette, Indiana, USA

The incorporation of humanism through exploration of pathology in gross anatomy allows students to develop a deeper appreciation of the pathological basis of disease and to explore the impacts of pathology on donors' lives through clinicopathologic correlation of their findings. The purpose of this study is to describe and evaluate a pilot intervention that integrated histopathology into an existing humanism thread, First Patient Project (FPP), in an undergraduate, dissection-based gross anatomy course. Students were asked to submit reflections five times during the term, and a post-course questionnaire collected data on student perceptions of the FPP and integrations of histopathology. Content analysis was used to analyse reflection and survey free response data and descriptive statistics were performed on Likert-style items using Excel. Each student (n=18) submitted five reflections (total n=90), and 6 students (33%) completed a post-course questionnaire. Five themes were identified from the questionnaire data that comprise the perceived impacts of the integration of histopathology into the FPP: pathology deepens anatomy knowledge, promotes career exploration, novice medical professional, reflections of donor pathology and lifestyle, general feedback on histopathology integration. Student reflections demonstrated that the histopathology component of the FPP improved clinical understanding of pathology, helped facilitate feelings of belonging in the medical profession, and allowed them to reflect on their own humanity as well as that of the donors. This ultimately demonstrated histology, and particularly histopathology, from anatomic donors was feasible. Integration of histopathology into gross anatomy education provides an avenue for curricular integration and promotes student appreciation of the donors' clinical history. The authors have no conflicts of interest to disclose. This study received exempt status from Indiana University Institutional Review Board (IRB # 10962). This project was funded through a 2023 Curriculum Enhancement Grant from the Center for Teaching and Learning, Indiana University Indianapolis, USA. All tissues samples were taken from donors of the Indiana University Anatomical Education Program, following ethical guidelines outlined for anatomical collections.

Session 1: Anatomical Education

INVITED SPEAKER

Don't Waste Their Action Potential: How To Unlock Your Student's Anatomy Learning Superpowers.

Professor Scott Border
University of Glasgow, Scotland, UK

The effective learning of anatomy can present challenges, even for the most capable students out there. Although today's anatomy educators are not short of intuitive strategies to remedy these obstacles, or afraid to lean on the relevant pedagogies to inform their practices, the most powerful means at their disposal are often overlooked. This is, of course, the influence they have over their student's minds and the way they think.

We often rush into making changes in the classroom before we fully understand what is happening inside our student's heads. The starting point is how the brain works in relation to how it responds to learning and instruction. As we know, anatomy as a subject to learn is terminology rich, spatially complex, and due to its use of human remains as a primary resource, also fairly intimidating at times. Therefore, it is logical to begin with trying to understand the cognitive architecture that is being used to process any new information. If our educational responsibilities can go beyond good ways of remembering, say the carpel bones, or the brachial plexus, but extend to modelling self-efficacy and self-regulation, then our students have a chance of becoming more productive and efficient outside the classroom. So, when they return, they are more empowered and better prepared to optimise their time when in our company. This talk aims to navigate through how to apply educator's pedagogic content knowledge so that their students can begin to think more metacognitively about their own learning. When we achieve this, we have made the first step towards unlocking the anatomy learning superpowers of our students.

Session 1: Anatomical Education

10 minute sponsor talk

The Value of Digital Resources in Teaching Anatomy

Mattias Bandilla, Elsevier

Session 2: Micro-CT 1

INVITED SPEAKER

Synchrotron X-ray CT in Natural and Cultural Heritage

Dr Vincent Fernandez
ESRF – The European Synchotron France

X-ray micro-Computed Tomography (micro-CT) is a widely used technique across various scientific fields. Beyond its medical applications, it is predominantly employed in engineering and material sciences. In recent decades, its use has expanded significantly in geology, biology, and even in natural and cultural heritage studies. This latter group presents unique challenges: samples vary greatly in size, shape, and density, and altering them to facilitate scanning is often impossible. Additionally, some objects require specialized handling or positioning, complicating experiments.

Despite these challenges, micro-CT has yielded remarkable discoveries, solving long-standing mysteries and transforming the study of museum collections. Fossils and artworks are frequently analysed at synchrotron facilities, which offer unparalleled X-ray beam properties like high flux, parallel beams, and coherence. These advantages make synchrotrons the gold standard for X-ray tomography.

The importance of natural sciences and cultural heritage research is now recognized in the development of synchrotron facilities. For example, the European Synchrotron Radiation Facility is constructing the BM18 beamline to meet the specific needs of these fields, highlighting their growing significance in the scientific community.

Session 2: Micro-CT 1

YOUNG INVESTIGATOR

3D Imaging of Clitoral Anatomy Across Primate Species (Pan troglodytes, Lemur catta, Saimiri sciureus, Aotus lemurinus, Eulemur flavifrons and Homo sapiens): Insights from microCT and MRI Scans.

Betzy Manners[1, 2], Neil Thomas[1], Alana Sharp[2], Magdalena N. Muchlinski[3], Daniel Varajao de Latorre [4], Charlotte Brassey [4]

[1]Human Anatomy Resource Centre, University of Liverpool, Liverpool, UK; [2]Department of Musculoskeletal and Ageing Science, Institute of Life Course & Medical Science, University of Liverpool, Liverpool, UK; [3]Anatomical Science Education Center, Oregon Health & Science University, Portland, OR; [4]Department of Natural Sciences, Manchester Metropolitan University, Manchester, UK

BlueSky Social: muchmagda

In humans, the glans clitoris is a small, pea-sized structure visible upon external examination of the female genitalia. But the majority of the clitoral erectile tissues are located beneath the surface; extending along the ischiopubic ramus, as the corpora cavernosa, and bordering the vaginal opening, as the vestibular bulbs. In many contemporary anatomical texts, the clitoris is often described alongside the penis, emphasizing their shared structural foundations and functional similarities. But their differences are barely noted. Our understanding of the clitoris' function and evolutionary origin is still limited, with studies suggesting that behavioural pressures may have influenced its development. For example, female ring-tailed lemurs, which exhibit social dominance over males, have an elongated clitoris, suggesting a potential link between "masculinized" genital morphology and female dominance. While much attention has been given to the role of sexual selection and mating systems in shaping male genitalia, such as the correlation between multimale-multifemale systems and more complex penile morphology, similar efforts to investigate the factors influencing the diverse clitoral anatomy in primates have been limited. Using microCT and MRI scans of human and non-human primates, a series of 3D models were created to: (1) visualise the anatomical architecture of the clitoris and surrounding tissues; and (2) compare anatomical variation between primate species by measuring: (a) the ratio of cura length to clitoral body length, and (b) total volume of the corpora cavernosa (consisting of the crus, body and glans clitoris). Results point to differences in the ratio of crus to the body of the clitoris, the positioning of the vestibular bulbs, and corpora cavernosa volume. This anatomical variation presents several avenues for further investigation: Is the diversification in genital morphology driven by phylogenetic factors, body size, or behavioural patterns? Ethical approval for the non-human primates was gained from Manchester Metropolitan University (ETHOS no. 50387). Ethical approval for the human tissue was gained from the Central University Research Ethics Committees of Liverpool University (Ref: 14095). Primate samples were obtained from the National Museum of Scotland.

Session 3: Micro-CT 1

Current challenges in the education of animal anatomy using microCT-derived digital models

Alice Leavey
University College London, London, UK

High-quality digital models of animal anatomy are sparse compared to those used in human medical sciences. This can place significant limitations on the ways we teach vertebrate anatomy, development, function and evolution in both schools and higher education academies. This issue is particularly prominent at institutions that cannot afford the space, time, and resources for dissection labs. Here, I present the results from a survey that explores how well the learning of animal anatomy is currently facilitated at UK universities. Staff and students across the veterinary and biological sciences agree that more high-quality, accessible digital models would improve education in animal anatomy. This presentation will cover the common areas of anatomy-based practicals (i.e., dissection labs, museum visits) flagged for the integration of more digital models, and which interactive elements need further development to improve the student learning experience. I will then demonstrate how digital models derived from contrast-enhanced microCT scans can be used to teach students about vertebrate anatomy using new 3D atlases of chameleon cranial morphology. On behalf of the Non-Clinical Tomography Users Research Network (NoCTURN) Education & Outreach community, we will also discuss how 'education kits' could help teachers integrate microCT imaging into education. Finally, I discuss the challenges currently preventing us from developing a digital library of anatomical models for education and research, including a concerning new development in the lack of places to collectively make digital models publicly accessible. Ethical approval for the survey was obtained through UCL's central Research Ethics Service (Ethics ID 28615/001) and the survey was performed with the understanding and consent of every participant.

782

Session 2: Micro-CT 1

Shape and internal structure of the *baculum* in the recently rediscovered Northern Pygmy Loris (*Xanthonycticebus intermedius*)

Spani Federica[1], Riccieri Alessandra[2,5], Spagoni Lucrezia[2,3], Nadler Tilo[4], Carosi Monica[2,5]
[1]Department of Science and Technology for Sustainable Development and One Health, Università Campus Bio-Medico di Roma, via Álvaro del Portillo 21, 00128 Rome, Italy; [2]Department of Sciences, University Roma Tre, Viale G. Marconi 446, 00146 Rome, Italy; [3]Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Calabria Marine Centre, C.da Torre Spaccata, Amendolara, Italy; [4]Three Monkeys Wildlife Conservancy, Cuc Phuong Commune, Nho Quan District, Ninh Binh Province, Vietnam; [5]NBFC, National Biodiversity Future Center, Palermo 90133, Italy

Pygmy lorises are small, nocturnal primates native to Southeast Asia, inhabiting forests in Vietnam, Laos, Cambodia, and southern China. Recent taxonomic revisions have established a new genus, *Xanthonycticebus*, comprising two species: *X. pygmaeus* and *X. intermedius*. Both species face severe threats from habitat loss and illegal wildlife trade, despite existing legal protections. This study utilized radiography and micro-CT scanning to examine the 3D structure and anatomical variation of the *baculum* in confiscated pygmy loris specimens. DNA barcoding confirmed the taxonomic identity of three samples as *X. intermedius*. The *baculum* was present in all specimens, with notable morphological variability observed, suggesting both inter- and intraspecific differences. To quantify shape complexity, alpha-shape analysis was applied, identifying distinct patterns in *baculum* morphology among the specimens. A novel metric, the Vacuity Index (Vi), was introduced to measure the degree of vascularization within the *baculum*. This metric showed a negative correlation with bone length and volume, indicating that smaller, more vascularized *bacula* are characteristic of younger individuals. These findings offer a non-invasive method to infer age and developmental stages in individuals where such data are unavailable. The results emphasize the potential of *baculum* morphology as a supplementary taxonomic marker in primate studies, particularly in distinguishing between closely related species. Moreover, the study highlights the value of internal bone structure, such as vascularization patterns, in providing insights into age and developmental processes. This research enhances understanding of the anatomy and evolutionary characteristics of the northern pygmy loris. By offering new data on *baculum* morphology and vascularization, it contributes to broader primate taxonomy and conservation efforts, underscoring the importance of integrating anatomical and ontogenetic insights into wildlife studies.

Session 3: Micro-CT 2

The use of microcomputed tomography for human trabecular bone microstructure analysis within the Centre for Anatomy and Human Identification: a twenty-year review

Rebecca Reid, Julieta Gomez Garcia Donas, and Craig Cunningham
Centre for Anatomy and Human Identification, University of Dundee, Dundee, Scotland, UK

Microcomputed tomography (µCT) is a non-invasive, high-resolution imaging modality enabling the visualisation of three-dimensional bone structure. Over the past two decades, the Centre for Anatomy and Human Identification (CAHID), University of Dundee, has adopted µCT to explore human bone microstructure. This study reviews the evolution of µCT research at CAHID, highlighting methodological advancements, challenges encountered, knowledge gained, and future directions. The analysis of the trabecular architecture from juvenile skeletal specimens and adult bones from Scottish body donors, has provided insight into the human skeleton at various phases of life. The resolution of µCT imaging used within CAHID has increased from 34.5µm to 8.74 µm for the smallest of neonatal bones allowing for advancements in quantification and analysis of trabecular bone. A variety of image analysis software including Skyscan's CTAnalyser and Comet's Dragonfly have been utilised to quantify a range of trabecular parameters including bone volume fraction, degree of anisotropy, trabecular thickness, separation, number, and structural model index. Multiple approaches to defining volumes of interests (VOI) have been explored, incorporating various grid systems, scaling methods, and shapes of VOIs. Recently, three-dimensional whole bone mapping has been added to the suite of analytical approaches adopted. As a result, a review of CAHID's µCT trabecular research demonstrates the challenges and advancements of µCT research. Future µCT research within CAHID will seek to investigate understudied areas of the skeleton, in addition to utilising µCT for cortical analysis and bone mineral density measurements. Ethical approval was not required for the research of the Scheuer Juvenile Collection due to individuals within the collection having a time-since-death of over 100 years. Use of body donors for research complied with the Anatomy Act (1984) and the Human Tissue (Scotland) Act 2006.

791

Session 3: Micro-CT 2

Highly vascular bone induced by cantering exercise in Thoroughbred racehorse metacarpals.

Alan Boyde[1], David Mills[1], Elwyn C. Firth[2]
[1]Queen Mary University of London, London E1 4NS, UK; [2]University of Auckland, Auckland, New Zealand

Distal portions of equine third metacarpal (Mc3, cannon) bones include substantial dorso-palmar trabecular plates containing fine secondary osteonal canals - an architecture not described in pedagogical texts. Cantering exercise induces new bone formation to replace fatty marrow. We studied archived material from the Massey University Grass Exercise Study (MUGES) to study this phenomenon. Seven 2-year-old Thoroughbred fillies were trained over 13 weeks, and seven untrained were confined to grass yards. Distal segments of right Mc3 were cut in defined planes and sections embedded in PMMA. Micro-milled block surfaces were studied by backscattered electron mode SEM (BSE-SEM) and confocal fluorescence microscopy and, after further subdivision and sectioning, by high contrast resolution X-ray MicroTomography (XMT: with Drishti rendering) and transmitted ordinary and polarized light microscopy. Finally, bone tissue was removed (by sequential HCl and bleach treatments, with ultrasonication to remove osteocyte casts) to leave the PMMA as a mould of the non-bone space - including marrow and small blood vessel canals - for 3D SEM. New bone 'scaffolded' on trabecular surfaces without prior resorption has mineralization levels below and autofluorescence levels above those in existing bone and incorporates blood vessel canals perpendicular to the growth surface – capillaries probably penetrating the osteoblast carpet as observed at growing endosteal surfaces in small rodent tubular bones. Unattached strands of 'woven' bone - more densely mineralized than the prior bone - form in fatty marrow and scaffold additional lamellar bone deposited in close relationship to and enclosing a fine capillary blood vessel network. Both these types of new bone contribute to volumetric densification, albeit their material density is less than preceding bone. The fine bore blood vessel canals in the rapidly formed new infill bone and those within the preexisting trabecular bone plates are well connected. Many small blood vessel canals are formed by osteoclastic-team tunnelling, without the repair-refilling phase seen in of secondary osteon formation. Using correlated findings from several SEM modes, LM, PLM and XMT (µCT), we highlight a previously unrecognised morphological type of bone. Cantering exercise alone is sufficient to induce this new bone formation in cannon bones. No ethical approval was required as the study used archived material.

808

Session 3: Micro-CT 2

INVITED SPEAKER

The Dutch Fetal Biobank: Advancing Research Opportunities in Human Development

Puck P Mulder[1,2] and Bernadette S de Bakker[1,2,3,4]
[1]Amsterdam UMC location University of Amsterdam, Dept. of Obstetrics and Gynecology, Amsterdam, The Netherlands; [2]Amsterdam Reproduction and Development research institute, Amsterdam, The Netherlands; [3]Amsterdam UMC location University of Amsterdam, Dept. of Medical Biology, Amsterdam, The Netherlands; [4]Erasmus MC – Sophia Children's Hospital, University Medical Center Rotterdam, Dept. of Pediatric Surgery, Rotterdam, The Netherlands

The 3D Human Development group is dedicated to elucidating the intricacies of human embryonic and fetal development through advanced imaging modalities. A cornerstone of our research is the Dutch Fetal Biobank, established in 2017, through which we collect and preserve human embryonic and fetal tissues from 3 to 22 post-conception weeks. This biobank provides unparalleled access to high-quality, intact specimens, enabling comprehensive morphological and molecular analyses.

