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anatomy

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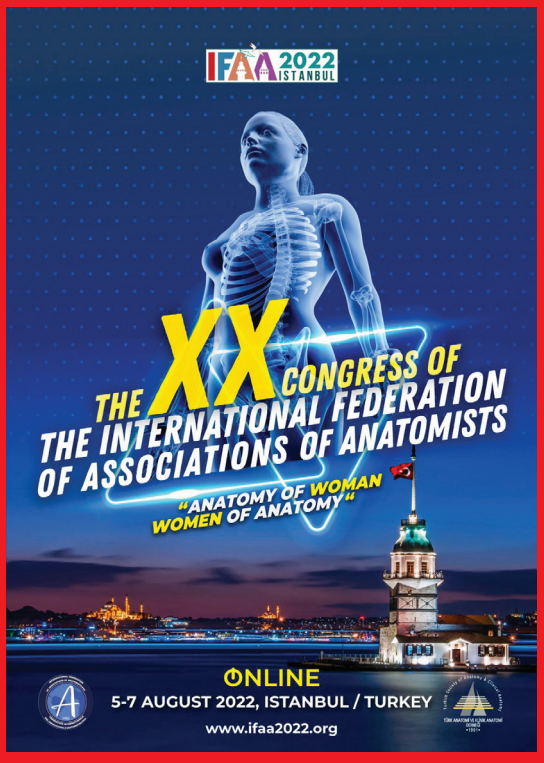

Special Issue includes abstracts of the 20th Congress of the International Federation of Associations of Anatomists, 5–7 August 2022, Istanbul, Türkiye

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An International Journal of Experimental and Clinical Anatomy

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Aim and Scope

Anatomy, an international journal of experimental and clinical anatomy, is a peer-reviewed journal published three times a year with an objective to publish manuscripts with high scientific quality from all areas of anatomy. The journal offers a forum for anatomical investigations involving gross, histologic, developmental, neurological, radiological and clinical anatomy, and anatomy teaching methods and techniques. The journal is open to original papers covering a link between gross anatomy and areas related with clinical anatomy such as experimental and functional anatomy, neuroanatomy, comparative anatomy, modern imaging techniques, molecular biology, cell biology, embryology, morphological studies of veterinary discipline, and teaching anatomy. The journal is currently indexing and abstracting in TUBITAK ULAKBIM Turkish Medical Index, Proquest, EBSCO Host, Index Copernicus and Google Scholar.

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- ***Reviews*** section highlights current development in relevant areas of anatomy. The reviews are generally invited; other prospective authors should consult with the Editor-in-Chief.
- ***Case Reports*** include new, noteworthy or unusual cases which could be of help for basic notions and clinical practice.
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- ***Terminology Zone*** category is a platform for the articles which discuss some terminological controversies or opinions.

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In the Materials and Methods section of the manuscripts where experimental studies on humans are presented, a statement that informed consent was obtained from each volunteer or patient after explanation of the procedures should be included. This section also should contain a statement that the investigation conforms with the principles outlined in the appropriate version of 1964 Declaration of Helsinki. For studies involving animals, all work must have been conducted according to applicable national and international guidelines. Prior approval must have been obtained for all protocols from the relevant author's institutional or other appropriate ethics committee, and the institution name and permit numbers must be provided at submission.

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Title page

In all manuscripts the title of the manuscript should be written at the top and the full names and surnames and titles of the authors beneath. These should be followed with the affiliation of the author. Manuscripts with long titles are better accompanied underneath by a short version (maximum 80 characters) to be published as running head. In the title page the correspondence address and telephone, fax and e-mail should be written. At the bottom of this page, if present, funding sources supporting the work should be written with full names of all funding organizations and grant numbers. It should also be indicated in a separate line if the study has already been presented in a congress or likewise scientific meeting. Other information such as name and affiliation are not to be indicated in pages other than the title page.

Abstract

Abstract should be written after the title in 100–250 words. In original articles and articles prepared in IMRAD format for Teaching Anatomy category the abstract should be structured under sections Objectives, Methods, Results and Conclusion. Following the abstract at least 3 keywords should be added in alphabetical order separated by semicolumns.

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Authors should provide direct references to original research sources. References should be numbered consecutively in square brackets, according to the order in which they are first mentioned in the manuscript. They should follow the standards detailed in the NLM's Citing Medicine, 2nd edition (Citing medicine: the NLM style guide for authors, editors, and publishers [Internet]. 2nd edition. Updated content is available at www.ncbi.nlm .nih.gov/books/NBK7256). The names of all contributing authors should be listed, and should be in the order they appear in the original reference. The author is responsible for the accuracy and completeness of references. When necessary, a copy of a referred article can be requested from the author. Journal names should be abbreviated as in *Index Medicus*. Examples of main reference types are shown below:

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  - *Journal article with indication article published electronically before print:* Sengul G, Fu Y, Yu Y, Paxinos G. Spinal cord projections to the cerebellum in the mouse. Brain Struct Funct Epub 2014 Jul 10. DOI 10.1007/s00429-014-0840-7.
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  - *Entire book:*
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    - *Book with organization as author:* Federative Committee of Anatomical Terminology (FCAT). Terminologia anatomica. Stuttgart: Thieme; 1998. 292 p.
    - *Citation to a book on the Internet:* Bergman RA, Afifi AK, Miyauchi R. Illustrated encyclopedia of human anatomic variation. Opus I: muscular system [Internet]. [Revised on March 24, 2015] Available from: http://www.anatomyatlases.org/AnatomicVariants/AnatomyHP.shtml
  - *Contribution to a book:*
    - *Standard reference to a contributed chapter:* Potten CS, Wilson JW. Development of epithelial stem cell concepts. In: Lanza R, Gearhart J, Blau H, Melton D, Moore M, Pedersen R, Thomson J, West M, editors. Handbook of stem cell. Vol. 2, Adult and fetal. Amsterdam: Elsevier; 2004. p. 1–11.
    - *Contributed section with editors:* Johnson D, Ellis H, Collins P, editors. Pectoral girdle and upper limb. In: Standring S, editor. Gray's anatomy: the anatomical basis of clinical practice. 29th ed. Edinburgh (Scotland): Elsevier Churchill Livingstone; 2005. p. 799–942.
  - *Chapter in a book:*
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- Data collection or management
- Data analysis
- Manuscript writing/editing
- Other (please specify briefly using 1 to 5 words)

For example: NBA: Project development, data collection; AS: Data collection, manuscript writing; STR: Manuscript writing

Funding: information that explains whether and by whom the research was supported.

Conflicts of interest/Competing interests: include appropriate disclosures.

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If the submission uses cadaveric tissue, please acknowledge the donors in an acknowledgement at the end of the paper.

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20th Congress of the International Federation of Associations of Anatomists

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Editorial
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Welcome Address of the Congress President

Anatomy 2022;16(Suppl 2):Siv

Dear colleagues,

Following Turkish Society of Anatomy and Clinical Anatomy's approval of hosting the 19th Congress during 18th IFAA Congress in Beijing, changing circumstances forced IFAA board rearrange the 19th meeting to be held in London and the 20th IFAA in Istanbul – Turkey and twice in five years span instead of one, by a change in IFAA's constitution.

The fate of this very valuable organization became a real frustration for us; following the postponing of the 2019 appointment to 2021, the Covid 19 pandemics caused us a one more year delay, we have to reschedule our calendar to 2022.

Our dream was to see all anatomists enjoy both the congress and İstanbul and really come together as social human beings eating, drinking, laughing, dancing as well as meeting established scientists and discussing the very up to date scientific data in our field.

Unfortunately, Covid-19 pandemics' progress is not predicted next year. Some of the countries seem to be relieved and living a better life among pandemics but it is not the same globally and this congress is not a regional one. Considering this, we drank the bitter medicine and decided to organize a totally on-line congress in order not to take the risk of completely canceling it or risking the lives of possible attendees. No change of date for congress, it will be August 5–7, 2022.

Our infrastructure is adequate for such an organization and our only bittersweet happiness is that the Turkish meeting would make real another first for the IFAA – postponing twice, yet even couldn't meet on the third attempt except on-line. Indeed, we all experienced that on-line meetings have some advantages as well. Many universities are struggling financially at this time and the ability of anatomists to travel may be constrained which might lead to a poor attendance if the meeting was held face to face. On the plus side, the virtual conferences make it possible for so many more people to attend and we are only getting better at virtual meetings.

As Turkish Society of Anatomy and Clinical Anatomy, our request is to make this congress more memorable than others not with its misfortune until now, but with record attendance, discussion, science and virtual friendships with your help.

Erdoğan Şendemir
President of the XX IFAA Congress
Professor of Anatomy,
Bursa Uludağ University, Turkey

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Committees and Biographies

Invited Speakers

Cezmi Akdiş
(Davos, Switzerland)
Swiss Institute of Allergy and Asthma Research (SIAF)

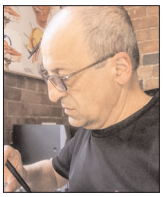
Cezmi Akdiş is the director of the Swiss Institute of Allergy and Asthma Research (SIAF) located in Davos and Ordinarius Professor in Zurich University Medical Faculty. He is a Senate Member of the Swiss Academy of Medical Sciences. Cezmi Akdiş has published more than 600 peer-reviewed articles. His h-index is 110 and he was selected as a highly cited author consecutively in 2016–2017–2018–2019–2020 and 2021 by Clarivate (Thomson Reuters) with approximately 70 thousand citations. Cezmi Akdiş acted as the President of the European Academy of Allergy & Clinical Immunology (14'000 members) between 2011–2013. He was the editor of Global Atlases of Allergy, Asthma I–II, Chronic Rhinosinusitis and Allergic Rhinitis. He was the founder and organizer of the World Immune Regulation Meetings, Davos I–XV (600–1000 participants). He is currently the Editor-in-Chief of Allergy, impact factor 13.15. Cezmi Akdiş's major scientific contributions are on immune regulation and allergen tolerance, plasticity of antigen-specific T cells 1995, human T regulatory cells 1996, immune suppressive role of histamine receptor 2 2000, human Type 2 NK cell subset 2001, human regulatory NK cells 2007, regulatory innate B cell subset 2017, regulatory innate lymphoid cells 2019. His current research is the continuation of his epithelial barrier hypothesis studies starting from mechanisms of eczema 2000, mechanisms of epithelial shedding in asthma and chronic rhinosinusitis 2003, endotypes of asthma, chronic rhinosinusitis and atopic dermatitis 2011, epithelial barrier hypothesis for the development of allergic and autoimmune diseases 2015–2022. Cezmi Akdiş is an author of more than 40 publications on Covid-19 and SARS-CoV-2 including pathophysiology, risk factors, severity, patient characteristics and how to handle allergy and asthma patients during the pandemic.

Hande Özdinler
(Chicago, IL, USA)
Department of Neurology, Northwestern University, Feinberg School of Medicine

Dr. Özdinler is an Associate Professor of Neurology at the Department of Neurology, Northwestern University, Feinberg School of Medicine. She is the founding director of the Özdinler Upper Motor Neuron Lab, focusing on the biology and pathology of upper motor neurons, which degenerate in diseases such as ALS, HSP and PLS. Dr. Özdinler graduated from Boğaziçi University, Department of Molecular Biology and Genetics, earned Best Master Thesis award, and went to the United States for PhD. She studied with Prof. Dr. Reha Erzurumlu at LSUHSC, and earned PhD in Cell Biology, Anatomy and Neuroscience. She then went to Harvard Medical School, Neurosurgery Department for her postdoctoral studies and received a HCNR fellowship. She was recruited to Northwestern University in 2008 and continues to work at Northwestern. Özdinler's research is funded by NIH, NIA and numerous foundations.

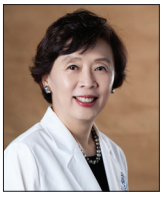
Helen Elizabeth O'Connell
(Melbourne, Australia)
Professor of Urology

Professor Helen O'Connell is an academic Urologist based in Melbourne who was Director of Surgery and Head of Urology at Western Health from 2016–21. Recently elected Vice President Urology Society of Australian and New Zealand she has held major leadership roles including examiner and Councillor for Royal Australasian College of Surgeons 2005–2014. She is a world renowned anatomy researcher.



Levent Efe
(Melbourne, Australia)
Medical illustration Studios

Dr. Levent Efe's pre-medical illustration years were preceded by medical practice, Anatomy and Artistic anatomy teaching. He has been running a Melbourne-based freelance business in medical illustration and animations for a world-wide clientele for over 30 years. Dr. Levent Efe specializes in building concepts and visual narratives for surgical publications. He recently introduced to the industry the concepts of Animated Graphical Abstracts, and Surgery Live Sketching.



Kyung Ah Park
(Seoul, South Korea)
Professor Emeritus, Yonsei University College of Medicine

Professor Dr. Kyung Ah Park is Prof. Emeritus of Yonsei University College of Medicine. She has taught Anatomy, Histology and Neuroanatomy for 40 years. She received her MS from Korea University and she earned her Doktor der Medizin from Kiel University, Germany under supervision of Prof. Dr. Robert F. Schmidt. She received several awards, including 'Prof. of the year' in Yonsei University College of Medicine three times from students. Also, she received 'Distinguished Prof. Award' from Yonsei University. She has served as President of Medical Women's International Association.