Using state-of-the-art imaging techniques, including micro-computed tomography (Micro-CT), 3D-ultrasound and synchrotron imaging, we achieve unprecedented resolution in visualizing anatomy. Micro-CT allows for detailed three-dimensional reconstructions of fetal structures, facilitating precise anatomical studies. Complementing this, synchrotron imaging, particularly through the Human Organ Atlas Hub (HOAHub) initiative, enables whole-organ examination at multiple scales down to the cellular level, with resolutions approaching one-fiftieth of a human hair.

The integration of these imaging modalities with the unique specimens from the Dutch Fetal Biobank fosters a comprehensive understanding of normal and abnormal human development. This synergy not only advances embryological research but also enhances educational resources, including 3D prints, thereby bridging the gap between scientific discovery and clinical application. Through open-access data sharing and collaborative efforts, the 3D Human Development group contributes significantly to the global scientific community's knowledge of human developmental biology.

3Dhumandevelopment.com

Session 3: MicroCT 2

10 minute sponsor talk

Primal Pictures: Accelerating Anatomy Learning

Alexis van Breda, Primal Pictures

PRIMAL PICTURES
POWERING ANATOMY.TV

Session 4: Microstructural Imaging

INVITED SPEAKER

Exploring Brain Microstructure – Diffusion Weighted MRI of the Grey Matter and its Relationship to Cognitive Performance.

Dr Oliver Sparasci
Clinical Research Fellow, University of Manchester, Faculty of Biology, Medicine and Health, School of Health Sciences, Division of Psychology, Communication and Human Neuroscience
Consultant Psychiatrist for Older People, Lancashire and South Cumbria NHS Foundation Trust, East Lancashire Memory Assessment Service

Using Diffusion Weighted Magnetic Resonance Imaging (DWI), it is possible to probe the diffusion of water within biological systems and thus to infer their microstructural properties. There are numerous methods for collecting and analysing DWI data, meaning it is possible to probe the microstructure of both grey (GM) and white matter (WM). Much research has focussed upon changes in DWI metrics in the WM, and how this may impact cognition. However, there is relatively limited research into the use of DWI in the grey matter of people with Mild Cognitive Impairment (MCI), commonly thought to represent a pre-dementia stage of cognitive impairment.

In this talk, we will explore how DWI may provide a window into microstructural changes that occur in the brain, prior to the volume loss that is typical of the dementias. He will discuss some of the key literature on this topic and present preliminary findings from a study using Diffusion Orientation Complexity (a DWI technique) in a cohort of people with MCI vs healthy controls. This work demonstrates that a range of DWI measures are more strongly related to cognitive performance than volume alone and thus may be an early marker of impending dementia. This work has potential for clinical translation to allow for the earlier diagnosis of the underlying cause of cognitive impairment than is currently possible with standard imaging techniques, and to support clinical discussions around prognosis.

Session 4: Microstructural Imaging

YOUNG INVESTIGATOR

Immunofluorescence and lineage tracing in the mouse reveals secrets of a novel structure in therian mammals

Luke A. Barlow, Abigail S. Tucker
Centre for Craniofacial and Regenerative Biology, Floor 27 Guy's Tower, Guy's Hospital, Kings College London, UK

Throughout their evolution from mammal-like reptiles to today's diverse groups, mammals have developed a range of traits incrementally. Among these, lactation stands out as a defining characteristic, enabling mothers to feed their young milk until they are mature enough to feed independently. Today, living mammals are divided into egg-laying monotremes, pouch-bearing marsupials, and placental mammals. Notably, monotremes are the only mammals that do not give birth to live young. While they produce milk like other mammals, they lack teats; instead, they nourish their young from specialized patches on the mother's abdomen. To facilitate suckling behaviour, marsupials, and placental mammals possess a paired structure at the base of the sphenoid bone known as the pterygoid hamulus. This structure supports the soft palate, functioning like a pulley to stiffen the soft palate and form a seal with the posterior tongue. The pterygoid hamulus develops late in gestation (around E15.5 in *Mus musculus*) and is notably absent in monotremes although they possess two elements in the same region that remain unfused through development. Furthermore, suckling in monotremes is considered unlikely, as echidna neonates retain a cleft palate upon hatching. In this study, we used immunofluorescence imaging with Runx2, Sox9 and 12-101 antibodies to track the development of the pterygoid hamulus in *Mus musculus*, our model placental mammal. We also employed lineage tracing via the non-inducible Cre lines Mesp1CreTomato and Wnt1CreTomato to investigate the developmental origins of the pterygoid hamulus. All use of transgenic mouse mutants was approved by the Faculty Biological Safety Committee and the Home Office, adhering to UK legislation under the Animals (Scientific Procedures) Act 1986 Amendment Regulations (SI 2012/3039). No additional ethical approval was required for this project.

787

Session 4: Microstructural Imaging

YOUNG INVESTIGATOR

Towards understanding the canine myotendinous and osteotendinous interfaces: A biomaterial perspective

Shaz A. Raja[1], Jane N. Brennan[2], Catherine McCarney[2], Estela I. Bini[2], Massimiliano Garré[3], David Kilroy[2], Sourav Bhattacharjee[2],

[1]School of Medicine, Trinity College Dublin, Dublin 2, Ireland; [2]School of Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland; [3]Super-Resolution Imaging Consortium, Department of Chemistry, Royal College of Surgeons in Ireland University of Medicine and Health Sciences, Dublin D02 YN77, Ireland

@souravdoc

A high degree of coordination between the triarchy of muscles, tendons, and bones is required for normal, efficient working of the musculoskeletal system. The muscle-to-tendon-to-bone tissue transition ensures a streamlined application of the (stable) force vector generated from the contraction of muscle fibres, enabling smooth joint movements. Macroscopically, the junctions (interfaces) between muscle and tendon (myotendinous) or tendon and bones (osteotendinous) seem obvious and clearly defined. However, it would be interesting to probe these interfaces with advanced biophotonic tools now available to anatomists, given these interfaces, despite their incredible sophistication and efficacy, are also known for vulnerability to injury. A thorough microscopic investigation of these interfaces can unravel a wealth of information regarding how these seemingly disparate tissue (bio)materials, viz., muscle, tendon, and bone, are arranged in tandem while withstanding and transmitting the traction due to muscle contraction. Hence, a systematic study was designed where tissue samples were harvested from the canine forelimb common digital extensor muscle, including the muscle, tendon, and osseous regions (n=4). The sampled (fixed in 4% formalin) tissues were subjected to the usual cascade of histology slide preparation, including dehydration and dewaxing. The osseous tissues were softened for microtome sectioning by application of 10% nitric acid for 24 hours. Finally, the tissue slices (5 µm and 10 µm) were mounted on glass slides without staining or coverslips in a Leica Stellaris 8 Falcon system (20□) for Fluorescence Lifetime Imaging Microscopy (FLIM) investigation based on tissue autofluorescence (λex=440 nm, λem=478–672 nm). The tissue slices elicited adequate emission with collagen-rich tendinous regions dominated by regions of lower fluorescence lifetime. On the contrary, the muscular belly harboured regions showing a mix of low to high lifetimes, while the periosteal regions demonstrated higher lifetimes. Moreover, the collagenous matrix in a tendon gradually transitioned from lower to higher lifetimes as it progressed from the myotendinous to an osteotendinous junction, with seamless stitching at these interfaces reflecting the diversity, flexibility, and ability of collagen to meld into neighbouring biomaterials, like muscle and bone. This study received approval from the UCD Animal Research Ethics Committee (Reference codes: AREC- E-21-19-Kilroy and AREC-E-24-32-Bhattacharjee).

Session 4: Microstructural Imaging

A Histomorphometric and Histopathological Analysis of the Human Acetabular Labrum Enthesis.

Yasmin Day, Abdulaziz Alomiery
Department of Anatomy, Edinburgh Medical School: Biomedical Sciences, The University of Edinburgh, Teviot Place, Edinburgh, EH8 9AG, UK

The acetabular labrum enthesis is the specialised attachment site of the acetabular labrum to the underlying bony skeleton. Its main function is to enable the smooth transmission and dissipation of mechanical load between these mechanically dissimilar structures, thereby safeguarding both components. Despite its importance, there is no existing classification of the labral enthesis, and its microanatomical structure remains unstudied. Therefore, this study aimed to classify the acetabular labrum enthesis as either fibrous or fibrocartilaginous, analyse the histomorphometric characteristics of the entheseal layers in the inner load-bearing and outer stress-shielded zones, and explore histopathological changes in these zones. Six hemipelves (2 males, 1 female; mean age 75.7) were obtained from three embalmed cadavers provided by Anatomy, University of Edinburgh, regulated by the Human Tissue (Scotland) Act 2006. The specimens were dissected and sectioned to obtain cross-sectional slides of the acetabular labrum that were histologically processed for the purpose of micromorphological and histopathological analyses. This included measurement of the depth of calcified fibrocartilage (CFC), length of the tidemark (TM) and cement line (CL), and area of the CFC, and incidence of pathological changes. The enthesis was classified as fibrocartilaginous. The inner zone was found to have a significantly greater average CFC depth/unit length compared to the outer zone, attributable to greater mechanical loading in this region. However, the outer zone was observed to have a significantly greater TM length, CL length and CFC area. The outer zone exhibited a greater incidence of pathological changes, likely due to the weakening effects of stress-shielding on the enthesis. These findings contribute significantly to the understanding of the acetabular labrum enthesis and its biomechanical functions. They demonstrate the features that need to be recreated in a pathological enthesis to restore a healthy environment, provide markers for the identification of pathological changes and facilitate comprehension of the processes that result in enthesopathy. Consent was obtained from all participants in the current study in accordance with the Human Tissue (Scotland) Act 2006, and dissection was carried out in an appropriate and respectful manner.

807

Session 4: Microstructural Imaging

YOUNG INVESTIGATOR

Microscopic changes in the multifidus muscle in people with low back pain associated with lumbar disc herniation

Shilpa Purushotham[1,2], Nathan Hodson[3], Carolyn Greig[4,5,6], Adrian Gardner[7,8], Deborah Falla[1*]
*[1]Centre of Precision Rehabilitation for Spinal Pain (CPR Spine), School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, Birmingham, UK; [2]Institute of Clinical Sciences, College of Medical and Dental Sciences, University of Birmingham, Edgbaston, Birmingham, UK; [3]Department of Sport and Exercise Sciences, Institute of Sport, Manchester Metropolitan University, Manchester, UK; [4]School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, Birmingham, UK; [5]MRC-Versus Arthritis Centre for Musculoskeletal Ageing and Health, University of Birmingham, Birmingham, B15 2TT, UK.
[6]National Institute for Health Research, Birmingham Biomedical Research Centre at University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK; [7]The Royal Orthopaedic Hospital NHS Foundation Trust, Northfield, Birmingham, UK; [8]College of Health and Life Sciences, Aston University, Birmingham, B4 7ET, UK.*

Lumbar disc herniation (LDH) is a common degenerative condition causing low back pain (LBP) due to nerve compression. Previous studies show conflicting findings regarding the multifidus (MF) muscle microscopic changes in LDH patients. So, this study aimed to compare the affected MF to the adjacent MF on the ipsilateral and contralateral sides in LDH patients and examined correlations with clinical features of LBP. Four muscle biopsies were collected from each of 30 surgical participants. Immunohistochemistry was performed on tissue sections and imaged with an epifluorescence microscope. Data was analysed using two-way ANOVA muscle fibres' cross-section area, perimeter, diameter, and composition, while pathological fibres were analysed using ANOVA. Pearson's correlation was employed to examine MF microscopy associations with clinical features. Results revealed no significant differences between the affected MF and MF from other sites, though significantly more pathological fibres were present in the affected MF ($p<0.05$). A weak but significant negative correlation was found between type I fibres and LBP clinical features, though no such correlations were observed for type IIA fibres. In conclusion, LDH primarily impacts the pathological status of the MF rather than fibre phenotype or size, and the severity of clinical features affects the size of type I fibres. The study was approved by the University's research governance (RG22-049; ethics reference number ERN no. 22-0418) and Royal Orthopaedic Hospital Research tissue bank (17/EM/0030). All eligible participants from the elective surgical list were consented by the research team.

Session 4: Microstructural Imaging

AGING CELL BEST PAPER AWARD 2023

Antiretroviral protease inhibitors induce features of cellular senescence that are reversible upon drug removal

Chisaka Kuehnemann[1, 2, 3], Jun-Wei B Hughes [1], Pierre-Yves Desprez [1, 4], Simon Melov [1], Christopher D Wiley [1, 3], Judith Campisi [1]

[1]Buck Institute for Research on Aging, Novato, California, USA; [2]University of Southern California, Los Angeles, California, USA; [3]Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University, Boston, Massachusetts, USA; [4]California Pacific Medical Center, San Francisco, California, USA.

Aging Cell. 2023 Jan;22(1):e13750. doi: 10.1111/acel.13750. Epub 2022 Dec 20.

Antiretroviral drugs have dramatically improved the prognosis of HIV-infected patients, with strikingly reduced morbidity and mortality. However, long-term use can be associated with signs of premature aging. Highly active antiretroviral therapy generally comprises two nucleoside reverse transcriptase inhibitors (NRTIs), with one of three additional antiretroviral drug classes, including protease inhibitors (PIs). One commonality between mitochondrial dysfunction (induced by NRTIs) and defects in lamin A (induced by PIs) is they can cause or accelerate cellular senescence, a state of essentially irreversible growth arrest, and the secretion of many bioactive molecules collectively known as the senescence-associated secretory phenotype (SASP). We hypothesized that senescent cells increase following treatment with certain HIV therapies. We compared the effects of two distinct HIV PIs: ritonavir-boosted atazanavir (ATV/r) and ritonavir-boosted darunavir (DRN/r), used in combination treatments for HIV infection. Upon ATV/r, but not DRN/r, treatment, cells arrested growth, displayed multiple features of senescence, and expressed significantly upregulated levels of many SASP factors. Furthermore, mice receiving sustained ATV/r treatment showed an increase in senescent cells and age-related decline in physiological function. However, removing treatment reversed the features of senescence observed in vivo and cell culture. Given how these features disappeared with drug removal, certain features of senescence may not be prognostic as defined by an irreversible growth arrest. Importantly, for patients that are treated or have been treated with ATV/r, our data suggest that switching to another PI that does not promote premature aging conditions (DRN/r) may improve the associated age-related complications.

Session 4: Microstructural Imaging

10 minute sponsor talk

Experience the BioDigital Human in Virtual Reality for the Best Experience in Anatomy Education

Stewart Fields, Wolters Kluwer

Session 5: Educational Imaging

INVITED SPEAKER

The Role of Radiology in Teaching Anatomy

Professor Cindy Chew
University of Glasgow, Scotland, UK

Radiology – in the form of medical imaging such as X-ray, CT, MRI, nuclear medicine and ultrasound – plays a central role in 21st century medicine. Thus, Radiology is perfectly placed to teach many aspects of medicine. In fact: if it didn't already exist, we would have to invent it! Since assessment drives learning, even the GMC acknowledges this in its MLA content map: Clinical Imaging has one of the most numbers of conditions examinable listed against it!

It has been almost 100 years since Dr CR Bardeen – a radiologist – asserted the benefits of Radiology to teach Anatomy (1927).

So where are we now? Are people using Radiology to teach Anatomy? How is it being done? Who is teaching? Does it work? Join us in this discussion to find out more.

Session 5: Educational Imaging

YOUNG INVESTIGATOR

An Inter-Institutional Assessment of Ultrasonographic Human Cadaveric Anatomy Structure Visibility Across Different Embalming Techniques

Ashley Durfee[1], Jill Hamilton[2], Scott Border[2], Denis Barry[1*] and Ourania Varsou[2*]
[1]Trinity College Dublin, Dublin, Ireland, [2]University of Glasgow, Glasgow, United Kingdom
**equal senior authorship*

@ashley_anatomy @ScottBorder1 @DS_Barry @OuraniaVarsou

The use of ultrasound in educational settings holds potential for the enhanced visualisation of anatomical structures. In practical settings, image quality varies significantly across cadaver preservation methods. Traditional formalin embalming presents limitations due to tissue stiffening and gas artifacts that distort imaging, complicating ultrasound interpretation. Soft-embalming methods, including Dodge, and fresh frozen cadavers may mitigate these challenges by retaining tissue moisture and flexibility. However, no studies to date have evaluated ultrasound efficacy on across different embalming techniques. This study assessed ultrasound image quality across three types of embalming methods (Dodge, fresh frozen, and formalin) and compared them to a live subject. The objective was to determine the optimal preservation method for clear ultrasound visualisation of neurovascular structures in the carotid sheath. A Ballater 2-in-1 Ultrasound Probe (Linear 7.5MHz/10.0MHz) was used to scan the neck of 7 formalin-embalmed cadavers, 6 fresh frozen cadavers, 5 Dodge-embalmed cadavers, and 1 live subject (control). Scans were independently assessed, after image acquisition, for anatomical structure identification by an anatomist (AD) and then jointly reviewed with a medically-qualified anatomist with ultrasound expertise (OV). Neurovascular structures included the internal jugular vein, common carotid artery and vagus nerve, with additional observations of the thyroid gland and larynx. Results showed 100% visibility for all structures in both live and Dodge-embalmed scans. Neurovascular structure visibility in fresh frozen cadavers showed 70% visibility, while formalin-embalmed cadavers had a lower rate of 57.1% visibility. External factors, such as numbers of thaws and time to thaw might have played a role in the fresh frozen cadaver anatomical structure identification. These findings suggest that Dodge-embalmed cadavers provide superior ultrasound visibility, closely matching live subjects, and present a promising alternative for anatomical and clinical training. This study highlights Dodge-embalming as a potentially optimal preservation method for both educational and clinical research settings, showcasing the utility of soft-embalming preservation methodologies in resolving current gaps in cadaveric ultrasound training resources. Glasgow: Research was performed in accordance with the Anatomy Act (1984) and the Human Tissue Act (Scotland) 2006 under the auspices of the Principal Licensed Teacher of Anatomy, Prof Scott Border, from the University of Glasgow, UK. Dublin: Approval for the use of human cadaveric specimens was granted by the Discipline of Anatomy, Trinity College Dublin in accordance with the Anatomy Act 1832 as outlined in Section 106 of the Medical Practitioners Act 2007.

Session 5: Educational Imaging

YOUNG INVESTIGATOR

Sound Advice: Developing A Multimedia Teaching Resource Providing Hands-On Ultrasound-Based Anatomy Education For Medical Students At Queen's University Belfast

Alexandra Carton, Dr Eva Sweeney, Dr Christopher Johnson
Queen's University School of Medicine, Dentistry and Biomedical Sciences, Belfast, United Kingdom

Point of care ultrasound has become a first-line medical imaging modality in many specialties, often being called the "new stethoscope". Medical schools are now recognising the need for its integration into their curriculum, however there is little consensus on the best format for this implementation. In keeping with findings from previous studies and after a focused needs assessment, we created a heuristic, hands-on teaching resource for trial with medical students at Queen's University Belfast (n=15) with the goal of future integration into the anatomy curriculum. The aim was to decrease the cognitive load on students learning this new skill through simplifying the procedure and by integrating various multimedia learning materials. Instructional images and videos and labelled 3D anatomical models were created to supplement their learning. The teaching was delivered through two presentations, one covering the basics of practical ultrasonography then afterward students followed a presentation instructing them in the hands-on practice of ultrasonography on simulated patients. While performing ultrasonography students were simultaneously being taught thoracic anatomy and pathology relevant to each view. Participant feedback and evidence of knowledge gained from the session were then evaluated. Pre- and post-test performance comparison through paired t-testing showed a significant improvement in both their gross and imaging anatomy knowledge ($p=0.012$) and in their ultrasonography knowledge ($p=0.002$). Qualitative feedback was gained through a focus group and survey. Participants reported a trend of increased confidence in carrying out basic ultrasonography from 0.9 to 6.4 out of 10 after the teaching. All participants agreed that ultrasonography aided their understanding of surface anatomy and 85.7% agreed it aided their understanding of gross anatomy. 92.9% found that ultrasonography made the anatomy teaching more engaging. All students believed that ultrasound should be implemented into their medical anatomy curriculum. These results have provided impetus for integration of ultrasound into the first-year medical curriculum at Queen's University Belfast which will allow for further assessment of the efficacy of this approach with a larger cohort. Ethical approval for this trial was obtained from the Faculty of Medicine, Health & Life Sciences Ethics Committee at Queen's University Belfast (MHLS 24_122).

827

Session 5: Educational Imaging

The Creation of Low-Cost Breast and Aortic Ultrasound Phantoms for Anatomical Education – A Methodology Study

Emma Bailey, Bethany Kinsella, Katie Leith and Ourania Varsou
School of Medicine Dentistry and Nursing, University of Glasgow, Glasgow, United Kingdom

@OuraniaVarsou

Identifying anatomical structures on imaging is becoming more important in anatomy teaching especially in vocational degrees. Ultrasound is particularly attractive to educators due to its increasing commonality in the clinic, its ability to perform real-time non-invasive scanning and the relatively inexpensive, portable handheld devices. However commercial phantoms which demonstrate normal vs abnormal anatomy are expensive and have short shelf-lives. The aim of this project was to create low cost easily reproducible phantoms for breast tissue (normal vs cancerous) and the abdominal aorta (normal vs aneurysm) for use in active teaching. These areas were selected for their clinical importance; breast cancer is the most common cancer among women globally, and early detection significantly improves outcomes, while abdominal aortic aneurysms are life-threatening and often undiagnosed until rupture. Training with phantoms provides hands-on experience, bridging educational gaps and improving diagnostic skills critical for early detection and effective patient care. To recreate authentic breast tissue and tissue surrounding the aorta initial protocols and reagents were sourced from existing ultrasound phantom literature. Reagents tested included Psyllium Husk, Agar and Gelatin. Different combinations were compared against commercially available phantoms in house. For the aorta itself silicon tubing was filled with water and sealed shut using parafilm before being embedded into the media. For the breast malignant tumours were simulated using small latex balloons filled with Anagel water-based gel, to recreate the irregular shape and simulate hypoechoic tissue. Data was collected on factors such as development time, tissue firmness, anatomical fidelity, echogenicity and cost. A mixture of 7g Agar and 1g Husk in 200ml of distilled water was found to be the most optimal ratio of reagents for both tissue types, providing not only the best echogenicity to replicate appearance and acoustic properties under ultrasound imaging, but also ensuring that the phantom did not degrade or lose structural integrity while scanning. All with an approximate cost of under £20 per phantom. User testing is planned to establish usability for hands on teaching. If the phantoms are favourably received we aim to introduce them into both vocational and non-vocational degrees at both undergraduate and postgraduate level.

831

Session 6: 3D Modelling

INVITED SPEAKER

3D Digital Models in Anatomy and Medical Education

Dr Caroline Erolin
Centre for Anatomy and Human Identification, University of Dundee, Scotland, UK

This presentation offers an overview of the development and application of interactive, three-dimensional (3D) digital models in Anatomy and Medical Education. As this field rapidly expands, many anatomists are creating their own models alongside commercially available ones, resulting in considerable variation in quality. The presentation will explore various methods of model creation, including working with different types of scan data and developing models from scratch using 3D modelling software. The advantages and limitations of each approach will be discussed. Additionally, the presentation will examine the different ways these models can be distributed, such as through online platforms, iBooks, interactive PDFs, and custom software.

The second part of the presentation will focus on a case study of recent research into user preferences for realism in anatomical surface scans. Dr. Erolin scanned a dissected upper limb using an Artec Space Spider 3D scanner. The resulting scan was processed using ZBrush, with one version kept minimally processed to closely represent the dissection, and two others enhanced to better highlight anatomical structures—though this reduced their realism. Staff and students at the University of Dundee were asked to view the three scan versions, hosted as private models on the 3D web-based platform Sketchfab, and provide feedback on their preferences for different scenarios, such as pre- and post-dissection. Thematic analysis of the feedback revealed that the preferred level of realism varies depending on the audience and intended use case.

Session 6: 3D Modelling

Combining 3D Scanning and 3D Printing for Arts-Based Learning of Skeletal Anatomy

Stephen J Maclean[1], Hunter Auck[1,2], Ellie M Horne[1], Victoria McCulloch[1], and Jennifer Z Paxton[1]

[1] Anatomy@Edinburgh, College of Medicine and Veterinary Medicine, University of Edinburgh, Edinburgh UK. [2] School of Medicine, University of St Andrews, St. Andrews, UK.

@BoneDoctorPhD; @hauck_23; @elliemhorne03; @DrJZP, @VM_Illustration

Over the past decade, there has been an ongoing, rapid expansion in the number of digital tools available to educators across a broad range of fields, including anatomists, osteologists, and biological anthropologists. This incorporates a range of scanning and digitisation technologies, notably the ever-growing ubiquity of medical imaging devices, and non-contact surface scanning technologies such as structured light scanning, LiDar and laser scanning. The Edinburgh ATLAS [**A**natomy **T**eaching **L**ab **A**dditive Manufacturing and **S**canning] Facility was created to develop bespoke digital anatomy teaching tools, primarily to develop novel anatomy education resources and tools to support a diverse and widely-distributed student population. The equipment and capabilities of the ATLAS Facility have also supported a growing series of research projects investigating the application of light-based scanners in the context of biological anthropology, with a particular focus on reproducibility and accuracy of models. The potential benefits of this technology are innumerable, including opportunities to develop novel analysis tools, create online reference databases, digitally preserve human remains for evidentiary purposes, and provide alternative visualisation options for courtroom evidence presentation. However, primary data regarding the validity, repeatability, and limitations of structured light scanning is currently limited and therefore confidence in this technology cannot be guaranteed. This report will provide an overview of anatomical and forensically-relevant research activities within the ATLAS facility, with reference to past and ongoing research projects. These projects predominantly reflect the translational nature of digital imaging, attempting to determine those areas where structured light scanning does offer benefit, and those areas where it may be less useful. We will outline the learning which has come from these projects, the directions for future research, and the potential benefits to practice that a deeper understanding of this technology may bring. The primary data discussed was produced from two research streams which received separate ethical approval under the AMERGE process (24-AM-008 (crania) and 24-AM-011 (clavicles)).

809

Session 6: 3D Modelling

Combining 3D scanning and 3D printing for arts-based learning of skeletal anatomy

Victoria McCulloch and Jennifer Z Paxton
Anatomy@Edinburgh, Edinburgh Medical School: Biomedical Sciences, The University of Edinburgh, Edinburgh, Scotland, UK

@vm_illustration, @Dr_JZP, @ATLASfacilityEd

In recent years, a notable decline in anatomy teaching time has led to a concerning reduction in the anatomical knowledge of medical graduates. It is therefore increasingly relevant to investigate novel anatomy teaching resources, such as 3D-printed models. Aside from providing additional learning opportunities for student populations, 3D-printed models also permit the addition of alternative learning techniques, particularly those in the arts-based space. This study focussed on the application of 3D-scanning and 3D-printing to produce anatomically accurate 3D-printed models of human bones of the upper and lower limbs. A selection of 3D-scanned bones from previous projects from the osteological collection at Anatomy@Edinburgh were printed for these sessions at a 50% scale in tough white PLA (0.2mm layer height, Ultimaker S5 Printer). Prior to the sessions, different types of paint were trialled on the models to evaluate the potential to reuse the bones for multiple events thus reducing overall cost. When compared to two different types of acrylic paints (Posca and Daler Rowney), washable paint (Crayola) was deemed a more suitable choice as it allowed for the reuse of models for subsequent events. An arts-based session was organised with volunteers from year 1 of MBChB programme at the University of Edinburgh (n=24). Groups (n=5-6) were given a set of upper and lower limb 3D printed bones, both matched and unmatched to body side. Groups were then given washable paints and encouraged to paint bony landmarks onto the models. Following this, they were encouraged to swap painted models with others in their group for revision and self-/peer-testing. Following the event, a service evaluation demonstrated that all students enjoyed the session (average rating (AR) 4.5/5) and felt like the painting process helped their understanding of bony landmarks (AR 4/5). Students indicated that they would welcome similar sessions on different areas of the body (AR 4.6/5).

820

Session 6: 3D Modelling

YOUNG INVESTIGATOR

A Novel and Accessible Method for 3D Scanning, Restoring and Digitally Preserving Human Cadaveric Specimens: Digital Plastination

Yusuf Furkan Ozaltay[1,2], Yasin Arifoglu[2], Omer Ozdogmus[1]
[1]*Department of Anatomy, Faculty of Medicine, Marmara University, Istanbul, Turkey;* [2]*Department of Anatomy, Faculty of Medicine, Bezmialem Vakif University, Istanbul, Turkey.*

In recent years, virtual and augmented reality (VR and AR) have emerged as transformative technologies in medical education, offering immersive and interactive learning experiences. The disruptions caused by the COVID-19 pandemic and the ongoing decline in donated bodies have highlighted the need for innovative teaching tools particularly in anatomy education. This study introduces "digital plastination", an accessible and cost-effective method for digitally restoring and preserving cadaveric specimens. Using a sagittal section of an aged brain specimen as our subject, we implemented a 3D scanning process with an affordable smartphone and the free version of Polycam, a cloud-based 3D scanning app, demonstrating that effective digitalization can be achieved without high-end equipment. The resulting model, exported as a GLTF file, was imported into Blender, a free sculpting software, where the mesh was refined and improved. The 3D model was retopologized using Instant Meshes, a free open-source software, ensuring a quad-based topology with homogeneous distribution for optimal sculpting. Color textures were baked from the initial scan onto the retopologized mesh, which was UV unwrapped with minimal islands to maintain anatomical integrity. The color textures were then exported as a PNG file to Pixlr, an online image editor with free-to-use AI features, for correction of both scan-induced imperfections and preexisting structural damage on the original specimen. A multiresolution modifier was applied to the retopologized mesh in Blender to increase its density, allowing us to sculpt finer details, and in sculpt mode, various brushes were used to accurately shape anatomical structures with the assistance of the overlying color textures. To assess our method's effectiveness, we engaged 42 neuroanatomy students to evaluate 84 anatomical structures across three versions of the specimen: the original, the initial scan, and the final model. Statistically significant improvements in detail and clarity were observed in the final model, confirming the success of our approach in restoring degraded and missing features. This method enables the digital preservation of cadaveric specimens for virtual use, not only allowing students to explore anatomy in immersive VR and AR environments but also facilitating 3D printing of their models when needed. Ethical approval for the work conducted was granted by the Bezmialem Vakif University Ethics Board. (No: E-54022451-050.05.04-50887)

Session 6: 3D Modelling

10 minute sponsor talk

Enatom: How Dutch UMCs Designed the Smart Dissection Room

Yorik van Overloop, Enatom

Session 6: 3D Modelling

JOURNAL OF ANATOMY BEST PAPER PRIZE 2023

Synchondrosis fusion contributes to the progression of postnatal craniofacial dysmorphology in syndromic craniosynostosis

Yukiko Hoshino [1 2], Masaki Takechi [1 3], Mehran Moazen [4], Miranda Steacy [5], Daisuke Koyabu [1 6], Toshiko Furutera [1 3], Youichirou Ninomiya [7], Takashi Nuri [8], Erwin Pauws [5], Sachiko Iseki [1]

[1]Department of Molecular Craniofacial Embryology, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University (TMDU), Tokyo, Japan; [2]Office of New Drug V, Pharmaceuticals and Medical Devices Agency (PMDA), Tokyo, Japan; [3]Department of Anatomy and Life Structure, Juntendo University Graduate School of Medicine, Tokyo, Japan; [4]Department of UCL Mechanical Engineering, University College London, London, UK.; [5]Institute of Child Health, Great Ormond Street, University College London, London, UK; [6]Research and Development Center for Precision Medicine, Tsukuba University, Tsukuba, Japan; [7]Research Organization of Information and Systems, National Institute of Informatics, Tokyo, Japan; [8]Department of Plastic and Reconstructive Surgery, Osaka Medical and Pharmaceutical University, Osaka, Japan.