Julia Frankenberg
(Berlin, Germany)
Sculptural Intervention, Squirt Eis

Julia Frankenberg is a sculptor living in Berlin, where she does collaborations and solo art projects. She studied fine arts in Weimar and Hamburg and exhibits in Germany and worldwide. In her artistic work, she researches overlooked potentials that have despite a patriarchal "NO - THERE ISN´T" left traces since all Ages but especially since industrial revolution. She wants to win back these overlooked potentials back for life and social space in a feministic and experimental way and with the help of artistic forms and outrageous materials.

Prizes/ Awards/ Scholarships:

- 2021/2 Grant Deutscher Künstlerbund Neustart Modul D
- 2021 Grant, Art in Public Space, Draussenstadt Mitte, Berlin
- 2020 Festivalgrant, Cafe Royal Stiftung, Hamburg
- 2018 Scholarship Kunsthallenstipendium 2018, Kunsthalle Stadt Kempten
- 2011 Nomination Kunstpreis Junger Westen, Recklinghausen
- 2010 Projektgrant Freundeskreis der HFBK
- Studiogrant in Istanbul, Mobilitätsstipendium der Karl-Heinz-Ditze Stiftung Hamburg

Publications:

- 2021 Sexed Power, MoM Art Space, Hamburg
- 2020 Peer to Piece, Galerie im Marstall, Ahrensburg
- 2019 Anna Lena Grau, Positionbestimmungen und andere Erzählungen (S.102–113),Textem Verlag, Hamburg
- 2011 friendsandloversinunderground, Textem Verlag, Hamburg
- https://juliafrankenberg.de
- https://squirt-eis.org
- https://www.instagram.com/juliafrankenberg/

Hugues Duffau
(Montpellier, France)
Department of Neurosurgery, Gui de Chauliac Hospital, Montpellier University Medical Center

Professor Hugues Duffau, MD, PhD is the Professor and Chairman of the Department of Neurosurgery, Gui de Chauliac Hospital, Montpellier University Medical Center and also the Director of the Team "Brain plasticity, Stem cells and Diffuse Low-Grade Gliomas" at the National Institute for Health and Medical Research (INSERM), France. He was awarded with the Victory of Medicine (French National Award in Medicine) in 2009 and 2010, and the Herbert Olivecrona Medal (Karolinska Institute) in 2010. He received Doctorate Honoris Causa from KU Leuven, University of Messina, and University of IberoAmerica. He is also a Member of the French National Academy of Medicine, the French National Academy of Surgery, and the Royal Academy of Medicine of Belgium. Hugues Duffau has published more than 500 peer-reviewed articles. His h-index is 87 and his work received more than 27 thousand citations. He is still serving as a Member of the Editorial Board of many highly reputed journals including Brain and Language, Neurosurgery, Neuro-Oncology, Central European Neurosurgery, European Journal of Surgical Oncology, Acta Neurochirurgica, and World Neurosurgery His main fields of interests are brain tumor surgery, neuro-oncology, low-grade gliomas, functional brain mapping, neuroplasticity, awake surgery, hodotopy, connectomics, quality of life, and cognitive neurosciences.

Türker Kılıç
(Istanbul, Turkey)
Department of Neurosurgery, Bahçeşehir University, Faculty of Medicine

Dr. Türker Kılıç is a Professor of Neurosurgery. He conducted his post-doctoral work on brain tumors and treatments at Harvard University and holds a PhD degree in Anatomy. In 2015, Prof. Kılıç was selected to the European Academy of Sciences and Arts, one of the three most important academies in the world with over 30 Nobel Prize winners and a total of 15 Turkish members since its inception a quar-

ter of a century ago. Dr. Kılıç was nominated as a fellow to the World Academy of Art and Science in May 2019, and in 2021, he was elected as a member of the World Academy of Art and Science (WAAS), the most distinguished scientific academy in the world founded by Albert Einstein, Bertrand Russell, Robert Oppenheimer in 1960 and under the auspices of the United Nations. Prof. Kılıç became the 8th scientist and the first neurosurgeon elected from all fields of science from our country to this Academy, which has a 62-year history. Having received medical training at Hacettepe, Marmara and Harvard Universities, Dr. Kılıç has been carrying out his academic work as the founding dean of the Bahçeşehir University School of Medicine since 2012. His research interest areas include the Mind-Brain Connection, Brain and Hypophysis Tumors, Microsurgery of Blood Vessels in the Brain, Intraoperative MRI. Prof. Kılıç has been invited as a guest lecturer by more than 10 universities, including Harvard Medical School, Yale Medical School, and Johns Hopkins University. Dr. Kılıç has received over 100 awards throughout his career for his contributions to medicine. His most prized awards are the European Association of Neurosurgical Societies Scientific Research Award (1999) and the American Association of Neurosurgery Award for Tumor Research in 2001. Prof. Kılıç, who has an H-index score of 36 and over 200 academic publications that have received +4000 citations, is the inventor of various brain surgery methods and has made significant contributions to Glivec, a smart drug for brain tumors. He is among the pioneers of Gamma-Knife Surgery, Tumor Banking, and Intraoperative MRI in Turkey. In addition to his ongoing scientific research, Dr. Kılıç is involved in Medical Education and Science Education. Dr. Kılıç's speeches on Science and Science Education have received over 10 million views online. Dr. Kılıç is the author of the books, published in 2021; Yeni Bilim: Bağlantısallık, Yeni Kültür: Yaşamdaşlık, published by the Ayrıntı press, and Beyin Nedir'den Yaşam Nedir'e Bir Hayat Serüveni: Türker Kılıç, published by Epsilon press. He is also the Founding Chair of the Istanbul Neurosciences Institute established in 2020.

Scott Gilbert

(Swarthmore, PA, USA)

Howard A. Schneiderman Professor Emeritus of Biology, Swarthmore College

Scott F. Gilbert is the Howard A. Schneiderman Professor of Biology, emeritus, at Swarthmore College, where he teaches developmental genetics, embryology, and the history and critiques of biology. He is also a Finland Distinguished Professor, emeritus, at the University of Helsinki. He received his B.A. in both biology and religion from Wesleyan University, and he earned his PhD in biology from the pediatric genetics laboratory of Dr. Barbara Migeon at Johns Hopkins University. His M.A. in the history of science, also from The Johns Hopkins University, was done under the supervision of Dr. Donna Haraway. He pursued postdoctoral research at the University of Wisconsin in the laboratories of Dr. Masayasu Nomura and Dr. Robert Auerbach. Scott has received several awards, including the Service Award for Education and Outreach at the Pan-American Society for Evolutionary Developmental Biology, the Medal of François I from the Collège de France, the Dwight J. Ingle Memorial Writing Award, the Choice Outstanding Academic Book Award, honorary doctorates from the University of Helsinki (Finland) and the University of Tartu (Estonia), and a John Simon Guggenheim Foundation Grant. In 2002, the Society for Developmental Biology awarded him its first Viktor Hamburger Prize for Excellence in Education, and in 2004, he was awarded the Kowalevsky Prize in Evolutionary Developmental Biology. He has been elected a fellow of the AAAS and the St. Petersburg Society of Naturalists. He received the Burnhill Award from the American Reproductive Health Association in 2009. In 1994, Scott established the first website for a textbook, and he is also the co-author of a digitally-based history of developmental biology. He continues to do research and write in both developmental biology and in the history and philosophy of biology.

The Organizing Committee

Erdoğan Şendemir

Congress President of IFAA 2022

Professor of Anatomy, Department of Anatomy, Faculty of Medicine, Bursa Uludağ University, Bursa, Turkey

Dr. Erdoğan Şendemir was born in Bursa, Turkey in 1960. He graduated from Bursa Anatolian High School in 1978 and from Uludag University Faculty of Medicine in 1985. After finishing his obligatory service in Akhisar, Manisa, he started his specialty in Uludag University, Medical Faculty, Department of Anatomy in 1988 and gave his thesis about "Effects of insulin and/or alfamethylparathyrosine injections on thyrosine hydroxylase activity and catecholamine levels in the adrenal medulla of rats following hemi- or transection of their spinal cords" in 1990. After his military service, he was appointed as assistant professor at Uludag University, Faculty of Medicine, Department of Anatomy in 1993. In 1994 he spent nine months as a "Visiting Scientist at the Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology (MIT), Cambridge, MA" and studied in G. Schneider's lab with R.S. Erzurumlu and S. Jhaveri. He received his associate professor title in 1997. Between 1999 and 2000, he continued his research as a "Research Fellow in Louisiana State University (LSU), School of Medicine, Anatomy and Cell Biology Department, New Orleans, LA" for six months with R.S. Erzurumlu. By 2002 he received his professorship and was elected as the Head of Department. He spent two and a half years with G.F. Jirikowski in the Friedrich Schiller Universität (FSU), Anatomie Institut, Anatomie II, Jena as a visiting scientist in 2003–2005. He has two international awards. His scientific fields of interest are: thalamocortical development and neural regulation of sympathoadrenal system.

Çağatay Barut

Congress Secretary of IFAA 2022

Professor of Anatomy, Faculty of Medicine, Bahçeşehir University, Istanbul, Turkey

Çağatay Barut, MD, PhD graduated from Gazi University School of Medicine in 1995 and held his PhD degree in 2001. He was appointed as an assistant professor of anatomy at Bulent Ecevit University (formerly Zonguldak Karaelmas University) School of Medicine in 2001 and as an associate professor in 2009 and as a professor in 2014. He was appointed as a professor in 2015 at Bahçeşehir University School of Medicine. He has 59 international publications, 71 international presentations in international congresses and 335 citations in indexed international scientific journals. He is the Interim Chair of the College of Representatives of the IFAA (International Federation of Associations of Anatomists) and member of the Executive Committee of the IFAA. He is the vice president of Turkish Society of Anatomy and Clinical Anatomy (TSACA). He is an associate editor of Anatomy (International Journal of Experimental and Clinical Anatomy). He is also on the editorial boards of Journal of Morphological Sciences, Acta Medica International and ISRN Anatomy. His research interests are radiological anatomy, clinical anatomy, anatomy education, laterality, morphometric analysis, geometric morphometry, and anthropometry. Besides his academic career, he is interested in photography and medical illustration.

Beverley Kramer

President of the IFAA

Emeritus Professor of Anatomy, School of Anatomical Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Beverley obtained her degrees at the University of the Witwatersrand (Wits) in South Africa. She was appointed as the Head of Anatomy in the Department of General Anatomy (Faculty of Dentistry) (1987–1995), and subsequently in the School of Anatomical Sciences (Faculty of Health Sciences) (1996–2003). She also held the position of Assistant Dean for Research and Postgraduate Support in the Wits Faculty of Health Sciences (2008–2016). Beverley was awarded the J.F van Reenen Award for teaching on two occasions and has co-authored three textbooks for students. She has published in the fields of developmental biology, anatomy education and research management. Beverley mentors both early career and senior staff members, a task which she feels is of great importance. She was responsible for initiating the IFAA Newsletter "Plexus" in 2003, the IFAA's "President's Emergent Anatomists Programme" in 2018 and was a member of the IFAAs FICAT (anatomical terminology committee) for several years. She is Director of the Carnegie-Wits Alumni Diaspora Programme, a programme which she initiated to "bring home" Alumni from the Diaspora to undertake research collaborations at Wits. Beverley is the recipient of numerous awards, such as the Anatomist Excellence Award (2012) and the Leonardo da Vinci Award (2021) from the International Committee of Symposium on Morphological Sciences (ICSMS). Professor Kramer was awarded the prestigious South African Department of Science and Technology/SARIMA award (2015) for "distinguished contributions to the research management profession". She is a past-President of the Anatomical Society of Southern Africa and serves on the Board of the ICSMS. She has had the following Fellowships conferred upon her: Honorary Fellow of the Anatomical Society (2015), Fellow of the American Association of Anatomists (2017) and Fellow of the Anatomical Society of Nigeria (2018). Beverley is currently President of the International Federation of Associations of Anatomists (IFAA).

Diogo Pais

Secretary General of the IFAA

Department of Anatomy, Faculty of Medical Sciences, Nova Medical School, Lisboa, Portugal

Diogo Pais graduated from the Faculty of Medical Sciences (NOVA University of Lisbon) in 1982, where he obtained his Master of Sciences Degree (1988) and his PhD (1996) in Medicine (Anatomy) with summa cum laude. He is Full Professor, Chairman of the Department of Anatomy and Course Director of Gross Anatomy, Regional Anatomy, Medical Ethics and Law and Legal Medicine, in both pre and postgraduate courses, since 2008. He is Director of the Gross Anatomy Laboratory and Body Donation Officer at the NOVA Medical School. He was honored by several teaching awards, namely "Best Teacher of the Year Award" in the Orthoptics Degree Course of the School of Health Technology of Lisbon in 1992/1993 and three times, between 2003 and 2008, of the Dental Medicine Degree Course at the Faculty of Dentistry (University of Lisbon. At the NOVA Medical School, in Lisbon, he is Member of the Pedagogic Council, Coordinator of the 1st year of the Medical Degree Course and Chairman of the Ethics Research Committee. He is a founding member of the Ethics Committee of the NOVA University of Lisbon. Diogo Pais is a member of numerous Scientific Societies, having been awarded Honorary Membership of the Anatomical Society of Paris and of the Romanian Society of Anatomy and "Special" Membership of the Portuguese Society of Comparative Anatomy. He is currently Secretary-General of the International Federation of Associations of Anatomists (IFAA) and Secretary-General of the International Committee of Symposia on Morphological Sciences (ICSMS). He was President of the European Federation for Experimental Morphology (EFEM) and President of the Portuguese Anatomical Society (AAP|SAP). Diogo Pais' main research interests are the microvasculature of tissues and organs, anatomical education and medical ethics. He is a member of the Editorial Board and referee of several scientific journals. He is a founding member of TEPARG.

Piraye Kervancıoğlu

President of the Turkish Society of Anatomy and Clinical Anatomy

Department of Anatomy, Faculty of Medicine, Gaziantep University, Gaziantep, Turkey

Dr. Piraye Kervancıoğlu is a Professor of Anatomy at the Department of Anatomy, Medical Faculty, Gaziantep University. She was born in Gaziantep in 1968. She graduated from Ankara University, School of Medicine in 1994. She received her degree as an anatomy specialist from the Department of Anatomy, Dicle University, Medical Faculty in 2000. In 2004, she attended as assistant professor to Dicle University, Medical Faculty, Department of Anatomy. She received her associate professor

title in 2006. She has been working at the Department of Anatomy, Medical Faculty, Gaziantep University as professor since 2012. In 2011, she spent three months as a "Visiting Observer" at the Department of Cardiology at Children's Hospital Boston in Massachusetts, USA. She has taught Anatomy for 22 years. She has more than 40 international publications, more than 25 presentations in international congresses and more than 200 citations in indexed international scientific journals. Dr. Kervancıoğlu has been serving as the Dean of Gaziantep University Faculty of Health Sciences since 2021 and also serving as President of Turkish Society of Anatomy and Clinical Anatomy. She is married and the mother of two sons.

Esat Adıgüzel

Department of Anatomy, Faculty of Medicine, Pamukkale University, Denizli, Turkey

Prof. Dr. Esat Adıgüzel was born in 1966. He graduated from Ankara University School of Medicine in 1988, and completed his residency in Cumhuriyet University Medical School, Department of Anatomy (Sivas-Turkey) between 1993 and 1996. He has been working since then as an academic staff in Pamukkale University Faculty of Medicine, Department of Anatomy (Denizli, Turkey). He served as the president (2018–2020) and is serving as a regular member of the Executive Committee of the Turkish Society of Anatomy and Clinical Anatomy.

Nadire Ünver Doğan

Department of Anatomy, Faculty of Medicine, Selçuk University, Konya, Turkey

Professor Nadire Ünver Doğan graduated from Ankara University School of Medicine in 2000. She worked as a general physician in Aksaray between 2001 and 2003 and started her residency in Anatomy in 2003 at the Selçuk University Meram Faculty of Medicine Department of Anatomy in 2003. She finished her residency in 2007, started working as an assistant professor at Selçuklu Faculty of medicine (2007–2010), and was appointed as an associate professor of anatomy in 2010 at the Selçuk University Faculty of Medicine. Since 2017, she has been working as a professor of anatomy and vice-dean at the same institution. Currently she serves as an Executive Board Member of the Turkish Society of Anatomy and Clinical Anatomy and the Medical Specialization Board of the Ministry of Health. Her research areas are clinical anatomy of the musculoskeletal, cardiovascular and peripheral nervous systems, radiologic anatomy, and fetal anatomy.

Selçuk Tunalı

Department of Anatomy, Faculty of Medicine, TOBB University of Economics and Technology, Ankara, Turkey

Dr. Tunali was born in Bulgaria from Turkish ancestors in 1973; graduated from Ankara Anadolu Lisesi and Hacettepe University Faculty of Medicine. He got his PhD on human anatomy in 2005 from Hacettepe University Institute of Health Sciences, Department of Anatomy. He has been in the University of Hawaii School of Medicine as a visiting professor, soon appointed as adjunct assistant professor since 2008. In 2010, he was appointed as assistant professor in the Hacettepe University Faculty of Medicine Department of Anatomy, promoted to associate professor in 2012. In 2013, he was transferred to the TOBB University of Economics and Technology Faculty of Medicine as a founding faculty member, where he was the Vice Dean and then Dean of the Faculty of Medicine. He organized countless cadaveric workshops on clinicaI and surgical anatomy. He has more than 50 national and international presentations in scientific meetings and 30 international publications in medical journals. He launched a new medical journal in 2008 entitled "International Journal of Anatomical Variations" and served as the Editor-in-Chief and publisher until 2017. He is a member of the Turkish Society of Anatomy and Clinical Anatomy (Council member, 2021– current), American Association of Clinical Anatomists, International Society for Plastination (Secretary 2014–2016, 2016–2018), Anatomical Society, American Association for Anatomy, British Association of Clinical Anatomists, Institute of Anatomical Sciences, Global Community of Anatomical Science Educators (founding member), Hacettepe University Faculty of Medicine Alumni Association (Former Member of Executive Committee as the Association Secretary). He is interested in plastination, anatomical basis of surgical and non-surgical facial esthetic procedures, anatomical variations, cross-sectional & clinical anatomy. He speaks English and French fluently. He is interested in Turkish music and literature, playing some traditional Turkish musical instruments. He is married and has a son.

Zeliha Kurtoğlu Olgunus

Department of Anatomy, Faculty of Medicine, Mersin University, Mersin, Turkey

Professor Dr. Zeliha Kurtoğlu Olgunus was born in 1973, in Trabzon. After graduating from Blacksea Technical University Faculty of Medicine in 1995 as a medical doctor, she studied at the Anatomy Department of the same university and received her anatomy specialist degree in 2000. She has been working as a faculty member at Mersin University Faculty of Medicine, Department of Anatomy since this date, as one of the founders of the department. She was a member of the congress organizing committee at the National Anatomy Congresses held in Turkey in 2008 and 2020. She worked as a board member of Turkish Society of Anatomy and Clinical Anatomy (TAKAD) between 2018–2021. Currently, she is the assistant editor of the "Anatomy" journal. Her work focuses on dissection for surgical anatomy, developmental anatomy and improving awareness of body donation in Turkey.

Ayhan Cömert

Department of Anatomy, Faculty of Medicine, Ankara University, Ankara, Turkey

After his graduation from Ankara University, School of Medicine, he completed his specialization in Ankara University, School of Medicine, Department of Anatomy in 2007. In 2014, Dr. Cömert completed his Research Fellowship in Neurosurgical Anatomy at the University of Pittsburgh Medical Center (UPMC), under the Direction of Dr. Juan

C. Fernandez-Miranda (University of Pittsburgh Medical Center - UPMC) Skull Base Center, Surgical Neuroanatomy Lab, Skull Base Anatomy, Pittsburgh, USA. As a researcher on surgical neuroanatomy, in 2016, he was a visiting researcher in Salzburger Landeskliniken – Universitätsklinikum Salzburg at the Universitätsklinik für Hals-Nasen-Ohren-Krankheiten, Salzburg, Austria. He currently works as a "Professor of Anatomy" since 2018 and since 2013 as School of Medicine Erasmus Coordinator. His wos h-index is 21 and he is author or coauthor of more than 120 international original peer-reviewed papers and eight international book chapters. He is a member of the European Association of Clinical Anatomy (EACA) and served as Auditing Board Member and Board Member of Turkish Society of Anatomy and Clinical Anatomy (TSACA). He currently serves as Associate Editor of spine and medulla section of "Surgical and Radiological Anatomy" and "Frontiers in Neuroanatomy" and is in editorial board and reviewer of more than twenty national and international journals. Dr. Cömert was an invited speaker in many international congresses, courses and symposia. His scientific fields of interest are surgical neuroanatomy, spinal anatomy, bone-implant biomechanics, clinical anatomy, stem cells and regenerative medicine.

Ceren Günenç Beşer

Department of Anatomy, Faculty of Medicine, Hacettepe University, Ankara, Turkey

Dr. Ceren Günenç Beşer was born in May 1980, in Ankara, Türkiye. She graduated from Ankara University, Faculty of Medicine in 2004 as a medical doctor. After finishing the university, she started to study in Hacettepe University, Faculty of Medicine, Department of Anatomy in 2006 as a research assistant and completed her Ph.D in 2010. Her finishing thesis was a radiologic and clinical anatomical study named "The prevalence and distribution of the atherosclerotic plaques in the abdominal aorta and its branches". In October 2017, she became an associate professor and she is still working at Hacettepe University. Her interest areas are macroscopic and microscopic anatomy; neuroscience; plastination; clinical, orthopedic and radiologic anatomy; western blot; immunohistochemistry techniques and medical simulation. She has many publications in the journals indexed in SCI and SCI-Expanded and in other indexes. She has more than 40 abstracts that were published in the abstract books of international and national congresses. She presented more than 30 studies in international and national congresses, and she was invited to many international and national congresses as an invited speaker. She wrote chapters about neuroanatomy in anatomy textbooks and she participated in the translation of 20 anatomy textbooks from English to Turkish. She is working as an associate editor in an anatomy journal named "International Journal of Anatomical Variations" and working as a reviewer in 5 more journals. She has been working on plastination with silicone and polyester plastination techniques since 2013. She is a member of Turkish Association of Anatomists and Clinical Anatomists since 2006 and she is the accountant member of this association since 2020. She is also a member of the medical simulation department in Hacettepe University and gives medical simulation lectures. She is a lecture board chairman for Tissue and Skeletal System Committee for Medical Faculty, Phase 2. She is also the associate coordinator of the Postgraduate Education, Basic Medical Sciences. She worked as a postdoc in Kuwait University, Faculty of Medicine, Department of Anatomy in 2018 for four months on western blot, immunohistochemistry, immunofluorescence techniques and experiments on animals. She is working on anatomy of acupuncture and working at the Traditional and Complementary Medicine Application and Research Center since 2018 and she is at the advisory board of this center since 2021.

İlke Ali Gürses

Department of Anatomy, School of Medicine, Koç University, Istanbul, Turkey

İlke Ali Gürses is an Associate Professor of Human Anatomy at Koç University School of Medicine (KUSOM). He received his medical degree from Istanbul University, Istanbul Faculty of Medicine in 2005, finished his residency in Anatomy in 2010, was appointed as an Associate Professor in 2017, and served as the Head of Assessment and Evaluation Office at the same institution. His research areas were clinical anatomy and radiological anatomy, focusing on musculoskeletal, circulatory, and peripheral nervous systems. Between 2012 and 2021, he also served as the coordinator for the Body Donation Program at the Istanbul Faculty of Medicine and shifted his research into body donation practice and ethics in anatomy. Currently, he is serving as the Secretary General of the Turkish Society of Anatomy and Clinical Anatomy and as a Second Year Coordinator at KUSOM.

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An International Journal of Experimental and Clinical Anatomy

20th Congress of the International Federation of Associations of Anatomists

5–7 August 2022, Istanbul, Türkiye

Program Schedule

August 5, 2022, Friday

Plenary Hall

10.00–10.30	**Opening Session** Erdoğan Şendemir *President of the XX Federative International Congress of Anatomy* Piraye Kervancıoğlu *President of the Turkish Society of Anatomy and Clinical Anatomy* Beverley Kramer *President of the International Federation of Associations of Anatomists*

Plenary Hall

10.30–11.15	**Opening Lecture** **Chair:** Erdoğan Şendemir Epithelial Barrier Hypothesis for the development of 2 billion allergic, autoimmune, metabolic and neuropsychiatric diseases A. Cezmi Akdiş / *Swiss Institute of Allergy and Asthma Research (SIAF), Davos, Switzerland*
11.15–11.30	**Break, Visit The Exhibition & Posters**

Plenary Hall

11.30–13.00	**Chinese Society of Anatomical Sciences Symposium** Clinical anatomy new insight in muscular skeleton system **Chairs:** Jun Ouyang & Nan Zheng The obscure joint – New insights into form-function relationships of the sacroiliac joint Niels Hammer Anatomical measurement and characteristic of anterior talofibular ligament with its adjacent ligaments in neutral position and plantar flexion Jingxing Dai The universal existence of myodural bridge complex in vertebrate: an indication of a necessary function Nan Zheng A multi-stage ensemble network system to diagnose adolescent idiopathic scoliosis Xiaohe Li Dual efficacy of Fasudil at improving survival and reinnervation of flap through Rho-ROCK-PI3K-AKT pathway Zhuang Yuehong A 3D visualization layered anatomy for acromial arterial rete and flap design Maochao Ding

Hall 2

11.30–13.00 **Symposium**

Body sourcing for anatomical education and research: experiences from the African Continent

Chairs: Goran Štrkalj & Brendon Billings

No challenge is insurmountable: dealing with the difficulties of sourcing human bodies on the African continent
Beverley Kramer

Cultural practices of South African ethnic groups on the body and their influence on body donation
Brenda De Gama

Where is our missing body?
Amenu Tolera Wirtu

Sourcing body for anatomy education and research: the Nigerian experience
Samuel Asala

Cadavers for education and research: overcoming challenges in Rwanda
Julien K. Gashegu

The sources of cadavers between Africa and Eastern Europe
Brendon Billings

Hall 3

11.30–13.00 **FIPAE Symposium**

Anatomy visualised

Chairs: Claudia Krebs, Nalini Pather & Paul Rea

Anatomy through visual-rich social media – Experiences, lessons, and opportunities
Joyce El-Haddad

Putting the 'fun' back in anatomy fundamentals with tabletop serious games
Mikaela Stiver

Deep anatomy observation with touch and drawing: the haptico-visual observation and drawing method
Leonard Shapiro