J Anat. 2023 Mar;242(3):387-401. doi: 10.1111/joa.13790. Epub 2022 Nov 17.

Syndromic craniosynostosis (CS) patients exhibit early, bony fusion of calvarial sutures and cranial synchondroses, resulting in craniofacial dysmorphology. In this study, we chronologically evaluated skull morphology change after abnormal fusion of the sutures and synchondroses in mouse models of syndromic CS for further understanding of the disease. We found fusion of the inter-sphenoid synchondrosis (ISS) in Apert syndrome model mice (*Fgfr2*$^{S252W/+}$) around 3 weeks old as seen in Crouzon syndrome model mice (*Fgfr2c*$^{C342Y/+}$). We then examined ontogenic trajectories of CS mouse models after 3 weeks of age using geometric morphometrics analyses. Antero-ventral growth of the face was affected in *Fgfr2*$^{S252W/+}$ and *Fgfr2c*$^{C342Y/+}$ mice, while Saethre–Chotzen syndrome model mice (*Twist1*$^{+/-}$) did not show the ISS fusion and exhibited a similar growth pattern to that of control littermates. Further analysis revealed that the coronal suture synostosis in the CS mouse models induces only the brachycephalic phenotype as a shared morphological feature. Although previous studies suggest that the fusion of the facial sutures during neonatal period is associated with midface hypoplasia, the present study suggests that the progressive postnatal fusion of the cranial synchondrosis also contributes to craniofacial dysmorphology in mouse models of syndromic CS. These morphological trajectories increase our understanding of the progression of syndromic CS skull growth.

Session 7: Looking Forward

YOUNG INVESTIGATOR

Assessing the Impact of Community Engagement in Anatomy: Insights from a World Anatomy Day Event in Birmingham

Paula García López[1], Jemima Chukwu[2], Leandros Rapteas[2]
[1]The University of Bath, Bath, UK, [2]The University of Birmingham, Birmingham, UK

@paula_gar_lo, @itz_Jemima

World Anatomy Day is celebrated annually on the 15th of October, in memory of Andreas Vesalius, the father of modern human anatomy. Recognising a need for public engagement in the anatomical sciences, the Human Anatomy Unit at the University of Birmingham hosted a community-centred event in October 2024. The event was designed to explore different body systems through interactive activities for all ages. Activities included the use of anatomical models, body painting, and anatomy-based games. The event welcomed 234 guests, comprising of 153 adults and 87 children. To evaluate attendees' experiences, feedback surveys were administered in print and online formats. The survey gathered demographic data and responses on a Likert scale, multiple-choice, and open-ended questions. Quantitative data were analysed descriptively to summarize demographic distributions, presented as frequencies and percentages, while open-ended responses were analysed using thematic analysis to identify key themes. A total of 29 participants consented to and completed the questionnaire. Respondents varied in age, with 34.5% (10) under the age of 16, followed by 24.1% (7) in the 35-44 age group. Ethnic diversity was notable, with representation from White British, Mixed, Indian, Bangladeshi, Pakistani, and African backgrounds. Overall satisfaction with the event was high, with 89.7% of respondents rating their experience positively (4 or 5 on a 5-point scale). Additionally, 86.2% reported an increased awareness of human anatomy following their participation. The level of engagement was reflected in the time participants spent at the event, with 55.2% of attendees engaging in activities for 30 to 60 minutes, followed by 24.1% who stayed for 60 to 120 minutes. Open-ended responses revealed that participants appreciated the interactive and educational nature of the activities. In terms of content, participants highlighted the value of interactive activities. Suggestions for larger venues and more adult-focused content emerged as areas for potential improvement. The enthusiasm for future events demonstrates the impact of such public engagement initiatives in promoting anatomical sciences. Participants provided consent to participate in the survey and for their responses to be used in research. The event and its evaluation process adhered to ethical guidelines set by the University of Birmingham. Institutional ethical approval is currently under review.

800

Session 7: Looking Forward

The Art of the Brain: creating an online exhibition of public anatomical artwork

Victoria McCulloch, Thomas R. Clarke and Jennifer Z Paxton
Anatomy@Edinburgh, Edinburgh Medical School: Biomedical Sciences, The University of Edinburgh, Edinburgh, Scotland, UK

@vm_illustration, @Dr_JZP, @ATLASfacilityEd

Anatomy is a very popular subject with the public. To address this interest, we focus on providing useful and engaging anatomy events for the general public to teach anatomically-relevant information in a relaxed and creative environment. This study investigated the use of combining 3D-printing, plaster-casting and curated painting sessions, to teach the anatomy of the human brain. We focussed on providing an engaging event and also a longer-term display for preserving the unique anatomical artwork in a digital online exhibition. A digital human brain model was obtained from the National Institutes for Health print exchange (https://3d.nih.gov/) in .stl format. This dataset was sectioned sagittally to separate the two brain hemispheres. Each hemisphere was then 3D-printed (UltimakerS5 printer), in tough white polylactic acid. Once printed, the models were cast in silicone (Kemsil, UK) and set overnight. 3D-printed models were then carefully removed from the silicone to produced flexible moulds of right and left hemispheres. Moulds were used to create 3D plaster models using 'plaster of Paris' (Mouldmaster, UK), left to dry for >3 hours. Once removed, the plaster brains were air-dried for > 48 hours before use in our public engagement event. Sessions began with a short talk alongside a worksheet used to guide participants through the anatomy of the brain prior to, and during, the painting session. Painting pattern was driven by participants, with some opting for an anatomical approach and others creating a more abstract design. Participants received one model each and could take their painted model home. Before leaving, digital photographs were taken of each brain hemisphere, as well as structured light scans for online exhibition display (Artec Spider Scanner). A service evaluation was conducted to assess the success of this event (n=4). Participants enjoyed this event with overall ratings of 100% for enjoyment, organisation, painting increasing brain knowledge and for learning new information. All participants agreed they would welcome more events with different organs demonstrating the desire for future interactive public engagement using this combination of 3D-printing and an arts-based approach. We have organised future events to increase evaluation and digital display of these anatomical artworks.

821

Session 7: Looking Forward

INVITED SPEAKER

Recent Advances in Medical Imaging: AI Demystified

Professor Bogdan J. Matuszewski
University of Central Lancashire, Lancashire, UK

The talk will focus on the application of AI (machine learning) techniques in medical imaging to address challenges in the prevention, diagnosis, and treatment of diseases. Emphasis will be placed on explaining key machine learning concepts and state-of-the-art algorithms, along with their advantages and limitations. The discussion will also cover the growing push to deploy machine learning in clinical practice, examining both the scientific advancements and the practical challenges of integrating AI systems into healthcare.

P 1 Applying Gamification Methods in Anatomage Series of Consolidation Sessions: Enhancing Engagement and Retention

Hanna Bondarchuk, Lauren Singer, Lily Evans, Ifeoluwa Agbeja, Stuart Medhurst, Siobhan M. Moyes
Peninsula Medical School, University of Plymouth, Plymouth, UK

The challenge of engaging students in anatomy education is a persistent issue through the ages. Nowadays, anatomy teaching is supported by advances in technology, which offer opportunities to enhance learning via interactive methods. The extracurricular Peninsula Anatomy Award series of sessions presents a promising model for anatomy education through interactive and technology-driven sessions, promoting student engagement and ultimately improving academic performance, integrating gamification methods into anatomy education. These small-group sessions occur at the end of each case unit (10-11 each academic year) and allow students to test their understanding of the topics and explore them in further detail with advanced questions and clinical relevance. Sessions are student-focused but guided by anatomy demonstrators providing support with difficult concepts. For Year 1 students there are Anatomage quizzes, guided virtual anatomy 'constructions' and 'dissections', while for Y2, clinical scenarios and 'ward rounds' directed towards the clinical anatomy and anatomical understanding of the MLA pathologies are created where peculiarities of the region are further studied. Gamification approaches have been included to create a fun and engaging atmosphere. These approaches include the use of quizzes, also students have to collect 6 stamps (one per activity) in order to attend the end of year activity, culminating in cash prizes. The event is a deep review of all anatomy content from the whole year in shape of a competitive quiz where the most knowledgeable and the quickest students who get the highest score win a monetary prize. All final participants get a certificate for their portfolio. The aim of this new initiative is to increase engagement and comprehension. This is driven by the interactive, competitive and enjoyable format of sessions that help in preparation for assessments by fostering deeper anatomical understanding and retention, improving cognitive focus. Reinforcement of anatomy after each case unit enhances long-term understanding. The integration of gamification in anatomy education through the Anatomage Table's quizzes and clinical scenarios encourages active participation and self-directed study fostering collaboration among students, encouraging peer learning and discussions. This poster outlines the theory and implementation of the Peninsula Anatomy Awards, including staff and student feedback and plans for the future.

YOUNG INVESTIGATOR

P 2 Mandibular metric-based sex estimation in Asian populations (*Homo sapiens*): A novel OPLS-LDA framework

Sumar Chan, Newman Caddies, Sameer Dhumale, Abduelmenem Alashkham
Anatomy, School of Biomedical Sciences, University of Edinburgh, Edinburgh, United Kingdom

Accurate sex estimation is paramount in forensic anthropology and bioarchaeology. One of the ideal candidates for skeletal sex estimation is the mandible, given its pronounced sexual dimorphism and high resistance to postmortem damage. Nevertheless, metric analysis, widely employed to develop mandibular sex estimation models, is mainly limited by the population-specific nature of sexual dimorphism and the influence of confounding factors. This pilot study aims to revolutionise sex classification methods for Asian populations through the innovative integration of Orthogonal Partial Least Squares (OPLS) for dimensionality reduction and Linear Discriminant Analysis (LDA) for evaluating mandibular metrics. This work implemented an innovative statistical approach to an existing dataset on Indian and Malay mandibles in the Anatomical Museum Skull Room, University of Edinburgh, regulated by the Human Tissue (Scotland) Act 2006. A total of 109 dry adult mandibles (85 males, 24 females), predominantly sourced from the late 19th century to minimise the influence of modern admixture, was analysed, measuring 16 key parameters. OPLS was utilised to isolate sex-relevant variations, followed by univariate and multivariate LDA to achieve robust classification, with cross-validation performed to ensure reliability. OPLS analysis showed prominent sex-predictive variation and minimal non-predictive variation, indicating the robust predictive ability of mandibular measurements. Nine robust parameters identified (with VIP score > 1) were incorporated into LDA. The results indicated high cross-validated accuracies ranging from 75.5% to 87.4% for univariate LDA and from 82.5% to 85.4% for multivariate LDA, with maximum ramus length identified as the most significant predictor (87.4%). This pilot study establishes a reliable framework for sex estimation based on mandibular parameters in pooled Asian populations, offering significant implications for forensic and bioarchaeological applications. The effectiveness of OPLS in eliminating confounding factors was highlighted, enhancing the robustness of the findings. Future research is recommended to extend these methodologies to other Asian subgroups and develop LDA models for fragmented mandibles, improving the practicality of sex estimation techniques in forensic contexts. Ethical statement: this study received ethical approval (AMERGE no. 24-AM-014) and was conducted in Anatomy, University of Edinburgh, regulated by the Human Tissue (Scotland) Act 2006.

YOUNG INVESTIGATOR

P 3 Stepwise visualisation of subcortical topographical anatomy via the Klinger technique and smartphone photogrammetry: a proof-of-concept study.

Dearbhla Cullinane[1], Basil Lim[2], Denis Barry[1]
[1] Discipline of Anatomy, School of Medicine, Trinity College Dublin, Dublin, Ireland; [2] Tisch School of the Arts, New York University, New York

@AnatomyTrinity @DearbhlaCulli @DS_Barry

An understanding of brain topography is a fundamental learning component of undergraduate medical education. However, due to limited curricular contact time and the technical challenges involved in dissecting formalin-preserved brains, white matter dissections are often not included in routine practical anatomy teaching. Consequently, the reduced emphasis on tactile neuroanatomy exploration results in surface-level approaches to learning and is associated with poorer learning, leading to student-reported neurophobia. 3D scanning of neuroanatomical structures presents a potential solution to neurophobia offering students alternate modes to learn neuroanatomy; however, these technologies require advanced post-scanning processing and resources. Here we showcase a novel proof-of-concept study describing the utility of the Klinger method to produce insightful white matter dissections of a formalin-preserved cadaveric brain, and the subsequent creation of high-fidelity 3D replications at each dissection step using the readily available smartphone application. The brain and dura mater were first extracted from the cranium and immersed in 10% formalin solution for six months. The brain was then washed under fresh cold water and sectioned in the mid-sagittal plane. Each cerebral hemisphere was stored in a chest freezer at -17 ℃ for two weeks. Hemispheres were then thawed under running water prior to dissection and re-frozen and thawed between dissection sessions. Lateral-to-medial and medial-to-lateral dissections were performed. High-quality 3D models of each dissection step were generated using the ubiquitous photogrammetry-based Polycam application. Scanning artefacts were cropped and edited using the open-source editing software Blender before housing the final 3D models on SketchFab. The 3D neuroanatomical models generated uphold an exceptionally high level of visual fidelity and are comparable to other technologically advanced systems. The preservation of neuroanatomical dissections in this manner has the potential to maximise multiple means of representation in neuroanatomy education helping to alleviate neurophobia, enhance spatial understanding of white matter tracts, and encourage educators to develop in-house teaching resources. This study addresses the challenge of strengthening neuroanatomy education, providing a scalable solution for broad impact in anatomy curricula. Ethics statement: The human cadaveric brain utilised in this study was sourced from the anatomy donation programme at Trinity College Dublin with consent for research provided at the time of donation. Ethical approval was not required.

YOUNG INVESTIGATOR

P 4 Multiple Anatomical Variations in extensor Tendons of the Posterior Forearm

Emelia Deane[1,2], Claire Lewis[1], Denis Barry[1]
[1]Trinity College Dublin, Dublin, Ireland [2]University of Galway, Galway, Ireland

@EmeliaDeee @AnatomyTCD @DS_Barry

Anatomical variations of the extensor musculature in the posterior forearm, hold significant importance due to their implications for surgical and diagnostic accuracy. This report focuses on the presence of a bilateral duplicated extensor pollicis longus muscle (dEPL), in an 84-year-old female cadaver during routine dissection at Trinity College Dublin. The dEPL represents a rare yet important variation due to its potential to complicate surgical procedures, contribute to compressive symptoms, or result in imaging misinterpretation. In this case, the dEPL demonstrated unique bilateral features. On the left side, it bifurcated at the carpometacarpal joint, with one branch inserting into the distal phalanx of the thumb and the other into the radial aspect of the index finger's palmar ligament at the MCP joint. On the right side, the dEPL inserted solely into the distal phalanx of the thumb without bifurcation but shared fibers with the extensor indicis (EI) and extensor pollicis longus (EPL). The presence of an additional EPL muscle within the extensor compartments has the potential to increase friction or crowding. Additional variations in the extensor apparatus were also noted, including early bifurcation of the extensor digiti minimi tendons (a relatively common finding), splitting and rejoining patterns of the extensor digitorum., with no direct tendon to the 5th digit. The identification of a dEPL is of particular importance in avoiding diagnostic errors and surgical complications. Its role in inflammatory conditions such as de Quervain's tenosynovitis further highlights the need for detailed anatomical knowledge in surgical planning and imaging interpretation. Approval for the use of human cadaveric specimen was granted by the Discipline of Anatomy, Trinity College Dublin in accordance with the Anatomy Act 1832 as outlined in Section 106 of the Medical Practitioners Act 2007.