So, you want to create XR – Now, what?
Claudia Krebs

Are they learning with immersive VR? A novel assessment tool for cognitive load
Nalini Pather

A MSc in medical visualisation and human anatomy
Paul M. Rea

Hall 4

11.30–13.00 **Chinese Society of Anatomical Sciences Symposium**

Development, stem cells and cancer

Chair: Zhengquan Yu

Centriole components' multi-site localization and involvement in spindle assembling and asymmetric positioning in mouse oocyte meiosis
Wei Ma

The AMPK–HOXB9–KRAS axis regulates lung adenocarcinoma growth in response to cellular energy alteration
Jun Zhan

Lepr^{+} mesenchymal cells sense diet to modulate intestinal stem/progenitor cells via leptin-Igf1 axis
Zhengquan Yu

Hall 5	
11.30–13.00	**Platform Presentation Session** **Chairs:** Ayberk Kurt & Erich Brenner Thalamus morphology in healthy and disease patients: MRI retrospective study Ramada Khasawneh Morphology of the temporomandibular joint in skeletal class II and III malocclusion Felipe Figueroa Frequency of ponticulus posticus in cone beam computed tomography Gustavo Matus Radiographic evaluation of the morphometric and morphological characteristics of the external occipital protuberance Hande Salim Physiological intracranial calcifications in children: a computed tomography-based single-center study Faiza Al Hajri Coexistence of bifid median nerve and persistent median artery: three case reports Ekrem Solmaz
13.00–14.00	**Break, Visit the Exhibition & Posters**
Plenary Hall	
14.00–15.30	**FICEM Symposium** Anatomical disciplines as incubators for ethics and professionalism in healthcare education **Chair:** Thomas H. Champney The dissection room as a transformational education space Jon Cornwall Reflecting on relational anatomy Sabine Hildebrandt Histology & neuroanatomy as transducers for ethics and professionalism Thomas H. Champney
Hall 2	
14.00–15.30	**President's Emergent Anatomists Programme Symposium** Establishing a professional profile and networking as an early career anatomist **Chair:** Carol Hartmann Becoming involved in academic citizenship: getting involved in societies and networking Nalini Pather Linking in and getting out of the research gate: developing your online profile Jason M. Organ Developing your curriculum vitae Carol Hartmann
Hall 3	
14.00–15.30	**Chinese Society of Anatomical Sciences Symposium** Stem cell in adult tissue development: from reproduction to regeneration **Chairs:** Yue Wang & Xuejiang Guo Phf2 coordinates ribosome biogenesis and DNA damage response for mouse and human neural stem cell activation Jia Feng Dynamic mRNA degradome analyses indicate a role of histone H3K4 trimethylation in association with meiosis-coupled mRNA decay in mouse and human oocyte aging Qian-Qian Sha

	Cell response to microenvironmental mechanical force during development Yue Wang
	Differential diagnosis and treatment of azoospermia in men Xuejiang Guo
Hall 4	
14.00–15.30	**Korean Association of Anatomists Symposium** 3D printing and digital anatomy **Chairs:** Beom Sun Chung & Joe Iwanaga 3D and digital technology in clinical anatomy Joe Iwanaga
	The sectioned images and three-dimensional models for digital anatomy Chung Yoh Kim
	The digital transformation and education equality in anatomy learning with female and male 3D anatomy models Grace Kim
Hall 5	
14.00–15.30	**Platform Presentation Session** **Chairs:** Mehmet Üzel & Mehmet Selman Demirci Intramuscular nerve distribution of the splenius capitis muscle with the modified Sihler's staining technique Melisa Gülcan
	Facial canal morphometry: a technical report Shavana Govender
	Tympanic anulus: clinical implications for endoscopic ear surgery Selçuk Mülazımoğlu
	Anatomical connections among the depressor supercilii, levator labii superioris alaeque nasi, and inferior fibers of orbicularis oculi: implications for variation in human facial expressions Mi-Sun Hur
	Crossing fibers of the depressor septi nasi and orbicularis oris attaching to the medial crura of major alar cartilage: medial crura depressor Mi-Sun Hur
	Ophthalmic artery arising from the middle meningeal artery in South African patients Bukola Rukayat Omotoso
15.30–15.45	**Break, Visit the Exhibition & Posters**
Plenary Hall	
15.45–17.15	**Anatomical Society Symposium** Part to part, part to whole: fitting the pelvis into the evolutionary puzzle of the human body **Chairs:** Nicole Torres-Tamayo & Shahed Nalla Understanding the evolution of the human birth canal through geometric morphometrics: insights from a Brazilian contemporary sample Maria Rita Guedes Carvalho
	Application of geometric morphometrics in predicting hominin pelvic morphology Mayowa T. Adegboyega
	A new reconstruction of the pelvis of KNM-WT 15000 reveals new insights into the body shape of Early African Homo erectus Nicole Torres-Tamayo

Hall 2

15.45–17.15 **Panel**

The anatomy of medical terminology

Chair: Stephen Russell

Teaching anatomical terminology: a systematic approach
Kyle McLeister

Bridging the gap: anatomical and clinical medical terminology
Amanda Hardman

Notes from a philologist: when the English equivalents of TA terms are inconsistent with the original Latin terms
Stephen Russell

Arteries don't got noses! (and the TA doesn't have "non-concordant adjectives")
Lewis Stiles

Giving the province of Quebec a taste of its own medicine: diversity of dialect in the medical field
Mélanie Houle

Meet the terminologia carcinomatosa: a proposed addition to the TA family
Anjali Sachdeva

Hall 3

15.45–17.15 **FICSP Symposium**

Ethical considerations in the publication of anatomy manuscripts

Chair: Gülgün Şengül

The ethicality of publishing anatomical research: perspectives from an author, reviewer, and editor
Shane R. Tubbs

Data integrity and ethical publishing behavior in the anatomical sciences
Heather F. Smith

Ethics in experimental animal research
Gülgün Şengül

Hall 4

15.45–17.15 **TEPARG Symposium**

Hybridising anatomy education

Chair: Joanna Matthan

Learner gain: evaluating learner gain and student satisfaction of teaching anatomy online using 3D digital models as compared to 2D illustrations
Rohan Bhate

Educator perspective: educational sources for distance teaching in anatomy during the Covid-19 pandemic
Erich Brenner

Innovation in imaging: an innovative online resource for learning radiology and anatomy
Safia Khan & Imogen Cowdell

Flexible Assessments: Adopting a flexible approach to professional anatomy spotter exams during Covid
Luisa Wakeling

Dissection post-Covid: the role of cadaveric dissection and hybrid medical education in the post-Covid-19 pandemic era
Hannah Bridgwater

Clinical anatomy solutions: online solutions to the delivery and assessment of a clinical anatomy and medical imaging unit
Ian Johnson

Hall 5

15.45–17.15 **Satellite Symposium**
End-to-end digital technologies as a key efficiency factor in anatomy teaching and learning
Yuri Vasiliev

15.45–17.15 **Platform Presentation Session**
Chair: Barış Özgür Dönmez

A marine collagen-based biomimetic hydrogel recapitulates cancer stem cell niche and enhances progression and chemoresistance in human ovarian cancer
Sik Yoon

In vivo preclinical evaluation of bioprinted human cartilage construct
Vladimir Mironov

Regenerative potential of chondrospheres fabricated from human perichondrium
Vladimir Mironov

Plenary Hall

17.15–18.00 **Plenary Lecture**
Chair: Çağatay Barut

Pineal region surgery
Türker Kılıç / *Department of Neurosurgery, Bahçeşehir University, Faculty of Medicine, Istanbul, Turkey*

Hall 2

17.15–18.00 **Plenary Lecture**
Chair: Ceri Davies

Shackled by the great chain: how embryological anatomy had been enrolled for systemic racism and sexism
Scott Gilbert / *Howard A. Schneiderman Professor Emeritus of Biology, Swarthmore College, Swarthmore, PA, USA*

18.00–19.00 **Federative International Committee for the Support of Anatomy Professionals (FICSAP) Annual Meeting**

August 6, 2022, Saturday

Plenary Hall

08.30–10.00 **Invited Panel**
Chair: Meltem Bahçelioğlu

Anatomy of the clitoris, science meets art
Helen O'Connell / *Urological Surgeon, Melbourne, Australia*

Visualizing the clitoris: a twenty-year journey
Levent Efe / *Medical illustration Studios, Melbourne, Australia*

Hall 2

08.30–10.00 **Chinese Society of Anatomical Sciences Symposium**
Multi-model analysis of the brain and neurodegenerative disorders
Chairs: Yuchun Tang & Lingzhong Fan

Probabilistic atlas of human brainstem pathways and its application
Yuchun Tang

Genetic and phenomic architecture of the human brain torque
Lu Zhao

Uncovering the genetic profiles underlying the intrinsic organization of the the human cerebellum
Lingzhong Fan

Spatial-temporal brain structure change during the progression of sporadic Alzheimer's disease
Junjie Zhuo

Hall 3

08.30–10.00 **Platform Presentation Session**

Chairs: Sergey Dydykin & Ayhan Cömert

Anatomy of the suspensory ligament of the penis: does size matters?
Leonardo Miguel Vieira Silva

Abductor pollicis brevis in fetuses: classification, measurements, and surgical implications
Saliha Seda Adanır

Anatomical characteristics of the hip flexion abduction external rotation (FABER) position using magnetic resonance imaging
Masahiro Tsutsumi

A novel approach for quantitative imaging of the seated anatomy of the buttocks using ultrasound
Nkhensani Mogale

Evaluation of the anatomical structures with physical examination and magnetic resonance imaging in ischiofemoral impingement syndrome
Ayşe Gamze Özcan

Morphological and morphometric study of the latissimus dorsi tendon for its transfers in rotator cuff tears
Mi-Sun Hur

Hall 4

08.30–10.00 **Chinese Society of Anatomical Sciences Symposium**

Synaptic and circuit plasticity and behavior

Chairs: Yun-Qing Li & Tao Chen

Mechanisms underlying descending modulation on pain and negative emotion through the pathway between prefrontal cortex and midbrain
Yun-Qing Li

Glutamatergic synapses from the insular cortex to the basolateral amygdala encode empathic pain
Tao Chen

Roles and neural circuits of the striatum on sleep-wake regulation
Xiang-Shan Yuan

Rostromedial tegmental nucleus nociceptin/orphanin FQ (N/OFQ) signaling regulates anxiety- and depression-like behaviors in alcohol withdrawn rats
Rao Fu

Mechanically evoked defensive attack is controlled by GABAergic neurons in the anterior hypothalamic nucleus
Peng Cao

Hall 5

08.30–10.00 **Platform Presentation Session**

Chairs: Burak Bilecenoğlu & Mert Ocak

Evaluation of trachea and bronchi with 3-dimensional reconstruction method in Covid-19 patients
Ayşe Erkaya

Sex-dependent morphometric analysis of sternum on computed tomography images
Hande Salim

Comparison of the cystocoledocal angle in patients with choledocholithiasis and only cholelithiasis
Zekiye Karaca Bozdağ

Differences in the anatomical structure of the uterus between fertile and infertile individuals
Betül Sevindik

Evaluation of coronary artery variations and anomalies with coronary computerized tomographic angiography
Nevin Aydın

Prenatal diagnosis of giant cardiac tumor with fetal echocardiography: two cases
Yasemin Özdemir Şahan

Hall 6

08.30–10.00 **Platform Presentation Session**

Chairs: Elisabeth Eppler & Vladimir Mironov

Protein homeostasis of lung tissue under the influence of Vipera berus berus and Vipera berus nikolskii poison
Liudmyla Sokurenko

STUB1-mediated proteasomal degradation of m6A methyltransferase METTL3 regulates cancer metastasis
Bin Li

Stomach secretes estrogen in response to the blood triglyceride levels
Yuta Yamamoto

99m Tc-labeled keratin gold-nanoparticles in a nephron-like microfluidic chip for photo-thermal therapy applications. An ultramicroscopical point of view
Selenia Miglietta

Di-(2-ethylhexyl) phthalate triggers proliferation, migration, stemness, and epithelial-mesenchymal transition in human endometrial and endometriotic epithelial cells via the transforming growth factor-β/smad signaling pathway
Yeseon Lim

Plenary Hall

10.00–10.45 **Plenary Lecture**

Chair: Selçuk Tunalı

Squirt Eis: A sculptural intervention with popsicles in shapes of the female prostate
Julia Frankenberg / *Sculptural Intervention*, *Squirt Eis*, *Berlin*, *Germany*

10.45–11.00 **Break, Visit the Exhibition & Posters**

11.00–12.30 **Anatomical Society Symposium**

Augmented and virtual reality in anatomy

Chair: Matthieu Poyade

Scaleable, accessible and affordable utilization of extended reality (virtual reality, augmented reality and the metaverse) in surgical education and global health and its scientific rationale
Jagtar Dhanda

Medical visualization: from medical art to XR visualization
Matthieu Poyade

Using cognitive load theory and visual elements of art to design anatomy learning resources
Thanasorn Asaswesna

Hall 2

11.00–12.30 **FIPAE Symposium**

Anatomy and sexism

Chairs: Gabrielle Finn & Nalini Pather

Welcome and Introduction to the Symposium
Nalini Pather

Feminist theory within education
Megan Brown

Sex and sexism in anatomy
Gabrielle Finn

Female genital cosmetic surgery: the role of anatomical knowledge in decision making
Jisoo Yoon