P 5 Bringing the Past to Life: Pathology Lab Catalogue.

John M Delieu[1,2], Alice Amyes[1], Andrew Biggs[1], Anthony Brindley[1], Nia Hughes[1,]
[1]Robert Jones & Agnes Hunt Orthopaedic Hospital NHS Foundation Trust, Oswestry, UK; [2]School of Medicine, College of Health & Life Sciences, Aston University, Birmingham, UK.

Many interesting, rare, historical and modern anatomical specimens are held within the Licensed Premises of the Robert Jones & Agnes Hunt (RJAH) Anatomy Department. The accepted procedure for maintaining a library of anatomical specimens, both pathological and normal, is to preserve the tissue in either a glass or Perspex receptacle containing a preserving fluid. There are limitations to the process. Firstly, they require a high maintenance threshold, being topped-up with fluid on a regular basis and they may even leak, therefore requiring a pot repair. In the worst-case scenario, the pot and specimen can be dropped, exposing the immediate area a risk to toxic chemicals. There are also legislative restrictions on the use of human tissue samples. The Human Tissue Act of 2004, however, does not cover images. The purpose of this project is the feasibility of using Photogrammetry to record 3-D colour images from historical potted anatomical human specimens. Hence, to develop an interactive catalogue of the hundreds of potted human specimens. The initial idea was using video capture of a rotating structure, 360 degree's, which was then uploaded and edited. However, another idea that transpired was the use of an iPhone with an App called Scanverse. A large potted specimen was placed on a stationary flat surface, and the operator walking around the 360 degrees, scanning. Therefore, digitising the specimen and the software rendering it into a 3-D image. This proof of concept is to develop an interactive catalogue of the RJAH Human Specimens. The catalogue will include high resolution images and information for each of the specimens held within the trust. This will demonstrate the feasibility, effectiveness, and potential impact of the platform on improving learning outcomes with potential applications to include: medical education, research, clinical practice, public health, quality control and standardisation, professional development, patient care.
Ethics Statement: All Relevant Material pre-dates the Human Tissue Act.

P 6 Can Gamification and Interactive Summaries Enhance Engagement and Knowledge Retention in Anatomy Education?

Rehab Eltarhoni
Section of Anatomy, City St George's, University of London, London, UK

Interactive summaries at the end of practical sessions are a vital tool for consolidating learning, providing students with an opportunity to review and reinforce key concepts in an engaging manner. Activities such as verbal quizzes and educational games encourage active participation, making learning both enjoyable and effective. This study emphasises the critical role of these summaries, including gamified activities such as "*Which Structure Am I?*", in enhancing student engagement and knowledge retention. Data were collected from two cohorts: first-year undergraduate (n=200) and first-year graduate (n=79) students at St George's, University of London (SGUL). Feedback, obtained through post-lecture and practical session surveys, consistently indicated high appreciation for these interactive elements. The surveys included quantitative questions rated on a scale from 1 to 5, alongside qualitative questions for in-depth responses. Analysing feedback from different practical or lecture sessions revealed distinct patterns in student responses. Student feedback shows ratings of 4.09/5 and 4.64/5 for the practical experience among undergraduate and graduate students, respectively. Gamification was highlighted as a significant factor in boosting engagement, transforming learning into a dynamic and competitive experience without complex or expensive setups. Positive student feedback underscores that simple, well-designed games can significantly enhance the learning experience. Quizzes, integral to the interactive summaries, received overwhelmingly positive responses. They play a crucial role in making sessions more engaging and promoting active learning by reinforcing material, providing immediate feedback, and motivating deeper content engagement. Feedback suggests that the clarity and structure of quiz questions are pivotal for their effectiveness. The analysis underscores the importance of interactive summaries and gamification in educational settings, significantly enhancing student engagement and knowledge retention. Positive student feedback supports the continued use and development of these methods, emphasising their value in academic environments. No ethical approval was required.

P 7 Anatomy, Anatomage, Ultrasound – Integrated Pre-clinical training

Marise Heyns
School of Medicine, Faculty of Life and Health Sciences, Ulster University, Derry/Londonderry, UK

The School of Medicine, Ulster University, aims to develop a new generation of doctors for the 21st century who are able to deliver whole person care with skill and compassion, as members and leaders of diverse clinical teams, in partnership with patients and clients. This presentation will demonstrate the strategies employed at Ulster University for Anatomy learning, and will present the teaching resources currently employed to enhance learning. We utilise a Teaching with Technology approach and combine Anatomage Tables with medical imaging and Ultrasound. Medical imaging improves the information collected from physical examination and a general understanding of the different imaging modalities and a basic skill in its interpretation are becoming increasingly important in medical practice. Medical imaging education has undergone immense transformation and changes in structure, content and delivery of teaching, largely due to recent advances in technologies. It is therefore important to include the latest developments in medical imaging in the medical curriculum, and students should acquire the basic knowledge of medical imaging and its use in practice, regardless of their eventual specialty. Ultrasound is used in almost all medical specialties, and globally, medical schools are integrating ultrasound education in their curriculum. Ultrasound technology enhances the physical examination, providing additional information and enabling better diagnostic care. The use of ultrasound as a first line modality means medical students are likely to encounter this technology early and often in their clinical practice, and it is therefore essential that we train our students before they begin clinical placements. Not only has it been demonstrated that it is possible to successfully train medical students in the critical skill of image acquisition and image interpretation, ultrasound has be proven to be valuable in understanding human anatomy and learning clinical skills. There is an undeniable interdisciplinarity between Anatomy and Medical Imaging, and technology offers the opportunity to link basic sciences with clinical approaches. The presentation will demonstrate the utility of Anatomage tables combined with Ultrasound to enhance the learning of Anatomy in a non-cadaveric approach. This study did not require ethical approval.

YOUNG INVESTIGATOR

P 8 Forensic Analysis of the Human Clavicle: Evaluating the Accuracy of Structured Light Scanning

Ellie M. Horne, Hunter Auck, Jennifer Z. Paxton, Stephen J. Maclean
Anatomy@Edinburgh, Deanery of Biomedical Sciences, College of Medicine and Veterinary Medicine, University of Edinburgh, Edinburgh, United Kingdom

@elliemhorne03 @hauck_23 @Dr_JZP @BoneDoctorPhD @ATLASFacilityEd

Structured light scanning (SLS) is an emerging technology within the anatomical disciplines of osteology and forensic anthropology, allowing for the digitisation of human remains. Possible applications of SLS in such contexts include creating digital representations of remains that can then be easily shared with others where appropriate or necessary, and stored long-term for potential future analysis. The aim of this study was to evaluate the accuracy and repeatability of SLS and its applicability in a forensic setting through the analysis of human clavicles. Fifteen human clavicles were selected from the Osteology Teaching Collection held by the University of Edinburgh. Three digital models were generated for each clavicle using two structured light scanners: the Artec Space Spider and the Einscan ProHD with Industrial Pack and Texture Pack accessories. Per scanner, two repeated models were created by the primary observer, and the third produced by a second observer. To estimate the sex and age of the remains, six osteometric measurements and four morphological observations were carried out on both the physical and digital clavicles. Physical osteometrics were carried out using digital Vernier calipers and a measuring tape, whilst digital measurements were carried out using the Artec Studio 18 Professional software. Each measurement and observation was carried out three times to allow for the generation of an average data point. The digital models produced displayed very similar metric results in comparison to each other as well as to the physical clavicles (min. $p = 0.59$, max. $p = 0.999$). However, this was not the case for the morphological results as the SLS scanners were unable to accurately capture finer textural details (min. $p = 0.001257$, max. $p = 0.8496$). This study shows evidence to suggest that SLS can be used to generate digital bone replications with relative accuracy, however they are more applicable for use during metric analysis only. Further research is needed to develop specific protocols for the analysis of digital remains in a forensic context. Ethical approval for this study was granted by the Anatomical Museum Ethical Research Gateway (AMERGE, Edinburgh) [24-AM-011].

YOUNG INVESTIGATOR

P 9 Extended reality tools: A replacement or an adjunct for anatomy education.

Tor Hormbrey, Deborah Merrick, Sadia Wazir Khan
The University of Nottingham, Nottingham, United Kingdom

@SadiaWK

Anatomy education is fundamental for medical students' development, forming the basis for accurate diagnosis and success in certain specialties. However, reduced time in anatomy labs due to increased focus on clinical and interprofessional skills necessitates effective alternatives to traditional teaching methods. Extended Reality (XR) tools, including Virtual Reality (VR) and Augmented Reality (AR), are emerging as potential solutions. This study was aimed to evaluate the effectiveness of VR and AR tools in comparison to conventional teaching methods in anatomy education. Participants were recruited from first- and second-year medical students at the University of Nottingham. After obtaining informed consent, the participants were introduced to the VR and AR tools through a tutorial and were then divided into three groups (A, B and C). Each participant was presented with anatomical content in one of the three teaching modalities: traditional instruction (using cadaveric material), AR, or VR. Instruction sheets were created relevant to each teaching modality and each participant spent approx.15 minutes on each station. Learning outcomes were assessed through pre- and post-intervention quizzes, and a perception survey evaluated user experience. The pre- and post-intervention quizzes contained questions testing knowledge recall and spatial awareness. All data was collected anonymously using participant numbers and was analysed for trends and significance. The analysis of post-intervention quiz responses revealed that participants who engaged with the content through extended reality tools (AR and VR) demonstrated significantly higher performance on questions pertaining to deep anatomical structures. However, their performance was comparatively lower on questions assessing knowledge of superficial structures. This trend was similarly observed in questions evaluating spatial awareness and knowledge recall, indicating a potential modality-specific influence on these cognitive domains. Students showed a positive response to the use of XR tools, citing their engaging nature and potential for enhanced visualization. Negative feedback focused on perceived limitations of XR tools, such as technological reliability and user interface issues. Ethics statement: This study adhered to rigorous ethical standards approved by the University of Nottingham, School of Life Sciences, Research Ethics Committee (Reference: A300924SK). Informed consent was obtained, and participant anonymity was maintained.

YOUNG INVESTIGATOR

P 10 Thinking Materially: physical models as conceptual tools in assessing cellular forces

Jeena Hunjan[1], Les Bicknell[2], Daksha Patel[1], Leigh Wison[1,] Richard Wingate[1]
[1]King's College London, UK, [2]Norwich University of the Arts, UK,

Anatomical models have a long teaching tradition where wax sculptures offered a means of preserving otherwise non-permanent dissections. However, the late 19th century saw the brief manifestation of wax as a research tool when Wilhelm His and the Ziegler family made accurate scale models of microscopic 3D forms, combining sectioning, photographic enlargement and synthetic anatomy. His also published experiments in rubber, lead, leather and wire as a way of explaining developmental mechanics. We are interested in whether this approach be rehabilitated both as a didactic and a research tool. To explore this, we explored whether physical modelling is an effective tool to explain the mechanics of growth of the roof plate epithelium of the fourth brain ventricle in the larval zebrafish. The roof plate is a single cell thickness epithelium of squamous cells that responds to forces imposed by the growing brain to maintain a dome like covering over the cerebral spinal fluid filled neural tube. Roof plate cells change shape, position, are lost by extrusion or added by division to enable this flexibility in a system that seems to be regulate by mechanical tension. Using in vivo time lapse recordings, we assessed parameters of cell shape and size at specific points and built material models using textiles, glue and laser cut cardboard and 3D printing to both explain and explore developmental forces. We used 3D prints as stencils to construct mosaics, testing the differences between actual and ideal distribution of membranes. This allows to ask questions such as how well a transformation of the epithelium into a flexible fabric allows us to explore the effects of stretch and pull on cell shape. We also explored the Japanese paper technique of Takuhon as a means of explaining the problems encountered in accurately charting the dimensions of cellular elements on a surface of a manifold. Can this didactic tool also be a means to devise better ways of plotting cell shape in and size in three dimensions? We discuss how these approaches help explain a model experimental system in teaching but furthermore enrich conversations of future experiments problems.

YOUNG INVESTIGATOR

P 11 Analysis of hepatic venous circulation veins with three-dimensional (3D) reconstruction

Nizameddin Fatih Karamus[1,2], Tugrul Ormeci[3]
[1] Department of Anatomy, Altinbas University, Istanbul, Türkiye; [2]Department of Anatomy, Istanbul Medipol University, Istanbul, Türkiye; [3]Department of Radiology, Istanbul Health and Technology University, Istanbul, Türkiye addresses

The primary objective in liver transplantation or tumor resection surgery is to accurately identify key vessels to prevent damage to the healthy liver parenchyma. Planning such operations using two-dimensional images involves a process that requires the surgeon to visualize and conceptualize the operative intervention lines in three dimensions (3D), necessitating extensive anatomical knowledge and surgical experience. With the advent of 3D reconstruction in radiological imaging, it has been possible for clinicians to plan liver surgery in a shorter time. The aim of the study is to evaluate the anatomical and morphological features of the liver and hepatic venous structures with 3D reconstruction methods, to examine the reliability of the results obtained and to determine their clinical role in individuals who are eligible to be liver donors. This retrospective study included 51 liver donors. The age range of the cases was between 19-49 years, with 34 males and 17 females. Contrast-enhanced CT examinations were conducted in arterial, portal, and hepatic venous phases, allowing for diameter measurements, 3D drainage area analysis, and 3D volumetric assessments of the liver and liver density using the maximum intensity projection (MIP) and volume rendering technique (VRT) on the syngo.via Workstation VB30B. Portal vein branching variations were detected in 14 of the 51 cases. Hepatic vein branching variations were found in 14 cases, and inferior right hepatic vein (IRHV) variations were identified in 18 cases. In some instances, both types of variations were observed simultaneously. Diameter measurements conducted using the reconstruction methods indicated that the MIP technique was more reliable than VRT. In volumetric evaluations, the right posterior portal vein (RPPV), left portal vein (LPV), left hepatic vein (LHV) drainage areas, and total liver volume were greater in males compared to females., Statistically significant correlations were observed between the RPPV, LPV, and IRHV drainage area volumes and diameter lengths. The fact that this process was completed in a short time without any invasive procedures underscores the importance of radiological imaging methods in the assessment of liver anatomy. Ethical approval for this study was granted by Istanbul Medipol University Non-invasive Clinical Research Ethics Committee (Number 666).

YOUNG INVESTIGATOR

P 12 Classification of fissure for round ligament and pons hepatis in human cadavers

Nizameddin Fatih Karamus[1]; Elif Sena Yaz[1]; Ahmet Ertas[2]; Omer Alp Tastan[2]; Osman Coskun[3], Hulya Erbagci[1]

[1] Department of Anatomy, Altinbas University, Istanbul, Türkiye; [2]Department of Anatomy, Istanbul University-Cerrahpasa, Istanbul, Türkiye; [3]Department of Anatomy, Istanbul University, Istanbul, Türkiye

Ligamentum teres hepatis (LTH) is situated in fissure for ligamentum teres (FLT). In some cases, this fissure may present anatomical variations where the fissure may be partially or completely covered by liver tissue (pons hepatis) or a fibrotic band. The study aimed to evaluate the incidence, morphometric characteristics and fissure structure of these variations in liver human cadavers. Within this study, 30 formalin-fixed livers were examined. We evaluated FLT variations based on Cawich classification, which divides them into 4 main groups and 14 subgroups. Type I represents the standard anatomical configuration. In type II, the FLT is surrounded by a fibrous band. For type III, a projection of hepatic parenchyma partially envelops the FLT, leaving it still visible. Type IV pons hepatis involves the hepatic parenchyma forming a continuous bridge over the FLT, completely concealing the fissure. We also examined pons hepatis types based on the Sugarbaker classification (Class 0-3), which indicates the degree of coverage of LTH by pons hepatis. In class 0, there is no presence of pons hepatis. Class 1 represents up to one-third coverage of the LTH, class 2 indicates up to two-thirds coverage, and class 3 denotes more than two-thirds coverage. In our study, based on the Cawich classification, type 2 was observed in 7 livers, type 3 in 2 livers, and type 4 in 10 livers. In 11 cases, there was no FLT variation. According to the Sugarbarker classification, five cases of class 2 pons hepatis and five cases of class 3 pons hepatis were observed. We were detected the presence of another type of pons hepatis covering the inferior vena cava, which is not included in any classification. Pons hepatis may affect the success of surgical procedures as it may create an anatomical blind spot in cytoreductive surgery. Considering the morphological features of these variations, complications can be minimized, and surgical outcomes can be improved. Knowing these variations may enhance radiologists' ability to avoid misinterpretation and make correct diagnoses. Ethical approval was obtained from Altinbas University Health Science Scientific Research Ethical Committee (Number 25).

P 13 Getting Started with Anatomage®: Early experiences with the Virtual Reality Anatomy Table as an adjunct to predominantly cadaveric prosection-based teaching.

Hubaira Khan, Venkatesh, Asha.
University of Aberdeen, Aberdeen, United Kingdom,

At the University of Aberdeen (UoA) Anatomy Facility, the mainstay of gross anatomy teaching is bequeathed human cadaveric material. Recent increases in medical student numbers (a rise of over 90% in 6 years) have increased pressure on our constrained cadaveric resource. We wanted to investigate whether using a virtual reality table (Anatomage ®) as an adjunct to existing prosection-based teaching would be accepted by and would benefit our students. The Anatomage Table (AT) allows visualization, rotation and 3D exploration of anatomical structures. Most existing literature on AT use either focuses on AT effectiveness as a sole teaching tool or whether students who work on AT have an enhanced knowledge gain than those working on cadaveric materials. We iteratively created short exercises (called 'presets') for students to complete using a self-directed team-based approach without staff supervision. Step-by-step worksheets aligning with existing learning outcomes were created. For the first student block (Gastrointestinal Anatomy) twenty optional 45 min sessions were timetabled for groups of 15 Year 2 MBChB. For the subsequent (Head and Neck Anatomy) block, students were asked to reserve a slot on AT to complete the presets. Student perceptions of its use were evaluated through a question: "I found AT a useful resource" through the anonymized student course feedback forms (CFF). 77% respondents agreed in the GI block, and 53% in Head and Neck. 12% and 13% respectively disagreed. Those who chose 'Not Applicable' increased from 12% to 34%; perhaps indicating that when the sessions were not timetabled students were less likely to engage with AT, especially when other curricular demands were pressing. Further quantitative and qualitative analyses are required however AT seems to have the potential to add to our repertoire of teaching tools. Students on the whole seem to find using AT beneficial. Creating presets is an effective way to integrate AT-use, however, it may be helpful to timetable such sessions as team-based self-directed activities. This is a service evaluation of existing teaching sessions; no ethical permission was required. Survey results were extracted from anonymised student course feedback reports from UoA Year 2 MBChB students.

P 14 The first 3D digital atlas of *Chamaeleo calyptratus,* a modern model organism for the education of reptile cranial anatomy and function

Alice Leavey, Eloy Galvez Lopez, Laura Porro
Division of Biosciences, University College London, London, United Kingdom

@AliceInEvoland

Unlike other squamate reptiles, the veiled chameleon, Chamaeleo calyptratus, is unique in that their development is only at the early gastrula stage at the time of oviposition, meaning that females do not need to be sacrificed to be able to study embryonic growth. This, combined with its simple husbandry requirements and large clutch sizes, has led to C. calyptratus being adopted as a model system for the study of reptile development, biomechanics and evolution. Teaching various topics across the biosciences has also seen chameleons used as a common example of ecological niche specialisation, given their unique approach to climbing and prey capture. Despite this, there has been a distinct lack of information on chameleon soft tissue anatomy, especially in a format that is accessible for educators. Here, we present the first 3D digital atlas of C. calyptratus. Using contrast-enhanced microCT scans, we have digitally dissected the cranial anatomy in the adult specimens of both males and females. Our interactive 3D digital models of this emerging model organism will be made publicly available online, enabling students the ability to perform virtual dissection labs in the classroom. These models can be used for education on vertebrate anatomy and function, where it demonstrates how major anatomical differences, such as variation in bone contacts and muscle topology, could be linked to variation in cranial function between sexes. Furthermore, these models can be used in biomechanical models, thus contributing towards the education of biological function. No ethical approval was required as no live animals were sacrificed for the purposes of this study.

YOUNG INVESTIGATOR

P 15 Investigating the effectiveness of different concentrations of Lugol's solution on visualising the facial musculature of the rhesus macaque (*Macaca mulatta*) using topical and perfusion staining.

Isabel H. Leighton, Charles W Ritchie, Craig Molloy-Humphreys
Human Anatomy Resource Centre, University of Liverpool, Liverpool, UK

Facial musculature in non-human primates, particularly rhesus macaques, remains understudied due to challenges in tissue acquisition and distinguishing muscle fibres from surrounding structures. DiceCT scanning, which enhances soft tissue visibility using iodine-based stains like Lugol's solution, is limited by time and technological constraints. This study explores the practicality of using Lugol's stain in gross dissection to visualise muscle fibres, building on Bock and Shear's 1972 work, which yielded excellent results in visualising previously hidden jaw and tongue muscles in small birds. However, their findings have not been further investigated in recent research. 20 rhesus macaques were photographed in four key positions for later comparisons. An initial experiment replicating the topical method used by Bock and Shear (1972) was completed and then was further developed. Despite the adaptations completed, the visibility of facial musculature of rhesus macaques did not improve with topical method of staining as expected. However, perfusion experiments demonstrated that perfusing 0.75% LS for 24hrs was the most effective way of increasing the visibility of the facial musculature. The method developed was then applied to N = 20 specimens. One observer recorded the muscles visible to them after staining and this data was then compared to previously published data. Photographic evidence illustrated the clear and positive effects of perfusing specimens with 0.75% LS for 24hrs, and the variability of success achieved with different methods. Comparison of data confirming the presence of different 15 muscles within rhesus macaque facial musculature. This study demonstrates the effective use of LS as a tool within gross dissection of the facial musculature. This may lead to more researchers being able to study indiscriminate muscle fibres by using the developed method. The specimens were collected and previously dissected as part of the European Research Council (ERC) funded FACEDIFF project (Grant Agreement No. 864694). Both the previous dissection, and the current work falls, under the AWCO245 ethical approval from the University of Liverpool Animal Welfare and Ethics Committee.

P 16 Evaluating the Accuracy of Structured Light Scanning for Sex Estimation in Skeletonised Human Remains

Stephen J Maclean[1], Hunter Auck[1,2], Ellie M Horne[1], and Jennifer Z Paxton[1]
[1] Anatomy@Edinburgh, College of Medicine and Veterinary Medicine, University of Edinburgh, Edinburgh UK.[2] School of Medicine, University of St Andrews, St. Andrews, UK.

@BoneDoctorPhD @hauck_23 @elliemhorne03 @DrJZP

Structured light scanning (SLS) technology is gaining recognition in anatomy and biological anthropology for generating accurate three-dimensional (3D) digital models of human remains. Recent research has demonstrated its effectiveness at capturing anatomical details with a high degree of metric accuracy, supporting its use in anatomical education, research, and in the digital preservation of historic anatomical collections. However, questions remain regarding the precision and consistency of SLS when used to analyse human skeletal structures in both anatomical and medico-legal contexts. Therefore, this study explores the effectiveness of SLS for craniometric analysis in the context of sex estimation from the human skull. Twenty-two adult human skulls of documented sex from the historic collection at the Anatomical Museum, University of Edinburgh, were scanned using the Artec Space Spider scanner [Artec 3D, Lux]. Thirteen (13) linear craniometric distances were measured on the physical skulls using digital Vernier calipers and on the 3D digital models using MeshLab software [v. 2023.12, Visual Computing Lab]. Measurements were repeated three times and averaged to minimise measurement errors. To analyse the effectiveness of SLS in sex estimation, 10 discriminant function equations were generated in SPSS for the physically-acquired data, and for the digitally-acquired data. Classification accuracies for both equation sets were generally high, with a minimum classification accuracy of 66.8% and a maximum of 81.8. When the accuracies of each modality were compared, it was found that four functions achieved identical accuracies regardless of data source, and three functions achieved a higher accuracy for each of the physical and digital data. When the digital data was used in the physically-derived equations, similar classification accuracies were returned when compared to the original function accuracy, though three equations each altered the classification of a single skull when using digital data. This comparison demonstrates that while metric accuracy of SLS scanners is generally very high, caution should be used when translating physically-derived methods to a digital environment. Subtle differences may result in less reliable results and, wherever possible specific digital equations and techniques should be applied. Ethical approval for this study was granted by the Anatomical Museum Ethical Research Gateway (Edinburgh) [24-AM-008].

YOUNG INVESTIGATOR

P 17 Neural Connection Between Human Vagus Nerve and Sympathetic Trunk

Ruaraidh McCulloch, Jenny Clancy
College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, Scotland

Vagus Nerve Simulation (VNS) is an approved therapy for treatment resistant epilepsy and has been investigated as a potential parasympathetic stimulation therapy for a wide range of conditions including heart failure, Alzheimer's disease, and chronic pain. However, the mechanisms of VNS are not fully understood, and not all patients respond to VNS treatment. Additionally, immunohistochemistry studies have detected positive tyrosine hydroxylase (TH) labelling in human cervical vagus nerve (VN). As stimulation of TH-fibres may reduce the efficacy of VNS therapy, this project aimed to determine the most effective location for VNS electrode implantation through understanding the fibre types present in the VN. The left and right cervical VNs of seven embalmed cadavers were dissected (n = 14). Of these, two had a physical connection between the VN and sympathetic trunk (ST). Neurofilament immunohistochemistry of the connection proved that a neural junction exists between the VN and ST in some humans at the cervical level. This provides potential insight into the origin of TH-positive fibres within the VN. Future research should aim to determine the fibre content of this connection as it could reveal the source of the TH-positive fibres found in the VN. If this is the case, VNS electrode placement should be above this vago-sympathetic connection to avoid stimulation of the sympathetic fibres. As this project had a limited sample size, the prevalence of this connection within the population should be researched further. Cadaveric tissue was donated for anatomical education and research under the 1984 Anatomy Act and 2006 Human Tissue Act (Scotland). Ethical approval was therefore not required by the University of Glasgow Ethics Committee.

P 18 Testing the Longevity of Painted 3D Printed Models in an Anatomy Teaching Laboratory: An Arts-Based Study

Victoria McCulloch
Anatomy@Edinburgh, Edinburgh Medical School: Biomedical Sciences, The University of Edinburgh, Edinburgh, EH8 9AG

@vm_illustration, @ATLASfacilityEd

The advancement of 3D printing technology and its inclusion into anatomical education has brought about the ability to create bespoke 3D printed anatomical resources. Although possible to 3D print in different colours, this is often expensive. Taking an arts-based approach by printing the model in one colour and painting it can be a more cost-effective route, allowing for educators to highlight specific structures important to their teaching, creating a bespoke teaching resource. However, it is important to know the longevity of the paint, especially when used alongside cadavers and prosections. The aim of the study was to test the longevity of the paint through handling with gloves on after touching prosections. Seven heart models downloaded from Thingiverse (www.thingiverse.com/thing:932606), were printed using tough white polylactic acid (PLA). To test how the preparation process of painting the 3D printed models, each model was prepared in a different way. All models were painted using Daler Rowney water-based acrylic paints, primed with Daler Rowney White Primer and finished using Montana Pro Acrylic Spray Varnish. Model 1; sanded, primed, painted and varnished; model 2: primed, painted, varnished; model 3: sanded, painted, varnished; model 4: painted and varnished; model 5: sanded, primed and painted; model 6: primed and varnished; and model 7: primed, painted, varnished. To ensure all models were identifiable, black sharpie was used to number each model before varnishing. The 7 heart models were put into the anatomy teaching laboratory with a sign asking everyone to handle the models with their gloves on for a period of 6 months. After 6 months of handling with gloves on, model 1 and 2 has small patches of paint missing. As models 3 – 7 used similar preparation methods, this warrants further investigation as to why model 1 and 2 preparation methods showed signs of wear and tear. Models 3 – 7 showed signs of longevity in the paint after 6 months in the anatomy teaching laboratory. The next stage is to implement painted 3D printed models into teaching and observe their longevity, alongside adding them to the teaching resources available outside the laboratory in the Anatomical Museum.

YOUNG INVESTIGATOR

P 19 'AnatoLingo': Can an Anatomy Linguistic Card Game Help Students Become Familiar with the Secret Language of Anatomy?

Eleni Patera
Human Anatomy Resource Centre, University of Liverpool, Liverpool, United Kingdom

@ArtedelCuerpoH1

Anatomical terminology is often characterized as the new 'language' medical students are expected to learn as part of their anatomy learning experience. Most anatomical terms originate predominantly from the Greek and Latin languages; therefore, it can be quite challenging for students to remember specific anatomical structures if they are not aware of the etymology behind each anatomical term. Many anatomical structures are named based on their shape (i.e., *cribriform*= sieve in Latin). Besides shape, an anatomical structure or its function could also be named after an element it resembles. Such elements include but are not limited to astronomy, utensils, plants, food, letters, numbers and agriculture. Familiarity with the etymology of anatomical terms can perhaps make anatomy learning more enjoyable and less challenging. A physical card game was developed to introduce first year undergraduate bachelor's students majoring in anatomy and human biology, to the secret language of anatomy as part of an introductory induction session at the Human Anatomy Resource Centre (HARC) at the University of Liverpool. The game consisted of 'anatomical term' cards and 'anatomical structure' cards. 'Anatomical term' cards included an anatomical term (i.e., hippocampus) and an icon (i.e., seahorse) that aimed to give a hint of what the anatomical term means in Latin or Greek. 'Anatomical structure' cards represented different anatomical structures of the human body, and a short description over the definition or function of the anatomical structure (i.e., part of the brain involved in the storage and retrieval of memories). The students needed to identify which icon each anatomical structure resembled, and they were expected to match each 'anatomical term' card with its corresponding 'anatomical structure' card. Through this game, students gained an insight on the various elements that the anatomical language has been influenced by. Overall, this card game aimed to showcase students how familiarity with the etymology of anatomical terms may help breakdown the voluminous subject of anatomy into more simplified concepts. This linguistic card game can be used by both anatomy educators and students and can potentially help them recall but also identify anatomical structures more easily on prosections or plastic anatomical models.