Inspiring and supporting women in Anatomy – Beyond stereotypes
Yolanda Salinas Álvarez

Challenging gendered norms: how might we drive change in and through anatomy education
Nalini Pather

Hall 3

11.00–12.30	**ISCAA Symposium** Recent advances in clinical and applied anatomy: from the bench to clinical practice **Chair:** Ayhan Cömert
	Surprising anatomical facts as a troubleshooter for saphenous nerve block Georg Feigl
	Surgical anatomy for suboccipital retrosigmoid approach Eyüp Bayatlı
	The anatomy and sonoanatomy for ultrasound-guided nerve blocks in the head and neck Ayhan Cömert
	Interdisciplinary clinical anatomy education Marcela Bezdickova
	Erector spinae plane blocks; same block with sonoanatomical differences Selin Güven Köse
	Surgical anatomy for intracranial and intracanalicular course of optic nerve: anatomical comparison of different surgical approaches Tuğba Moralı Güler
	Microsurgical anatomy of the Sylvian fissure Y. Efe Güner
	Ultrasound-guided cervical sympathetic ganglion block: anatomical considerations Burcu Candan

Hall 4

11.00–12.30	**Chinese Society of Anatomical Sciences Symposium** Brain development and regeneration **Chairs:** Feng Mei & Sonia R. Mayoral
	Long-term intravital single cell tracking under 2-photon microscopy Ya-Jie Liang
	A neural circuit from thalamic paraventricular nucleus to central amygdala for the facilitation of neuropathic pain Yu-lin Dong
	Understanding normal and diseased human basal ganglia using combinatory indexing single nuclei RNA sequencing Linya You
	Crosstalk between astrocytes and oligodendrocytes in early life stress Jianqin Niu
	Poly-L-ornithine reverses the inhibitory effect of fibronectin on oligodendrocyte differentiation and promotes myelin repair Hui Fu
	Neuronal requirements for the initiation of myelination in the CNS Sonia R. Mayoral

Hall 5

11.00–12.30	**Satellite Symposium** Complete anatomy's female model, a new perspective in anatomy education Ashton Luxgrant (Medical Writer 3D4Medical) & Mohamed Shahin
11.00–12.30	**Platform Presentation Session** **Chair:** Seher Yılmaz
	The effect of growth hormone on 6-OHDA induced HEK-YFP-DAT cell line Özlem Kirazlı
	Preventive effects of bone marrow-derived mesenchymal stem cell transplantation in a D-galactose-induced brain aging in rats Gehan Farouk El Akabawy

Cannabidiol ameliorates lithium chloride pilocarpine-induced seizure, consequent hippocampal damage in acute, latent and chronic phases of epilepsy in animal model
Olatunji Sunday Yinka

Evaluation of two point discrimination sensation in the hand
Cevdet Yardımcı

Hall 6

11.00–12.30 **Platform Presentation Session**
Chairs: Servet Çelik & Eren Öğüt

Anatomical formation of the sural nerve: descriptive study on a sample of South African cadavers
Jayshree Harangee

Anatomical investigation of the connection between the accessory nerve and the posterior root of the first cervical nerve using cadaveric dissections
Jayshree Harangee

Origin and cervicothoracic connections of the cardiac nerves in human fetuses
Mailén Lucía González

Evaluation of the alteration of morphometry in foramina ovale and spinosum: the contribution of the foramen vesalius
Michael Kostares

Anatomical variations of foramen of the diaphragma sellae and neighbouring structures: a cadaveric study
Uğur Berk Akdağ

Dr. Marjorie Ann England: innovative fetal imaging, human morphology educator, researcher & humanitarian pioneering gender shift in medical anatomy
Brion Beninnger

Plenary Hall

12.30–13.15 **Plenary Lecture**
Chair: Gülgün Şengül

The human brain anatomy revisited in the light of intraoperative functional mapping in awake patients with gliomas: towards a meta-networking organization of the cerebral connectome
Hugues Duffau / *Department of Neurosurgery, Gui de Chauliac Hospital, Montpellier University Medical Center, Montpellier, France*

13.15–14.30 **Break, Visit the Exhibition & Posters**

Break Out / Chat Room (Hall B1)

13.15–14.30 **Open Mic Session: Ethics in Anatomy supported by Federative International Committee for Ethics and Medical Humanities (FICEM)**
Moderators: Jon Cornwall & Andreas Winkelmann
Other experts: Thomas Champney & Sabine Hildebrandt & Goran Straklj

Plenary Hall

14.30–16.00 **Korean Association of Anatomists Symposium**
Anatomy in forensic sciences
Chair: Sang-Seob Lee

The applicability of two forensic dental age estimation for Japanese children and the comparison with the Korean population
Akiko Kumagai

Forensic Anthropology from a practitioner's view
Reza Gerretsen

The use of alternating light sources for discrimination of bone material in common soil
Frank van de Goot

Defense POW/MIA Accounting Agency Korean War Identification Project (DPAA KWIP)
Esther Choo

Thermal alteration and trauma in human bones
Giovanna Vidoli

Hall 2

14.30–16.00 **Symposium**

Animal modelling in the anatomy of human disease

Chairs: Busisiwe Maseko & Carmen Falcone

Does preeclampsia lead to autism? An investigation using Sprague Dawley rats
Busisiwe Maseko

Animal models of FASD: important considerations when developing FASD model using animals
Oladiran Olateju

The zucker diabetic Sprague Dawley (ZDSD) rat and a translational rodent model of type 2 diabetes
Robert Ndou

A Sprague Dawley rat model used to investigate the effects of binge gestational alcohol exposure in skeletal health: is it translational?
Diana Pillay

Hall 3

14.30–16.00 **Symposium**

Bone-deep anatomy: from the bench to clinical practice

Chairs: Diogo Pais & Diogo Casal

Bone composition in Wistar rats and its composition after infrasound exposure and glucose intolerance
Luísa Zagalo

Assessment of intraosseous arterial vascularization of the L1 vertebral body – Differences between human and Wistar rat
Diogo Moura

Arterial blood supply to the Wistar rat iliac bone
Gonçalo Coluna

Gross and microscopical anatomy of the human medial femoral condyle: new grounds to improve old flaps in this region
Alexandre Almeida

Digital anthropometric analysis of the phylogenetic evolution of the female pelvis: contributions to the understanding of labor
Raquel Lopes

Digital evaluation of the congruency of the shoulder joint surfaces in patients with brachial plexus lesions
Luís Gonçalves

Comparison of the 3-dimensional shape of the joint surfaces of the proximal interphalangeal joints of the fingers and the surfaces of the hamate and the base of the fifth metacarpal bone
Manuel Vilela

Anatomical basis of elongating bone transfers useful for pediatric bone reconstruction
Diogo Casal

Hall 4

14.30–16.00 **Korean Association of Anatomists Symposium**

A new era of clinical anatomy: from the classical dissection to the advanced medical imaging corresponding to clinical needs

Chair: Hee-Jin Kim

Challenge to unlanded territory: ultrasonographic anatomy of the face for the minimally-invasive procedures
Hee-Jin Kim

Progressive methodologies for the anatomical structures: microdissection, microcomputed tomography, and numerical simulation
Mi-Sun Hur

Dynamic coordination of the smooth and skeletal muscles in the pelvic floor: meso-anatomical examination
Keiichi Akita

Hall 5

14.30–16.00	**Platform Presentation Session** **Chair:** Yolanda Salinas-Alvarez Integrating virtual-reality enriched active leaning into pre-clinical gross anatomy education Jian Yang
	3D-Printing: a viable substitute for commercially purchased anatomical models David Resuehr
	Creating a global community during Covid-19 pandemic: bringing anatomical sciences educators together Inaya Hajj Hussein
	As a learning tool social media in anatomy education from the students' perspective Abdullah Ortadeveci
	Let students tell us what resources they used in their online anatomy education! Zekiye Karaca Bozdağ

Hall 6

14.30–16.00	**Platform Presentation Session** **Chair:** Guo-fang Tseng Three-dimensional visualization and quantification of the whole enteric nervous system in mouse and human using tissue clearing Young Hyun Yun
	Evaluation of dendrite morphology in wistar and genetic absence epileptic (GAERS) rats Özlem Kirazlı
	Ameloriative effect of 'Zingiber offinale and Allium sativum' on the hippocampus of streptozotocin induced diabetes mellitus in adult male wistar rat models Dorcas Olubunmi Taiwo Ola
	Dorsal and ventral hippocampus changes in a novel TDP-43 overexpression rat model by viral-mediated gene transfer method Elif Polat Çorumlu
	The role of platelet-rich plasma (PRP) on motoric functions after peripheral nerve injury Rizni Fitriana
	The dose dependent effects of linalool on the cerebellar morphology of diabetic rats Merve Nur Ermez
16.00–18.30	**IFAA General Assembly Delegate Registration** **IFAA GENERAL ASSEMBLY - IFAA Members Only**
24.00–01.00	**Federative International Committee for Ethics and Medical Humanities (FICEM) Annual Meeting**

August 7, 2022, Sunday

Plenary Hall

08.30–10.00	**FICSAP Symposium** Growing anatomists: anatomists perceptions of needs and provision of support **Chairs:** Stephanie Woodley & Helen Nicholson What support do anatomists need to develop their careers: data from the FICSAP/FIPAE survey Stephanie Woodley, Helen Nicholson

Hall 2

08.30–10.00	**Chinese Society of Anatomical Sciences Symposium** Preparation for the colorful life **Chairs:** Guang Wang & Kai Yuan Misregulation in protein O-GlcNAcylation contributes to neurodevelopmental defects Kai Yuan

Loss of Atoh8 attenuates skeletal myogenesis
Beate Brand-Saberi

Atg7 is involved in the neural development of the early embryo
Guang Wang

The function of connexin in OL development and myelin repair
Tao Li

The role of Eph-ephrin signaling in axon guidance of serotonin raphe neurons during development
Teng Teng

Hall 3

08.30–10.00

FIPAE Workshop
Active learning in anatomical sciences education: emerging from the pandemic
Chairs: Anneliese Hulme, Joyce El-Haddad & Nalini Pather

Diogo Pais, Gülgün Şengül, Jason Organ, Joy Balta, Quentin Fogg and Natasha Flack

The workshop is designed to maximise audience participation and dialogue. The discussion is scaffolded by the prompt questions with initial responses from a panel of experts from different geographical regions, and sub-disciplines of the anatomical sciences. Audience responses, views and experiences are welcomed and encouraged in this dialogue.

The outcome of this session is to:
- appreciate the diverse experiences of teaching and learning in the anatomical sciences during the pandemic, and identify common areas that we might collaboratively share and develop practice to advance anatomical sciences education globally.

Hall 4

08.30–10.00

Chinese Society of Anatomical Sciences Symposium
Tissue engineering and regenerative medicine: To restore tissue functions
Chairs: Wen Zeng & Jing Zhou

Applications of multifunctional hydrogels in tissue engineering
Malcolm Xing

Dimensionality-dependent mechanical stretch regulation of cell behavior
Yong Yang

Mechanical regulation of metabolic reprogramming of vascular smooth muscle cells in vein grafts
Jing Zhou

Endothelium-mimicking coating engineered cardiovascular stents for regulating vascular tissue regenerative repair
Zhilu Yang

Stem cells and the regeneration of tissue engineered blood vessels
Wen Zeng

Hall 5

08.30–10.00

Platform Presentation Session
Chairs: Behice Durgun & Ceren Günenc Beşer

Developing maternal socio-demographic and anthropometric protocol: determining birth size and delivery outcomes at the Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Nigeria
Chinedu Godwin Uzomba

A comparison of results using three mathematical models for multifactorial adult age-at-death estimation in a South African population
Nicolene Jooste

Proportional evaluation of measurements related to height and body parts: assessment of the presence of golden ratio
Songül Çuğlan

Assessing growth changes in the human palate across different stages of dental eruption
Erin Frances Hutchinson

Quantitative differentiation of thoracolumbar transitional vertebrae: possible associations with other anomalies in the vertebral column
Anneli Poolman

Hall 6

08.30–10.00 **Platform Presentation Session**
Chair: Zeliha Kurtoğlu Olgunus

Revisiting the muscles and nerves of anterior compartment of the arm: preliminary results of a cadaver study
Büşra Anacur

Width of the orbicularis oculi fibers extending to the upper lip with the lateral and inferior lengths of the orbicularis oculi at the level of the lateral canthus: application to botulinum neurotoxin type A injection for crow's feet
Mi-Sun Hur

Localization of the mandibular lingula using panoramic radiographs
Juan Pablo Aravena

Topographic anatomy of the tibial nerve and posterior tibial artery in the tarsal tunnel
Ayşe İmge Uslu

Case cadaveric series on the sural nerve formation variants and the aberrant sensory innervation of the lateral surface of the foot
Maria Piagkou

10.00–11.00 **Break, Visit the Exhibition & Posters**

Plenary Hall

11.00–12.30 **Korean Association of Anatomists Symposium**
Craniofacial development and regeneration
Chairs: Hyuk-Jae Edward Kwon & Richard Schneider

Hierarchical levels of gene regulation in the development and evolution of jaw length
Richard Schneider

Distinct BMP-Smads signaling outputs confer diverse functions in the dental mesenchyme
Liwen Li

Epigenetic regulation of palate formation
Hyuk-Jae Edward Kwon

Lower jaw bone length is altered by pharmacological inhibition of embryonic osteoclast activity
Erin Ealba Bumann

Injury induced transient dedifferentiation of taste receptor cells in mice
Han-Sung Jung

Hall 2

11.00–12.30 **Platform Presentation Session**
Chairs: Lena Hirtler & Gökşin Nilüfer Demirci

Topographical anatomy of the superficial temporal artery
Tuğba Moralı Güler

Contralateral transorbital endoscopic approach to petrous apex: a feasibility cadaver study
Hazan Başak

Beyond the tip of the iceberg: a meta-analysis on the anatomy of the clitoris
Rebecca Beni

A microsurgical study of the anatomy and anatomical variations of the median nerve: a cadaveric study
Manuel Encarnacion

Hall 3

11.00–12.30 **Platform Presentation Session**
Chairs: İsmail Nadir Gülekon & Cenk Murat Özer

Clinically relevant morphometric analysis of pterygopalatine fossa and its volumetric relationship with adjacent paranasal sinuses: a CT-based study
Betül Digilli

Chronic neck pain and its association with the angle of the cervical curve
Thuduwage Chamalika Sujeewanie Weerakoon

Evaluation of the piriformis muscle anatomy by magnetic resonance imaging
Ekrem Solmaz

Evaluation of the alignment of the intersesamoidal ridge's axis through 3D-printing models and digital method
İsmail Türkten

Morphometric evaluation and classification of the superior orbital fissure on 3D MDCT images
Büşra Pirinç

Investigation of the presence of discoid meniscus and its effect on anatomic structures in the knee joint by magnetic resonance images: a retrospective study
Hilal Irmak Sapmaz

Hall 4

11.00–12.30 **Chinese Society of Anatomical Sciences Symposium**
Adaptive learning and teaching in the post-Covid-19 era
Chairs: Xuesong Yang & Wei Wei

Unpacking the relationships between teacher-led and learner-led mobile learning activities and their impacts on teacher evaluation in a blended medical program
Wei Wei

Surgical boot camp improves clinical competencies in senior medical students
Jifeng Zhang

The anatomists' perceptions of blended learning changed by COVID-19 pandemic: a national survey in mainland China
Xin Cheng

The Chinese anatomists' perceptions towards blended learning approach in anatomy education: a national survey in the post-Covid-19 era
Xuesong Yang

Blended learning approach improves active learning and academic performance in a human embryology course
Shangming Liu

Modulations of the autonomic nervous system and hormone-physiological changes in response to Covid-19-related adaptations of different learning environments
Morris Gellisch

Hall 5

11.00–12.30 **Platform Presentation Session**
Chairs: Joanna Matthan & Goran Strkalj

The development of a core musculoskeletal anatomy syllabus for physical therapy education
Stephanie J. Woodley

Neuroanatomy in the medical curriculum: a South African perspective
Gerda Venter

A postgraduate perspective of radiology into the anatomy curriculum
Courtney Barnes

A Southern African perspective on the ethical use of digital images in anatomical teaching
Tamara Lottering

Hall 6

11.00–12.30 **Platform Presentation Session**
Chairs: Dusica Lazar Maric & Neslihan Yüzbaşıoğlu

Factors that influence decomposition timeline estimation in Anambra state, Nigeria
Darlington Nnamdi Onyejike

An evaluation of the reliability of current stature estimation equations for contemporary White South Africans
Natasha Rosanne Loubser

Morphological evaluation and clinical significance of the supracondylar process and supratrochlear foramen: an anatomic and radiological study
Ayşe Erkaya

Aplasia cutis congenita associated with coarctation of aorta in a newborn: is this a coincidence or variant of Adams-Oliver syndrome?
Başak Soran Türkcan

An anatomical variation: absence coeliac trunk
Hürriyet Ercan Çetinok

Plenary Hall

12.30–13.15 **Plenary Lecture**
Chair: Hyuk-Jae Edward Kwon
The first woman anatomist in Korea "Prof. Bok Young Rha" (Mother and daughter woman anatomists)
Kyung Ah Park / *Professor Emeritus, Yonsei University College of Medicine, Seoul, South Korea*

13.15–13.45 **ICSMS Executive Committee Meeting**

13.15–14.30 **Break, Visit the Exhibition & Posters**

Break Out / Chat Room (Hall B1)

13.15–14.30 **Developing future anatomists: Share your views**
Moderator: Carol Hartmann

Plenary Hall

14.30–16.00 **FICEM Symposium**
Historical anatomical collections: treasure, legacy, and challenges
Chairs: Andreas Winkelmann & Brendon Billings
Provenance of collection items from the early 19th century in an anatomical collection
Andreas Winkelmann

Restitution of indigenous bodies: the ethics of what remains
Marina L. Sardi

Collections of the unborn
Jason Mussell

Congdon's Anatomical Museum: from educational collections to Thailand's first anatomical museum
Adisorn Ratanayotha

African life and death masks in the Raymond A. Dart Collection
Brendon Billings

Hall 2

14.30–16.00 **Symposium**
Forensic clinical anatomy: an update 5 years later its proposal
Chair: Raffaele De Caro
Forensic clinical anatomy: introduction
Raffaele De Caro

Forensic clinical anatomy: Definition and perspectives
Andrea Porzionato

Imaging in forensic clinical anatomy
Veronica Macchi

Forensic clinical anatomy and surgery
Carla Stecco

Forensic clinical anatomy and clinical anatomy
Shane R. Tubbs

Hall 3

14.30–16.00 **FICEDA Symposium**

Equality and diversity in anatomy

Chair: Odile Plaisant

Colonisation, cadavers and colour: is there a case for decolonising the anatomy curricula?
Gabrielle Finn, Adam Danquah, and Joanna Matthan

Policies for equality and diversity in anatomy across different anatomical societies within the IFAA
Diogo Pais and Bernard Moxham

The development of guidelines for equality and diversity by the IFAA
Bernard Moxham and Beverley Kramer

Teaching female anatomy in the medical curriculum
Jennifer Hayes

Hall 4

14.30–16.00 **Chinese Society of Anatomical Sciences Symposium**

Morphology and function of myodural bridge

Chairs: Hong-Jin Sui & Gary D. Hack

The biomechanics, and physiological function of MDBC in dog
Hong-jin Sui

The myodural bridge in humans: discovery and potential implications
Gary D. Hack

Study on the developmental of myodural bridge of human and SD rats
Jianfei Zhang

The myodural bridge of the American alligator (Alligator mississippiensis) alters CSF flow
Bruce A. Young

Effect of myodural bridge management on postoperative results and complications during decompression of subcerebellar tonsillar hernia
Bin Dong

Hall 5

14.30–16.00 **Platform Presentation Session**

Chairs: Kerem Atalar & Dila Şener Akçora

Immune-mediated arthritis: is there any way for experimental modelling of its premorbid conditions and detection of compensatory mechanisms in the joint during the preclinical phase?
Andrii Viktorovych Fedotchenko

A different exosome secretion modality occurs in patient-derived colorectal cancer spheroids and in their mouse xenograft
Michela Relucenti

Evaluation of muscle spindle density and distribution of certain mimic muscles: preliminary results of a cadaveric study
Ekin Karacan

Microanatomic alterations in the uterus of a polycystic ovary syndrome (PCOS) mouse model and the potential role of carnitines
Maria Grazia Palmerini

Prenatal choline, uridine monophosphate, and fish oil supplements affect synaptogenesis in 5XFAD animals
Elif Nedret Keskinöz

Effect of exosomes derived from Sertoli cells on reconstruction of seminiferous tubule
Chunyang Li

Hall 6	
14.30–16.00	**Platform Presentation Session** **Chair:** Isabel Stabile Education of anatomy of arm and leg using 60 hand gestures Mi-Sun Hur Consolidation carnival: a modified speed-dating approach to reviewing musculoskeletal anatomy in an undergraduate medical curriculum Rosemary B. Bassey Virtual journal club in anatomy: perspectives of postgraduate students Kerri Keet Short and long-term retention of anatomical variation recognition using extended reality visualization Güneş Aytaç Exploring the most effective combination of drawing approaches for observation and understanding three-dimensional anatomy Leonard Shapiro
16.00–16.15	**Break, Visit the Exhibition & Posters**
Plenary Hall	
16.15–17.45	**Platform Presentation Session** **Chair:** Maria Piagkou A biomechanical study on the effect of long head of biceps tenotomy on supraspinatus load and humeral head position during shoulder abduction Shavana Govender Branching patterns and variations of the facial artery and clinical importance: a cadaveric study Zeynep Askin A novel anatomical description of the terminal peroneal artery and the terminal peroneal window with its important clinical and radiological implications James Richard Archer
Hall 2	
16.15–17.45	**Symposium** Methodologies in applied anatomy: clinical, forensic, and evolutionary anatomy **Chairs:** Shahed Nalla & Nicole Torres-Tamayo A biological perspective on ivolving mathematical methodologies Sundika Ishwarkumar, Nicolene Jooste Assessing age-related bony pelvis variation from CT scans Caroline VanSickle A brief review of virtual methodologies and their importance for evolutionary anatomy and biological anthropology Nicole Torres-Tamayo
Hall 3	
16.15–17.45	**Symposium** Integration of anatomy and innovation into healthcare **Chair:** Brion Benninger Integration of ankle anatomy and innovation into healthcare Lena Hirtler Integration of hand anatomy and innovation into healthcare Quentin A. Fogg Integrating anatomy with innovation: advancing the blueprint and knowledge of the lower limb, especially neurovascular structures from the pelvis to the foot improving healthcare Brion Benninger

Hall 4

16.15–17.45 **The Anatomical Record Symposium**

Evolution of a discipline: the changing face of anatomy

Chairs: Jason Organ & Heather F. Smith

The evolving ethics of anatomy: dissecting an unethical past in order to prepare for a future of ethical anatomical practice
Amber Comer

Books, bones and bodies: the relevance of the history of anatomy in Nazi Germany for medical education today
Sabine Hildebrandt

Ethical dilemmas in skeletal collection utilization: implications of the Black Lives Matter movement on the anatomical and anthropological sciences
Shanna E. Williams

Queer anatomy: how anatomy has played a role in the sociopolitical treatment of the LGBTQIA+ community
Theodore C. Smith

Shifting language for shifting anatomy: using inclusive anatomical language to support transgender and nonbinary identities
Jessica Byram & Lauren Easterling

Decolonization of anatomy curricula
Gabrielle Finn

Hall 5

16.15–17.45 **Platform Presentation Session**

Chairs: Figen Gövsa & Tuncay Peker

Effect virtual interactive 3-Dimensional models on anatomy education: a randomized controlled study
Pradip Rameshbhai Chauhan

The effectiveness and satisfaction of virtual anatomy laboratory education on medical students: a randomized trial compared to cadaver dissection
Young Hyun Yun

Customized 3D printing model in preventing vertebral artery injury for cervical pedicle screw insertion
Asli Beril Karakaş

Creation of 3- dimensional anatomical models using mobile phone applications
Suresh Selvaraj

Individualized 3d printing-assisted C1 and C2 cervical posterior screw fixation using full-scale models
Aslı Beril Karakaş

Hall 6

16.15–17.45 **Platform Presentation Session**

Chairs: Eduardo Andres Olivera Pertusso & Rodrigo Enrique Elizondo-Omaña

Biomechanical properties of the tendinous and capsular layers of the rotator cuff complex in a fresh tissue sample
Jessica Yvonne Cronje

A guide to facilitate the creation of a femoral tunnel for arthroscopic ligamentum teres reconstruction: a three-dimensional computed tomography study
Abdul Veli İsmailoğlu

Endonasal endoscopic route to superior orbital fissure: a feasibility anatomic study
Hazan Başak

Morphometric analysis of select cranial ventricular access points in patients with scaphocephaly
Vensuya Bisetty

Evaluation of preop and postop 6 months findings of surgery and transcatheter ventricular septal defect closure with Doppler echocardiography
Zeynep Bilge Yılmaz

Investigating the accuracy of ultrasound-guided blocks of peripheral branches of trigeminal nerve using methylene blue: an anatomical study
Selin Güven Köse

Plenary Hall	
17.45–18.30	**Closing Lecture** **Chair:** Emel Ulupınar Understanding ALS one neuron at a time: the power of cellular anatomy Hande Özdinler / *Department of Neurology, Northwestern University, Feinberg School of Medicine, Chicago, IL, USA*
18.30–18.45	**Closing Ceremony**

http://dergipark.org.tr/en/pub/anatomy
doi:10.2399/ana.22.002s

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Invited Plenary Lectures

(I-01 — I-09)

I-01

Epithelial barrier hypothesis: mechanisms of development of allergic and autoimmune diseases

Cezmi A. Akdiş

Swiss Institute of Allergy and Asthma Research (SIAF), Davos, Switzerland

Humans are exposed to a variety of toxins and chemicals every day. According to the epithelial barrier hypothesis, exposure to many of these substances damages the epithelium, the thin layer of cells that covers the surface of our skin, lungs and intestine. A defective epithelial barrier has been demonstrated in allergic and autoimmune conditions such as asthma, atopic dermatitis, allergic rhinitis, chronic rhinosinusitis, eosinophilic esophagitis, celiac disease, and inflammatory bowel disease. In addition, leakiness of the gut epithelium is also implicated in systemic autoimmune and metabolic conditions such as diabetes, obesity, multiple sclerosis, rheumatoid arthritis, systemic lupus erythematosus, ankylosing spondylitis, and autoimmune hepatitis. Finally, distant inflammatory responses due to a 'leaky gut' and microbiome changes are suspected in Alzheimer's disease, Parkinson's disease, chronic depression and autism spectrum disorders. Here the "epithelial barrier hypothesis" is introduced, which proposes that the rise in epithelial barrier damaging agents linked to industrialization, urbanization and modern life underlies the rise in allergic, autoimmune and other chronic conditions. After breaking of the epithelial barriers by various environmental agents and infections, microbiome which normally floats above the skin and mucosas goes deeper between and beneath the epithelial barrier. Microbial dysbiosis and decreased biodiversity develop following the colonization of opportunistic pathogens, such as S. aureus, Moraxella, Haemophilus and Pneumococcus. An immune response and inflammation inside and beneath the epithelium develop with the aim of expulsion of dysbiotic microbiome, which is deeper than its usual anatomic position. Defective epithelial barrier healing capacity because of microbial dysbiosis, chronic tissue inflammation and epigenetic mechanisms lead to the chronicity of the disease.