YOUNG INVESTIGATOR

P 20 Biological Sex and Asymmetry: Normative Size Variations of the Basal Ganglia and Thalamus

Eleni Patera[1], Nathan Jeffery[2]
[1]Human Anatomy Resource Centre, University of Liverpool, Liverpool, United Kingdom; [2]Institute of Life Course & Medical Sciences, Faculty of Health & Life Sciences, University of Liverpool, Liverpool, United Kingdom

@ArtedelCuerpoH1

Dysmorphic basal ganglia are putatively linked to various common motor disorders. However, the range of non-pathological variation among the morphology of the basal ganglia and the sources of covariation are not well established. This study investigated the variation patterns in the size of the basal ganglia and thalamus in left-handed white biological females (n=20) and males (n=13) aged between 45-70 years using MRI data taken from the OASIS3 repository. T1w images and associated FreeSurfer segmentations were imported into 3Dslicer (V5.6.2). Regions of interest (ROIs) which included the basal ganglia (CN: Caudate nucleus, P: Putamen, GP: Globus Pallidus), and the thalamus (T) were visualised in 3D and volumes were calculated by summating the voxel volumes. Mann-Whitney tests were conducted to test for statistically significant differences between left and right hemispheres and between biological sex. Differences between sexes for the GP, CN and P were classified as weak (p=0.04), moderate (p=0.001) and high (p=0.0002), respectively. For all four ROIs, males had larger volumes than the females (CN: +10.35%; P: +11.37%; GP: +8.09%; T: +1.49%). Two sample paired tests for asymmetry revealed significant differences for all ROIs except for the GP in the male group. In males, the right CN was larger than the left by 4.43% (p=0.001) and the left P and T were greater by 4.60% (p=0.02) and 6.87% (p=0.04), respectively. In contrast, in the female group significant differences were observed for the CN (p=0.0006) and thalamus (p=0.003) only. The right CN was larger by 4.13% whereas the left T was larger by 8.71%. Overall, this study showed that the volume of the basal ganglia is greater in males than in females, and that some ROIs were larger on the non-dominant cerebral hemisphere in both males and females despite the relation between handedness and brain dominance. Further investigation is needed to identify whether these results might be due to methodological errors (i.e., FreeSurfer subcortical segmentation overestimating the volume surface area of a ROI) or due to normal variation and different sources of variation, including for example body size scaling. No ethical approval was required for using the MRI scans from the OASIS3 repository.

P 21 'Circus of Activities': Bridging the Gap through an Induction Session

Eleni Patera[1], Alistair Bond[1], Charlotte Casey[1], Alice Davies[1], Alix Hudson[1], Louisa Hulls[1], Mae Hunter[1], Alice Maher[2], Betzy Manners[1], Amy Manson[1], Charles Ritchie[1], Paul Rothwell[1], Drew Worthington[1,] Craig Molloy-Humphreys[1]

[1] Human Anatomy Resource Centre, University of Liverpool, Liverpool, United Kingdom; [2] School of Biosciences, Institute of Systems, Molecular & Integrative Biology, Faculty of Health and Life Sciences, University of Liverpool, Liverpool, United Kingdom

@ArtedelCuerpoH1 @Craig_Anat @Alix_Hudson @MaeHunter_1 @AmyManson13 @alicedaviess19_ @Paulatoglossus @MaherAlice

The University of Liverpool offers an undergraduate bachelor's programme in Anatomy and Human Biology. Recent curricular changes resulted in first year students enrolled in this programme not receiving specific anatomy modules until they progress to their second year. Throughout the past decade, an induction session titled 'Circus of Activities' (CoA) is given to the students at the beginning of each academic year. The aims of the CoA are to: (1) introduce students to the Human Anatomy Resource Centre (HARC) facility and staff, (2) give students the opportunity to get to know their peers via different ice-breaker activities and (3) establish a professional relationship with them. During the CoA, students are divided into groups of 4-6 and rotate around six stations for two hours. Each year, the stations vary depending on staff availability. In five out of the six stations, students are introduced to the subject of anatomy by performing fun activities prepared by HARC staff. The activities range from games such as anatomical trivial pursuit, anatomy pictionary, physical card games on anatomical terminology and 'matching anatomical pairs', crafts such as 'create your own brain hat', dissection of jelly babies to introduce the three anatomical planes, and a research station on craniofacial anatomy. One station that remains constant allows students to interact with the programme director and current second- and third-year students who serve on the committee of the student anatomy society. During this station, students can ask questions about the programme's structure and assessment. Due to the substantial changes made to the programme's structure, the CoA induction session now holds particular importance in terms of bridging the one-year gap until students begin their sessions at HARC. The CoA session does not solely serve as an induction session; instead, it intends to build rapport with the students and make them feel welcome and aware that the HARC staff are available to support them, share their experience on what having a career in anatomy looks like, and provide advice where relevant.

P 22 Evaluating the Relationship Between Type 2 Diabetes, Popliteal Artery Circumference and Osteoarthritis in the Human Knee.

Paul Rothwell[1], Nathan Jeffery[1,2], Alistair Bond[2], James Gallagher[1]
[1]University of Liverpool Institute of Life Course and Medical Sciences, Liverpool, United Kingdom; [2]University of Liverpool, Human Anatomy Resource Centre, Liverpool, United Kingdom

Osteoarthritis (OA) is the most common condition to affect joints and a major cause of limitation and morbidity globally; affecting 528 million people. Diabetes is the most prevalent and rapidly increasing metabolic disorder in the world; in 2023 over 4.4 million people in the UK had diabetes with 90% having type 2 diabetes mellitus (T2DM). Conflicting evidence suggests individuals with T2DM have an increased risk of OA. Articular cartilage, whilst avascular, relies indirectly upon an adequate blood supply to the joint. If vessels become diseased in T2DM, it is postulated this can result in poor joint health leading to OA. This study aims to evaluate whether changes in artery circumference, observed in T2DM, is related to the presence of OA in the knee joint. Using data from the Osteoarthritis Initiative (OAI), MRI knee scans have been used to measure popliteal artery luminal circumference. To account for the non-linear path taken by arteries, a 3D reconstruction was used to orientate slices in the correct plane for accurate measurement. Average Circumference is compared to Kellgren and Lawrence OA classification. MRIs of patients with a BMI <30 and T2DM were compared to non-diabetic controls. Age, sex and BMI have all been considered to rule out confounding results. Results show males with T2DM have a smaller lumen but does not relate to severity of OA. Females with T2DM have smaller lumen and is related to OA severity. OA severity is related to lumen size in women with T2DM but not seen in men suggesting there may be a possible link between T2DM and OA severity in women and could potentially be a target for therapeutic intervention. With better understanding of this mechanism patients with T2DM can be advised to manage their condition better and be at less risk from poor joint health. To validate this method, cadaveric knees were MRI scanned using this method then dissecting the artery. A 3D printed model of the artery and specific anatomical landmarks were used to identify where measurements were taken to verify the new method was more accurate. All cadaveric research has been approved by University of Liverpool central research committee and complies with HTA practices and standards (under license 12022).

YOUNG INVESTIGATOR

P 23 How does hip joint size and morphology influence the risk of avascular necrosis in the paediatric hip?

Rosin Ryan[1, 2], Hannah Kane [1], Neha Natu[1, 2], Brendan Murphy[4], Siobhan Hoare[5], Connor J. Green[1, 3, 5], Niamh C. Nowlan[1]

[1]UCD School of Mechanical and Materials Engineering, University College Dublin, Belfield, Dublin 4, [2]UCD School of Medicine, University College Dublin, Belfield, Dublin 4, [3]National Orthopaedic Hospital at Cappagh, Finglas, Dublin 11, [4]UCD School of Mathematics and Statistics, University College Dublin, Belfield, Dublin 4, [5]Children's Health Ireland, Dublin.

Legg-Calvé-Perthes disease (LCPD) is a paediatric idiopathic hip disorder, mainly affecting 3-12-year-old-males, leading to unilateral or bilateral necrosis of the femoral head. At present, there is no known cause of the disease. The focus of this study was to compare contralateral Perthes' hips of children with unilateral LCPD with normal control 'healthy' hips. In this study, it was hypothesised that there would be a difference in the hip joint size and/or shape between the contralateral Perthes' hips and healthy hips of children without LCPD. These differences may predispose children to LCPD and understanding these differences may help in disease prevention, diagnosis and treatment. A sample of 16 MRIs, age (between 3-13 years) and sex-matched as much as the sample would allow, were segmented using Synopsys Simpleware. Seven separate anatomical regions were segmented using both semi-automated and manual methods on the separate 2D slices of two different scan types. The software then created a patient specific 3D anatomical model which was used in the volumetric analysis. In the volumetric analysis, graphical analysis, t-tests and Fisher's r to z transformation were used to compare the two different groups. From the graphical analysis, it initially appeared that the normal control group tended to have larger volumetric data. However, when statistical tests were undertaken, it was found that there is no statistically significant difference between the volumes of the main anatomical regions between the Perthes and control hips. Through this study, a detailed segmentation protocol was developed which can be used in further studies of LCPD and other hip disorders. The final results are also vital in determining the prognostic factors of LCPD and provide a source for future analysis in determining what makes children more susceptible to LCPD to gain a better understanding of the disease aetiology. The volumetric data generated provides an abundance of information that can be further analysed to gain a more comprehensive understanding of LCPD. Ethical approval for this study was obtained from the Children's Health Ireland Research Ethics Office and the UCD School of Medicine Undergraduate and Taught Masters Research Ethics Committee.

P 24 Transcriptomics meets histology: wound healing in Salmo salar skin through the lens of single-cell RNAseq and spatial transcriptomics

Barbara Shih[1], Lene L. Sveen[2], Pablo Harrison-Alsar[1], Diego Robledo[3], Rose Ruiz Daniels[3]
[1]Lancaster University, Lancaster, UK, [2]Nofima AS, Ås, Norway, [3]Universidad de Santiago de Compostela, Spain, [4]The University of Stirling, Stirling, UK

The process of skin wound healing involves myriad cell types acting in concert both spatially and temporally to repair tissue damage and restore tissue integrity. It is recognised that this involves coordinated responses from keratinocytes, fibroblasts, immune cells and mesenchymal stromal cells. With the advent of single-nuclei RNA sequencing (snRNAseq) and spatial transcriptomics (ST), we are now able to characterise the involved cells and cell subtypes through the subtle difference in their gene expression at a single-cell level or with spatial resolution. In this work, we combined hematoxylin and eosin staining with snRNAseq and spatial transcriptomics to define the spatialtemporal gene expression changes that occur in the healing wounds of Atlantic salmon skin. Skin samples were collected 2 (n=2) and 14 days (n=2) after a single incisional wound. Samples were snap frozen in liquid nitrogen for snRNAseq. Data for ST (n=2) and snRANseq control samples (n=2) were taken from public available data. Approximately 7,000 nuclei were used for snRNAseq library construction using the 10X Genomics Chronium platform, which were subsequently sequenced using NovaSeq 6000 platform. Generated data were analysed using R and python bioinformatics packages.
Through the integrated analysis between snRNAseq and ST, we identified and localised a subpopulation of mesenchymal stem cell at the wound bed that potentially give raise to all mesenchymal cell types through trajectory analysis, as well as a different subpopulation of mesenchymal stem cells that concentrate within the wound site. Additionally, we have identified markers that differentiate muscle cell subtypes associated with wounding healing.
Our finding localised the principal cell types involved in salmon wound healing within the tissue architecture, improving our genetics understanding of salmon wound healing. This information can potentially help make informed selective breeding programs for more wound resilient salmon, as well as expending to other regenerative species. The sampled fish were part of the routine production at the University of Life Sciences (As, Norway). The maintenance of stock animals for experiments was in accordance with the guidelines of the EU legislation (2010/63/U) as well as the Norwegian legislation on animal experimentation and was approved by the Norwegian Animal Research Authority.

P 25 Exploring the Evolution of Dental Students' Professional and Technical Concepts: Progression and Change from BDS1 to BDS3 in the Dissection Room

Ourania Varsou[1], Alison Cairns[2], Christopher Delaney[2], Neil Henderson[2], Neil Nairn[2], Gillian Richardson[2], Scott Border[1]* and Aileen Bell[2]* *equal senior authors

[1]Anatomy Facility, School of Medicine, Dentistry and Nursing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Scotland UK; [2]Glasgow Dental Hospital & School, School of Medicine, Dentistry and Nursing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Scotland UK

@OuraniaVarsou @ScottBorder1

Anatomy education, especially through cadaveric dissection, plays a pivotal role in fostering professionalism among healthcare professions, instilling humanistic values and reflective practices. This experiential learning also fulfils the General Dental Council's learning outcomes and is directly transferable to the clinic. However, there is literature scarcity on how these behaviours evolve in the Dissection Room (DR) amongst dental students. Considering this, in 2024-25, we implemented the "Introduction to the DR and Reflections" session for BDS1 and BDS3. This began with an overview of the Anatomy Code of Conduct, followed by gradual cadaver exposure through a clinically-focused end-of-bed assessment. Students then worked in small groups, using set prompts, to reflect about the DR and Code of Conduct. They collectively documented their insights, while in the DR, which were subsequently thematically analysed. BDS1 reflections emphasised the discrepancy between expectations and reality, with many students expressing surprise regarding the room's size, the number and characteristics of cadavers, and sensory experiences such as tissue firmness, room temperature, and preservation odours. Initial exposure was less emotionally overwhelming than anticipated, as the emphasis on learning and professionalism mitigated psychological discomfort. The sensory elements facilitated experiential learning, engaging students beyond theoretical frameworks. Respect and professionalism emerged as themes, focussed more on own conduct, reinforced by the rules that created a formal learning environment. BDS3 reflections revealed a more mature understanding of respect and professionalism, viewing these as integral components of their clinical practice. Students demonstrated deeper awareness of ethical considerations involved in working with cadavers and how sensory experiences contribute to comprehensive anatomical education. Manual dexterity and technical skills for precise dissection were highlighted, reflecting advanced appreciation of technical competencies. The importance of collaboration was also emphasised, as students managed the DR's emotional and technical demands with peer support. The structured learning was appreciated for reducing stress and aiding focus. As students progressed through their studies, there was better appreciation of more complex professional and technical concepts, reflecting a clear trajectory of professional identity formation. The differences in BDS1 and BDS3 reflections also highlight the importance of considering when and how to teach specific aspects of professionalism.

P 26 Transforming Histology Education using a freely available virtual microscope software

Michelle Welsh, Lesley Hamilton, Caroline Allen, and Laura Nightingale
University of Glasgow, Thomson Building, University Avenue, Glasgow, G12 8QQ, UK

Learning and teaching histology is fundamental in many biomedical and healthcare degrees like medicine; however, it can be notoriously difficult to learn and teach. Students have described issues relating to the complexity of the topic, new terminology, 3D orientation of the tissue and lack of practical teaching time as potential barriers. Learning environments and how students perceive it can impact students learning of a subject. Histology is commonly taught through practical sessions with microscopes which can be difficult for both staff and students as two people cannot look down the microscope simultaneously to compare and discuss what they are looking at. Furthermore, once students leave the laboratory, without a microscope it is difficult for them to continue their learning interactively and instead rely on static images. With advancements in technology, there are many web-based applications that can be used by students to support learning such as lab-based platforms like LT and gamifications like Kahoot. However, these modalities tend to use static histological images that limits students ability to interact with the material, which can be vital in learning histology. OMERO is a freely available software that acts as a virtual microscope environment (VME), allowing students to zoom in and out, move around the slide and investigate the histology as they would in traditional laboratory based learning. This VME has the additional benefit of allowing students to continue their learning after they leave the lab but also allows more team-based learning whilst in the lab with students easily able to share their screens with peers and staff. Furthermore, this resource can be integrated into the local virtual learning environment, allowing embedding and integration with questions and interactivity built in. Student interns led on the design of the OMERO teaching resources, incorporating quizzes and interactivity that they would find useful for their learning. This brought a new perspective to histology teaching approaches and drove much needed change in how this will be delivered. This study will demonstrate how these new resources were created and how they were used in teaching, and will discuss the student perspective and impact on their learning. Local ethical approval was granted.