Keywords: epithelial barrier, allergic diseases, autoimmune diseases, microbiome

I-02

Pineal region surgery

Türker Kılıç

Department of Neurosurgery, Bahçeşehir University, Faculty of Medicine, Istanbul, Turkey

I-03

Shackled by the great chain: how embryological anatomy had been enrolled for systemic racism and sexism

Scott Gilbert

Howard A. Schneiderman Professor Emeritus of Biology, Swarthmore College, Swarthmore, PA, USA

The core of systemic racism and sexism is not merely an emphasis about human differences and thinking that another group of

people is inferior to one's own. Rather, the institutional nature of racism or sexism establishes a permanent group hierarchy that is believed to reflect the laws of nature or the decrees of God. It thus becomes the norm of a culture to think and behave according to these rules. Notions of hierarchy became solidified into the Great Chain of Being during the Middle Ages, as did views concerning hereditary racial and gender superiority. During the Enlightenment, such classifications became established by philosophy and science. Starting in the 1800s, embryology and anthropology were used to provide evidence for the unilinear progression of species and races. The first evolutionary schemes were not "branching trees." In these schemes, women and nonwhite races were seen as embryonic or juvenile forms of the adult white male, and they were often depicted as intermediaries between the fully human and the animals. Such linear schemes of evolution remain part of popular culture and even some science, promoting the racism and sexism associated with them.

Keywords: sexism, racism, developmental anatomy

I-04

Anatomy of the clitoris, science meets art

Helen O'Connell
Urological Surgeon, Melbourne, Australia

Anatomy and Medical Art represent the body's internal structure hand in glove. To look at human tissue in its raw or fixed state requires a trained eye, a modified autonomic nervous system so we can cope with the appearance of the dead. Though it takes resolve, dissection, the systematic delayering of human tissue to understand how it is constructed, has enabled evolution of this science. Medical art provides accurate yet digestible selection of structures. From the mid-1990s O'Connell and Levent have developed photographs and medical art of female pelvic dissections. The clitoris was the most neglected human structure. For millennia the subject of tribal trauma, its anatomy often included intellectual shortcomings such as poor labeling, poor quality dissections, and poor medical art. This intellectual failure has been labeled "Critical Clitoridectomy". New anatomical concepts forged by O'Connell, Eizenberg and colleagues have been complemented by detailed art which is not restricted to fixed planes unlike dissection. The clitoris and its bulbs cross the midline anterior to the distal urethra. The bulbs sit on the perineal membrane lateral to the distal vaginal wall. The concept of clitoral complex to highlight this relationship between the clitoris, urethra and vagina is helpful given functional relationships in human sexuality. The public still struggles with basic human anatomy such as the difference between the vulva and vagina. Digital medical art reconstructs anatomy thereby permitting reversal of the delayering that occurs in dissection. This helps clinicians, scientists and educators to understand and teach the anatomy without needing to dissect it themselves.

Keywords: clitoris, bulb of clitoris, vagina, anatomy, medical art, medical illustration

I-05

Visualizing the clitoris: a twenty-year journey

Levent Efe
Medical Illustration Studios, Melbourne, Australia

Visual depiction of the Clitoris has traditionally lacked detail and reflected inaccuracies in many textbooks along the years. Our work with Dr Helen O'Connell and other authors over two decades started with 2D line illustrations, and later evolved into in-depth visual narratives.We are now offering 3D, interactive visuals to elucidate the Anatomy of the Clitoris and all related structures. We believe such depictions will help better understand the Anatomy and complement MRI and other visualization techniques.

Keywords: female anatomy, representation, scientific research, medical art, medical illustration

I-06

Squirt Eis: a sculptural intervention with popsicles in shapes of the female prostate

Julia Frankenberg
Sculptural Intervention, Squirt Eis, Berlin, Germany

Squirt Eis is a sculptural intervention in public space: popsicles in the shape of the female prostate are handed out of a rickshaw, a booth or an icestand to overcome the Gender Data Gap of the barely known organ. In 2001 the FICAT agreed to acknowledge the term "female prostate" in spite of the research by M. Zaviacic (SL) and Richard J. Ablin (USA). Since then many scientists that study the urogenital system assure the term is valid and more useful than the term skene glands. Despite the name confusion there is neither material on the paraurethral gland/skene gland nor the female prostate in current medical textbooks and it is still unknown to most students, teachers and practicing physicians. The centuries-long negation of female prostate tissue is an example of the Gender Data Gap. Among other things, it hinders medical research on incontinence and prostate cancer in women. It is important to focus on the closing of the Gender Data Gap. Let's end the exclusionary knowledge production.

https://squirt-eis.org/

https://juliafrankenberg.de

https://www.sexmedpedia.com/weibliche-prostata/

Keywords: female prostate, gender data gap, female ejaculation, squirting, art, Squirt Eis

I-07

The human brain anatomy revisited in the light of intraoperative functional mapping in awake patients with gliomas: towards a meta-networking organization of the cerebral connectome

Hugues Duffau

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In the traditional literature, brain processing was mainly thought in a localizationist framework, in which one given function was sustained by a discrete cortical area, with a similar organization across individuals. However, this static view of cerebral functioning does not explain numerous observations of postlesional recovery. My goal is to revisit this classical modular and inflexible model by evolving towards a dynamic organization of neural circuits, which enables adaptive phenomena. In addition to anatomic dissection in specimens, serial mappings performed in patients who underwent awake surgery for glioma provided new insights into the brain anatomo-functional architecture. They evidenced a network distribution and resulted in the reappraisal of neural foundations underpinning movement, language, executive and emotional functions. Moreover, combination of neuropsychological assessments and functional neuroimaging before and after operation(s) demonstrated that massive resections of "critical" regions were feasible without eliciting permanent neurological deficits, thanks to neural reconfiguration mechanisms. These recent findings on brain connectome challenge the outdated localizationist view and lead to an alternative meta-networking theory, in which complex behaviors arise from the spatiotemporal integration of distributed cortico-subcortical networks subserving conation and cognition. Constant circuit interactions result in a perpetual succession of new neural equilibrium states, explaining interindividual behavioral variability and neuroplastic phenomena. A meta-networking organization underlies the uniquely human propensity to learn news abilities and also enables functional compensation in brain-damaged patients. The implications of this original neuroanatomical model are discussed in fundamental neurosciences and clinical neurology, especially in surgical neurooncology, with an optimization of survival and quality of life.

Keywords: brain connectivity, connectome, meta-networking theory

I-08

The first woman anatomist in Korea "Prof. Bok Young Rha" (Mother and daughter woman anatomists)

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Prof. Bok Young Rha is the first woman anatomist in Korea. She graduated medical college in 1947 and began her career as an anatomist. Until 1979, she was the only one MD woman anatomist. As the first woman anatomist, she faced many difficulties. It was a pioneer's adventure. She had to embalm the cadavers and prepare histology slides all by herself. Because of the war, there were no cadavers in the tank, so she had to go to another city to get cadavers for student dissection. She was the founding member of the Korean Association of Anatomists and dedicated for the development of the Association. Due to her meritorious service, she was presented in the 'Wall of Fame' of the Korean Academy of Medical Sciences which is a very honorable event. In 1974, her daughter Prof. Kyung Ah Park graduated Korea University College of Medicine and decided to major in Anatomy. She went to Germany for further study and came back to Korea with a degree of 'Doktor der Medizin'. She became a Prof. of Anatomy in Yonsei University in 1979. This is the story of 'Mother and Daughter Anatomists and pioneer Prof. Bok Young Rha.

Keywords: history of anatomy, women in anatomy, South Korea

I-09

Understanding ALS one neuron at a time: the power of cellular anatomy

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In neurodegenerative diseases, like amyotrophic lateral sclerosis (ALS), not all neurons in the brain show the same level of vulnerability and progressive degeneration. The upper motor neurons, which have the unique ability to initiate and modulate movement display selective vulnerability, while other cells and neurons in the brain remain healthy and functional. Understanding the cellular and molecular basis of this vulnerability remained an important quest. Recent advances in anatomy, with special emphasis on detailed cellular analyses, shifted focus from tissues to cells and opened a new era of investigation: cellular anatomy. We now utilize cellular anatomy to identify novel drug targets for diseased upper motor neurons. Our investigations already led to the identification of the first compound that improves the structure and health of upper motor neurons diseased by misfolded SOD1 toxicity and TDP-43 pathology. Cellular anatomy paves the way for future discoveries, especially in rare diseases of the nervous system.

Keywords: upper motor neuron, cellular anatomy, future research

Symposia–Panels–Workshops

(S-001 — S-158)

Chinese Society of Anatomical Sciences Symposium

Clinical anatomy new insight in muscular skeleton system

S-001

The obscure joint – New insights into form-function relationships of the sacroiliac joint

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Objective: The sacroiliac joint functionally connects the spine and the pelvis and therefore plays an active role in daily bipedal load transmission. In spite of the versatile function this joint has to fulfill, it remains obscure. For those affected by its dysfunction, daily life is impaired to a significant extent. Contemporary research on sacroiliac joint anatomy, pathology and treatment has so far been carried out by a small community of specialists, facing a growing body of widespread basic science and clinical data.

Methods: In the recent years, detailed biomechanical research on the three-dimensional physiological motion of the sacroiliac joint under normal weight-bearing conditions has come to light, specifically regarding the influence of the ligaments as potential pain-causing structures and fat-presence, as a force-dampening structure within the joint.

Results: Detailed histological analyses and reconstruction of ligaments have shed light in their involvement with pain based on the collagen-bundle alignment and subsequent tension in vitro. In addition, subchondral bone mineralization of the auricular sacroiliac joint surfaces has enabled the visualization of the force transmission in chronic loading conditions in healthy and dysfunctional joints based on pattern analyses.

Conclusion: Treatment strategies for sacroiliac joint dysfunction have evolved over the last decades, both non-surgical and surgical. Our group has specifically focused on the effect of pelvic orthosis in reducing dysfunctional pain by the release of ligament tension within the joint. Despite these new advancements the reciprocal integration of basic science concepts on sacroiliac joint morphology, kinematics, and therapeutic advancements remains challenged.

Keywords: low back pain, lumbosacral transition, sacroiliac joint

S-002

Anatomical measurement and characteristic of anterior talofibular ligament with its adjacent ligaments in neutral position and plantar flexion

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Objective: The purpose of this study is to collect detailed anatomical information of ATFL with its adjacent ligaments that included ATiFL and CFL and clarify the relationship of quantitative data changes between neutral position and plantar flexion.

Methods: Ethical approval for this study was obtained from School of Basic Medical Science, Southern Medical University. Seventy healthy specimens with complete ankle ligaments were listed. ATFL with single, double and triple bands corresponded to Type I, II, and III. ATFL length and width, ATFL/CFL/ATiFL angle were collected and analyzed in neutral position and plantar flexion. The distance of the fibular center of insertion (fCOI) of ATFL–CFL–ATiFL in neutral position was also collected.

Results: In Type II, the length, width and ATFL/ATiFL angle of superior and inferior band are varied (length: $p<0.0001$, width: $p<0.0001$, ATFL/ATiFL angle: $p<0.0001$). Among types, the total width of Type I/II and Type I/III are significantly different ($p=0.0027$; $p=0.0009$). In the postural change, a significant difference of ATFL/ATiFL angle can be seen in Type I ($p=0.0045$), Type II ($p<0.0001$) and Type III ($p=0.0037$).

Conclusion: Type II ATFL shows the maximum flexibility. The width of different ATFL types may contribute to the different bracing mechanism. In addition, ATFL and CFL can be seen as a functional unit, while ATiFL is relatively independent from ATFL.

Keywords: lateral ankle collateral ligament, anterior talofibular ligament, calcaneofibular ligament, anterior tibiofibular ligament, anatomy

S-003

The universal existence of myodural bridge complex in vertebrate: an indication of a necessary function

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Objective: Myodural bridge complex (MDBC) is a new functional complex structure including the rectus capitis dorsal minor (RCDmi), rectus capitis posterior major (RCPma), obliquus capitis inferior (OCI), nuchal ligament (NL), vertebrodural ligament (VDL) and dense MDB fibers originate from these muscles and ligaments. We firstly proposed that the MDBC could be a significant contributor to CSF (Cerebrospinal Fluid) dynamics at the craniocervical junction in addition to other factors such as heartbeat and respiration. MDBC was found to exist in the vast majority of studied amphibians, birds, reptiles and mammals in our study. It was considered as an evolutionarily conserved structure. During the landing process of the vertebrates, the morphological evolution process of MDBC and its regulatory mechanism that adapt to the terrestrial living environment remains unclear.