811

YOUNG INVESTIGATOR

P 27 Geometric Morphometric Analysis of Craniofacial Shape Variation in Mouse Models of Osteogenesis Imperfecta (OI) Type III

Prabajalini Wijekumar, Tom O' Mahoney
Faculty of Science and Engineering, Anglia Ruskin University, Cambridge, UK

Osteogenesis Imperfecta (OI) is a rare genetic skeletal disorder due to mutations in the *COL1A1* or *COL1A2* genes responsible for encoding type 1 collagen, which is abundantly present in bone tissue. Type 1 collagen is crucial to bone, skin, tendon, ligaments, and other connective tissues. The gene mutations of *COL1A1* or *COL1A2* genes disrupt the synthesis or processing of type 1 collagen for its structural function. The altered collagen affects the structure and strength of bones, making them brittle and prone to fractures. Individuals with OI type III often exhibits underdeveloped craniofacial bones, which can lead to unique facial traits such as a triangular-shaped face, prominent forehead, and midface retrusion. There is a scarcity of knowledge related to the influence of the genotypes on the craniofacial phenotypes in OI type III mouse models. This project aimed to compare craniofacial shape variation in mouse models of OI type III with normal wild type mice using Geometric Morphometrics. The study used dense landmarks of the cranium, endocast and mandible of OI type III and Wild type (WT) mice from the public Musmorph database. The 3D landmarks were processed, and shape variation was analysed using Geometric Morphometric Methods in R (v4.4.1) using the packages 'Geomorph' and 'Morpho'. In Principal components (PC) 1 and 2 for cranium, OI individuals clustered differently to WT. PC 1 and 2 for the endocast also separated the WT and OI. In the mandible, there was no similar separation of groups through PCs. Heatmapping was used to further visualise shape differences between OI and WT for cranium, endocast and mandible. Procrustes ANOVA revealed that the distance between the left and right articular surface is increased in OI the WT. Overall, the size of cranium, endocast and mandible significantly predict the shape although endocast doesn't show the differences in the heatmaps. This further denotes that the anatomical relation to the results is more important than statistical power. The results were deduced to the anatomical differences caused by mutation in COL1A2 gene that explains the shape differences among different species. Further studies should be focused on comprehensively analysing the morphological variation in a larger sample size. This study was conducted under Anglia Ruskin University Ethics approval, reference ETH2324-7635

P 28 Student Perception of Virtual Cadavers at a New Medical School

Dylan Williams
Edge Hill University, Ormskirk, United Kingdom

Anatomy education has benefited from the development of many electronic tools such as virtual cadavers. Research and student attainment have shown these to be effective both individually and alongside physical cadaveric material. There are practical and economic advantages to using virtual resources that make them attractive to smaller and newer medical schools. At Edge Hill University Medical School anatomy is taught using virtual cadaver tables. However, medical students often hope to use physical cadavers. As student satisfaction is one of the main metrics by which institutions of higher education are assessed, the effect of using virtual cadavers instead of physical cadavers upon student satisfaction was investigated during this preliminary research. MBChB students in their first, second, and third year of study were invited to take part. Students were sent a digital questionnaire which assessed their opinions on several matters relating to anatomy resources using a Likert scale. Respondents were also given the opportunity to elaborate and make any other comments in a free text field. 13 responses were received. Respondents indicated that they found virtual cadavers and other resources such as models to be useful for studying anatomy. 85% agreed that virtual cadaver tables aided their studies and the remainder neither agreed nor disagreed. There was no overall preference between virtual cadavers and physical cadavers when asked which they would rather use exclusively (62% neither agreed nor disagreed). However, it was also noted that 92% of respondents believed they would benefit from seeing cadaveric material in addition to their existing resources. In combination with research showing them to be effective educational tools, these findings suggest that virtual cadavers are an appropriate alternative to physical cadavers for the purposes of medical education. This is particularly important as new medical schools without access to traditional resources are developed. Using a combination of both forms presents an opportunity to increase student satisfaction beyond using a single method individually. Ethical approval was granted by the Edge Hill University Centre for Learning and Teaching ethics committee. Permission to invite MBChB students to participate was granted by Edge Hill University's Medical School Research Advisory Group.

803

YOUNG INVESTIGATOR

P 29 Atrophy of the teres minor muscle in a human cadaver: Anatomical findings and clinical correlations

Elif Sena Yaz[1], Nizameddin Fatih Karamus[1], Ahmet Ertas[2], Alp Tastan[2], Sabri Kerem Diril[3], Ramin Hashemihesar[4], Ipek Coruhlu[4], Oktay Arda[4], Hulya Erbagci[1],
[1]Department of Anatomy, Altinbas University, Istanbul, Türkiye; [2]Department of Anatomy, Istanbul University – Cerrahpasa, Istanbul, Türkiy; [3]Department of Orthopedics and Traumatology, Bahcelievler State Hospital, Istanbul, Türkiye; [4]Department of Histology and Embriology, Altinbas University, Istanbul, Türkiye

The teres minor muscle is one of the rotator cuff muscles that stabilize the shoulder joint and provide external rotation movement and is important for the functional mobility of the shoulder. Teres minor muscle atrophy, although rare, is a pathological condition that causes limitation of shoulder movements, loss of strength and chronic pain. Anatomical dissections, histological examinations and radiological studies are valuable in understanding the etiology of muscle atrophies and correlating them with clinical findings. In our study, bilateral teres minor muscle atrophy, which was noticed during routine cadaver dissection at the Department of Anatomy, Altınbaş University Faculty of Medicine, was evaluated in detail with clinical collaboration. The axillary nerve innervating the teres minor muscle and its anatomical relationships were examined. For histological examination, three sections were taken from the medial, middle and lateral parts of the tissue replacing the teres minor muscle, stained with the Haematoxylin Eosin-Masson Trichrome technique and examined under a microscope. It was determined that fibrotic tissue replaced the teres minor muscle on both sides, and that muscle fibers decreased from medial to lateral and fibrotic degeneration increased. The length of the fibrotic tissue replacing the teres minor muscle was measured as 14.9 cm on the left and 12.1 cm on the right. Hypertrophy of the infraspinatus muscle and anatomical variation in the trace of the axillary nerve were not observed on either side. Additionally, it was determined that there was no tear in the rotator cuff muscles and no quadrangular space syndrome. Detailed examinations of the anatomical and histological features of the teres minor muscle are rarely encountered in the literature, and information on the atrophic processes of this muscle in particular is limited. Although fatty degeneration of the teres minor muscle was reported in previous studies, no study on fibrotic degeneration of the teres minor muscle was found. Therefore, anatomical and histological evaluation of cases with teres minor muscle atrophy is of great importance in terms of better shaping clinical and surgical approaches. Ethical approval for this study was obtained by Altınbaş University Health Sciences Scientific Research Ethics Committee under No: 28.

P 30 Engaging Minds: Enhancing Anatomy Education With Bingo Gamification

Viktoriia Yerokhina, Gillian Lewis
School of Medicine, University of Central Lancashire, United Kingdom

@vi_histo @Actinomycete123

Anatomy, with its intricate structures and complex relationships, often presents significant obstacles to students, who may rely heavily on rote memory, potentially limiting their critical thinking and application skills. To address these issues and promote active learning, we have introduced a gamification approach using Bingo to boost student engagement and facilitate deeper understanding. In this approach, students attend a two-hour anatomy tutorial incorporating a 90-minute interactive Bingo game. Prior to the session, they watch a pre-recorded lecture, providing them with foundational knowledge of the topic. Before the tutorial, the lecturer prepares 30 anatomy-related questions, each numbered to correspond with a number on a Bingo card. At the start of the tutorial, each student receives a Bingo card containing 25 randomly assigned numbers out of the 30-question set. During the session, an online-based number generator selects a number between 1 and 30, each corresponding to an anatomy question. For example, if number 5 is called, question 5 is displayed on the screen. Students who have the number 5 on their Bingo card then have 30 seconds to answer, submitting their responses via an interactive platform. Correct responses earn a “sticker” to mark the corresponding number on their Bingo card, and the first student to complete a line or fill the entire card wins the game. Initial informal feedback from students has been overwhelmingly positive. Students reported that the Bingo gamification approach increased their engagement and motivation to study anatomy while reinforcing their understanding of complex anatomical concepts. The game format allowed for active participation, quick recall, and immediate feedback, contributing to a more enjoyable and effective learning experience. The Bingo gamification strategy demonstrates significant potential for enhancing anatomy education by providing a structured yet flexible interactive learning tool. By transforming traditional study methods into an engaging activity, this approach supports active learning and deeper comprehension, making anatomy both accessible and enjoyable for students. Ethical approval statement: this educational activity did not involve cadaveric specimens, human subjects, or animals, and therefore did not require ethical approval.

P 31 Digital Imaging In Histology: Balancing Innovation And Tradition In Modern Education

Viktoriia Yerokhina[1], Benedicta Quaye[2]
[1]School of Medicine, University of Central Lancashire, Burnley, United Kingdom; [2]Faculty of Health and Medicine, Lancaster Medical School, University of Lancaster, Lancaster, UK

@vi_histo

Histology education has always presented a challenge to past and present student learners due to its complexity and detailed understanding required to fully understand concepts. The challenge of faculty specialised in this area of anatomy education as well as the impact of the COVID pandemic led to a paradigm shift with an initiative to develop online-based free digital microscopic platforms. These resources to enhance student engagement and comprehension of histological concepts remotely and at any time. Though this provides a solution to these challenges, it comes with its own advantages and disadvantages. Advantageously, the increasing availability of digital imaging platforms provides a cost-effective and accessible way for histology learners without a microscopic equipment to access high-resolution images of histological slides, interactive modules, and quizzes for self-assessment. Additionally, accessibility of these resources from any location with or without an internet connection has been useful for students in remote areas whiles providing flexibility and convenience in learning. Features such as zooming, labelling, and annotations enhance the learning experience as they allow for self-paced learning that can be particularly useful for institutions with limited resources. On the other hand, the lack of hands-on experience that is developed when using actual slides is a significant drawback, especially for kinaesthetic learners as this will hinder how they retain and recall information as well as how much they retain. Additionally, there is always an uncertainty in reliance on technology as frustrations can occur due to unforeseen technical issues. The absence of a direct instructor to facilitate interaction may hinder the development of critical thinking and problem-solving skills. Conclusively, online-based free digital histological imaging platforms offer significant benefits for histology education, particularly in terms of accessibility and availability. However, they should complement, rather than replace, traditional microscopy that provide hands-on experience and direct interaction. Balancing digital and traditional approaches can lead to a more comprehensive and effective histology education.

YOUNG INVESTIGATOR

P 32 Construction of an immunological brain atlas using multiplexed immunofluorescence and transcriptomic data integration: Advancing brain imaging techniques

Sankar Vaidyanathan[1], Varun Shanmugasundaram[2], Viktoriia Victoria Yerokhina[3]
[1]University of Central Lancashire, Burnley, United Kingdom; [2] University of Central Lancashire, Burnley, United Kingdom; [3]University of Central Lancashire, Burnley, United Kingdom

@vi_histo

Construction of an immunological brain atlas using multiplexed immunofluorescence and transcriptomic data integration: advancing brain imaging techniques. Understanding the intricate cellular composition of the brain is essential for elucidating neurological function and disease pathogenesis. Traditional imaging techniques often fall short in providing comprehensive spatial and functional mapping of diverse cell types. In this study, a detailed immunological brain atlas was constructed by integrating multiplexed immunofluorescence imaging with single-cell transcriptomic data, thereby creating an accurate, cell cluster mapped brain image. Multiplexed fluorescence immunohistochemistry (fIHC) was employed to simultaneously visualise multiple cellular markers, overcoming the limitations of conventional staining methods. Single-cell RNA sequencing data relating to the specific cellular markers were integrated to annotate cell types with high specificity. Publicly available datasets, including the Allen Brain Atlas and Ensembl gene databases, were utilised to identify gene clusters encoding common cell surface receptors, and study data was obtained from similar attempts to create mouse brain atlases. The genes were cross-referenced with conserved orthologues in humans using the GeneOrthology tool to ensure translational relevance. Computational tools, such as MapMyCells, facilitated the layering of immunofluorescent imaging data with transcriptomic information, resulting in a multilayered 2D model with annotated cell types. The integration of multiplexed fIHC and single-cell transcriptomics enabled the creation of a comprehensive 2D brain atlas, detailing the spatial distribution and functional characteristics of various cell types. This model provides a high-resolution map that surpasses the capabilities of traditional imaging techniques. The developed immunological brain atlas represents a significant advancement in brain imaging methodologies, offering detailed insights into cellular architecture. Future integration of deep learning algorithms and more extensive datasets hold the potential to expand this model into three dimensions, facilitating non-invasive visualisation of brain processes and contributing to the study of complex neurological diseases, such as Alzheimer's disease, Parkinson's and amyotrophic lateral sclerosis (ALS). This study did not involve experiments with animals or human cadaveric specimens. All data were sourced from publicly available repositories, ensuring compliance with ethical standards.

Thanks to the Organising Team:

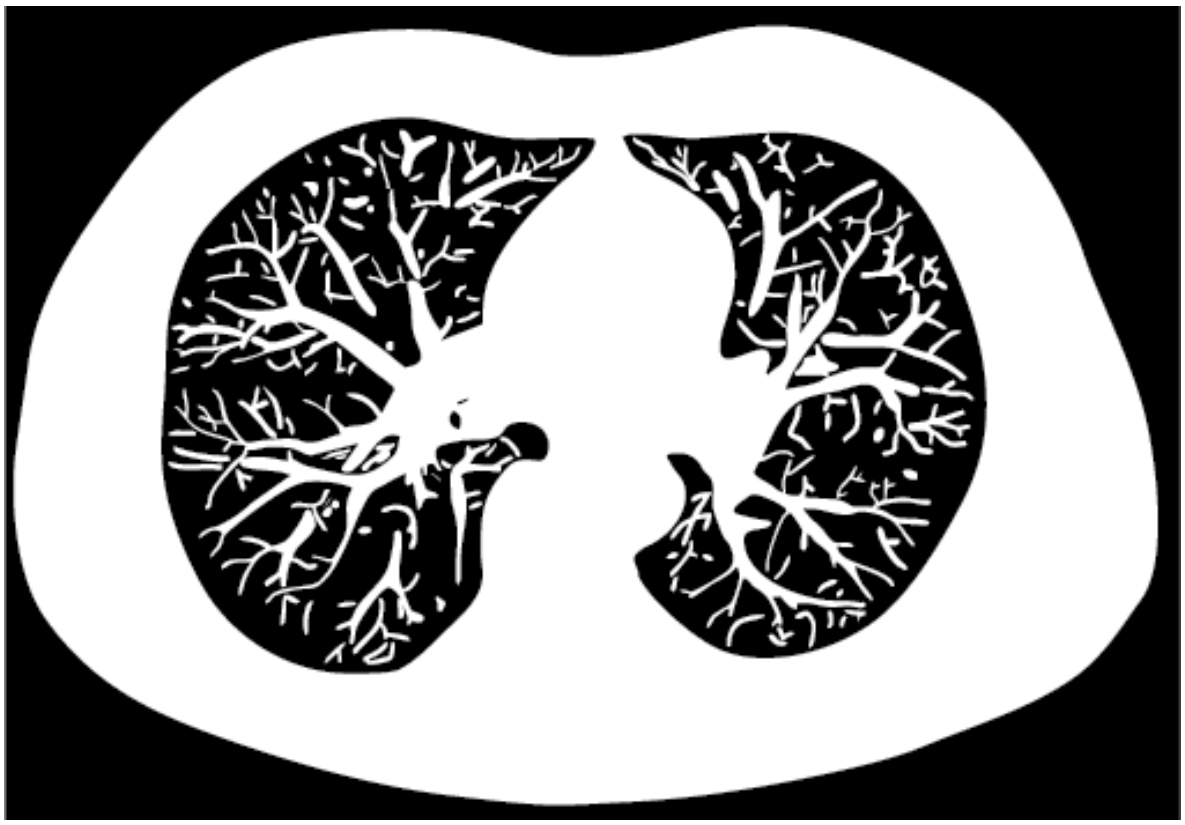
Kris Phillips, Liam Young, Lyndsay Murray, Hannah Webb

Colin Michie, Caitlynn Hudlow, Maryam Rajid, Rachel Jones

Anatomy Team Support: Izu Obazie, Lois Holt

UCLan Support: Anna Williams, Laura Richardson, Martine Townsend, Catering Team, and Student Ambassadors.

Additional thanks for the support to Dr Geraldine O'Connor, Rupal Lovell-Patel, and Prof. Alison Carr.



Cover images designed by Caitlynn Hudlow.