Methods: Anatomical, multiple histologic staining methods and scanning electron microscopy observation were used in the present study to compare and analyze the morphological differences among the MDBC in different animals.

Results: It was found that MDBC/MDBC-like structures widely existed in vertebrates. It was also found that MDBC/MDBC-like structures exist throughout the vertebral tubes in fish, but for amphibians, birds, reptiles and mammals, the MDBC is concentrated in the cervical vertebral segments.

Conclusion: Our study implies that the transformation of amphibian MDBC/MDBC-like structures might be an adaptive change in the evolution of the vertebrate from water to land.

Keywords: cerebrospinal fluid circulation, myodural bridge complex, vertebrates

S-004

A multi-stage ensemble network system to diagnose adolescent idiopathic scoliosis

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Objective: To develop a deep learning algorithm to automatically evaluate and diagnose scoliosis on full spinal X-ray images.

Methods: This retrospective study collected full spinal X-ray images (anteroposterior) from four hospital databases from January 1, 2018, to March 31, 2021. The data were divided into training and validation sets. Full spinal X-ray images for external validation were independently collected at one hospital from April 1, 2021, to June 30, 2021. Model effectiveness was validated with a public dataset. Statistical software R was used to analyze the accuracy and sensitivity of the model curvature and anatomical balance parameters and assess interrater consistency.

Results: This study included 788 and 185 training and test datasets, respectively. The accuracy and recall of the algorithm model for the Cobb angle, apical vertebrae (AV), upper vertebrae, and lower vertebrae were 89.36%, 85.71%, 77.2%, 80.24% and 97.35%, 93.38%, 84.11%, 87.42%, respectively. The symmetric mean absolute percentage error at the Cobb angle was 5.99°, and the automatic measurement time was 1.7 s. The mean absolute error values of the Cobb angle and the distances between the center sacral vertical line and AV and C7 plumb line were 1.07° and 1.12 and 1.38 mm, respectively. Statistical analysis confirmed that the Cobb angle results were in good agreement with the gold standard (interclass coefficients of 0.996, 0.978, and 0.825; $p<0.001$).

Conclusion: Our deep learning algorithm model had high sensitivity and accuracy for scoliosis, which could help radiologists improve their diagnostic efficiency.

Keywords: adolescent, scoliosis, X-ray, artificial intelligence

S-005

Dual efficacy of Fasudil at improving survival and reinnervation of flap through Rho-ROCK-PI3K-AKT pathway

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Objective: To evaluate the efficacy of Fasudil in promoting flap survival and reinnervation.

Methods: Ninety-two ICR mice were divided into four groups, receiving a daily intraperitoneal injection of normal saline, Fasudil, LY294002, and Fasudil+LY294002, respectively. On days 0 and 5, the blood perfusion and diameter of the iliolumbar artery were evaluated using LSCI. On day 5, the necrosis rate was calculated. In addition, tissues were harvested from the flaps and divided into two parts. One part underwent immunofluorescent staining using the antibody against CD31 for evaluation of the microvascular density. In the other part, the expression of RhoA, ROCK1+2, p-CPI-17, p-MYPT, p-PTEN, p-PI3K, p-Akt, and VEGF were determined using

western blotting. Moreover, at days 0, 7, 15, and 30 after flap surgery, the axons within the flaps were evaluated.

Results: The necrosis rate was (24.4±7.7)%, (5.2±1.6)%, (29.8±4.2)%, and (30.9±7.1)%, respectively in the four groups ($p<.001$). Moreover, Fasudil could significantly expand the diameter of the iliolumbar artery, boost the overall blood perfusion, and increase the microvascular density of the flaps in the Fasudil group ($p<.05$), which could all be abolished by LY294002. On day 5, the expression of p-CPI-17, p-MYPT, and p-PTEN were downregulated, whereas pPI3K, p-Akt, and VEGF were upregulated in the Fasudil group ($p<.001$). At days 15 and 30 only in the Fasudil group new axons were observed.

Conclusion: Fasudil can simultaneously improve the survival and axon growth after flap harvest through the RhoA/ROCK /PI3K/AKT pathway.

Keywords: Fasudil, flap, PI3K/Akt, PTEN, RhoA/ROCK

S-006

A 3D visualization layered anatomy for acromial arterial rete and flap design

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Objective: The acromial arterial rete (AAR) is the junction between the skin blood supply of the cervical side and that of the upper arm, and it is the only site crossed by the transregional blood supply of the cervico-humeral flap (CHF). The aim of this study was to explore the structures of AAR to optimize flap design.

Methods: A body arteriography and spiral CT scan were performed on 33 whole adult corpses. The 3D reconstruction was used to perform continuous digital layered anatomy of the shoulder and upper chest; the acromion and acromioclavicular joint were used as the center to observe the source, route and distribution characteristics of a perforating branch and their anastomosis.

Results: The perforating branches were separated from an acromial branch of the transverse cervical artery (97%), posterior humeral circumflex artery (95%), a deltoid branch of the thoracoacromial artery (95%), and the acromial branch of the thoracoacromial artery (93%). The diameter of the acromial branch of the transverse cervical artery at its initial location was 1.18±0.37 mm; the trunk length was 12.53±3.83 cm, and it was anastomosed with other blood vessels in three forms.

Conclusion: Deep fascia should be included in the flap design. Three kinds of pedicled transfer flaps can be designed with the acromial branch of transverse carotid artery as the vascular pedicle. Free flaps can be designed with the acromial branch of thoracoacromial artery as the vascular pedicle.

Keywords: cervico-humeral flap, acromial arterial rete, angiography, 3D visualization, plastic surgery

Symposium

Body sourcing for anatomical education and research: experiences from the African continent

S-007

No challenge is insurmountable: dealing with the difficulties of sourcing human bodies on the African continent

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Research has consistently shown that human dissection is beneficial to training health sciences students and that students themselves consider it vital in their learning. Thus, the sourcing of human bodies for teaching and research remains central for health sciences institutions. While recently, some anatomists predicted that the Covid pandemic would prevent and limit the use of human remains for teaching and research, the sourcing and utilization of human bodies has endured and remains operational in many anatomy departments globally. However, one of the problems facing anatomists, particularly on the African continent, is obtaining bodies from ethical sources. The International Federation of Association of Anatomists (IFAA) has recommended that written consent must be provided by those individuals who bequeath their bodies and that the use of unclaimed bodies is ethically unacceptable. Many international institutions, including those on the African continent, have not been able to fulfill the IFAA recommendations due to a set of factors which vex both the body donors and the anatomists who curate these body donor programmes. The presentation will consider some of the challenges which impinge on consented body donations such as legislation, religion, culture, trust, ignorance about body donation programmes and the attitudes of staff and students and will attempt to suggest mechanisms for overcoming some of these challenges. It will also pose questions related to the altruism of donors and whether anatomists may go a step too far, thus hindering body donations for the future.

Keywords: body donation; ethics; unclaimed bodies

S-008

Cultural practices of South African ethnic groups on the body and their influence on body donation

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Objective: Cultural practices in the African continent have been thought to have a negative impact on body donation. Consequently, most African countries still rely on unclaimed bodies for their dissection programs, or bequests from the people of non-African ancestry. The latter mode is preponderant in South Africa. South Africa, in the Southern Hemisphere of Africa, has diverse cultural and religious belief systems. This is further compounded by its diverse population groups consisting of four population groups with the largest population group having nine ethnic groups. Since South Africa is multicultural, it is important to investigate the reasons behind lack of participation in body donation. The aim sought to understand these reasons among the Black African population group, through studies conducted in the KwaZulu-Natal (KZN) and Limpopo (L) provinces of the country.

Methods: 600 community members were recruited to respond to a three-page questionnaire covering willingness to donate, their cultural and religious perspectives towards body donation. Ethical clearance was obtained from the University of KwaZulu-Natal (BREC/00003121/2021).

Results: Respondents in the KZN and L provinces who were predominantly of the Zulu and Pedi ethnic groups reflected low willingness to participate in body donation (34.5% and 41%) due to cultural and religious reasons.

Conclusion: The two ethnic groups had low willingness to participate in body donation due to strong cultural beliefs on the body. Exploration of other ethnic groups is underway as cultural practices on the body may threaten the steady supply of human cadavers for medical education in the future especially from this predominant population group.

Keywords: beliefs, body donation, cultural, practices

S-009

Pre-post-Covid-19 challenges, Ethiopian anatomical education or research

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Objective: Before Covid-19 outbreak, "Patient X" who grew up in Ethiopia, was admitted to Tikur Anbessa Hospital for an unknown illness. Hours later, he was left unattended, then doctors tried all best to save his life, but his health condition deteriorated when found at the mortuary unit. His embalmed body was sent to the dissection room. In the Ethiopian context, 90% of medical schools use unclaimed bodies sourced from Tikur Anbessa for their medical education. Months later, Patient X's family claimed, where is our missing body? Finally, they were directed to the Department of Anatomy for further discovery. This study aims to assess body sourcing challenges; anatomy experts are facing before and after Covid-19 to sustain anatomy education or research.

Methods: It was carried out in randomly selected medical schools in Ethiopia.

Results: Our findings show trends towards dwindling (86.6%) of dissection practices across the country during Covid-19 pandemic linked with disinformation of Covid-19 infection. Result also points to an existence of misinformation or lack of written consent among the stakeholders. That is, the absence of any legal document (guidelines) between the Universities, Ministry of Health and Ethiopian constitution.

Conclusion: In conclusion, Covid-19 pandemic severely jeopardized dissection practices, which was even more exacerbated with other prevailing situations in the country, to a point where anatomists were limited or forced to stop body dissection. Given that, anatomy is the blueprint of health, in our perspective, these challenges will be addressed at intercontinental level to ensure robust medical education practice for the resilient health systems.

Keywords: anatomy, Covid-19, education, ethiopia, patient x

S-010

Body sourcing for anatomical education and research: experiences from Nigeria and West Africa

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Objective: Despite the increasing adoption of computer-based methods of teaching anatomy in West Africa, cadaver dissection remains the most used for teaching and research in Anatomy. The objective of this presentation was to correct the perceived misunderstanding that the source of bodies for education and research in this part of Africa is deceased criminals.

Methods: Discussions on the history of body sourcing and the current practice took place between senior anatomists from regional universities in Nigeria. Some of them either worked with colleagues in other West African countries or interacted with their anatomy departments.

Results: The sources and guidelines for acquiring bodies appear to be the same across the countries by the expatriate Anatomists who established the departments. When persons admitted into hospital wards or brought in from sites of accidents are certified

dead, the bodies are kept in the mortuary for up to 6 months to enable their relatives to collect them for burial. The Police obtain a burial permit from the appropriate court of law. Departments of Anatomy which have needs for bodies are given the priority to select those that are suitable for dissection.

Conclusion: Nigerian anatomists know the ethics of body sourcing and have started to engage universities and neighboring communities. Professors of Anatomy now talk about it in their Inaugural Lectures. The reviewed and updated Anatomy Act, which guides the handling of cadavers, is in the National Assembly for ratification. This document will empower the body of anatomists in Nigeria to engage stakeholders in all aspects of body management.

Keywords: body sourcing, education, research, West Africa

S-011

Cadavers for education and research: overcoming challenges in Rwanda

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Objective: Anatomy is the foundation for medical education and practice. Teaching anatomy has evolved with decades however the dissection remains a golden standard for a quality delivery of the anatomy learning. In Rwanda, anatomy has been introduced in medical programs 7 years after the beginning of medical education. The development of a clinical anatomy unit in 2002. At the beginning, the collection of anatomical specimens was from amputated limbs and body organs from autopsy.

Methods: The law that regulates the use of human bodies, organs and tissues in teaching and research was promulgated in 2010. From 2020, the S-CAR in collaboration with the UR department of surgery and the UR clinical anatomy unit is regularly organizing surgical anatomy dissection with a positive impact on the surgical trainees' skills. Those courses have increased the need of cadavers at the UR clinical anatomy unit. To overcome that specific challenge, the UR clinical anatomy unit has signed MoU on cadavers for teaching purpose supply with various hospitals in Rwanda.

Results: Challenges for getting cadavers range from mindset even with health professionals including medics. The logistics of supplying cadavers, conserving them and having a disposal system is another challenge. An anatomy lab to function needs enough financial resources which is not the case in Rwanda as a low resourced country.

Conclusion: However, despite all those challenges, the anatomy is alive in Rwanda as we are able to mobilize additional for various patterns.

Keywords: dissection, cadavers supply, Rwanda

S-012

Perspectives of body donor programmes in South Africa and Serbia

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Objective: The purpose of the study was to establish the provenance and to assess the effects of the Covid-19 pandemic on existing body donor programs within South Africa and Serbia

Methods: A cross-sectional self-administered questionnaire was distributed to the medical schools within South Africa and Serbia. The questionnaire focused on the number of established donor programmes, the provenance and number of cadavers used for teaching and research. Additionally, the effects of the Covid-19 pandemic on cadaver based teaching as well as the changes to memorial services to honor the individuals that graciously donated their remains were investigated. Ethics number: M2000555 MED20-03-129

Results: Preliminary results suggest that the majority of respondents from both Serbia and South Africa combined used cadavers for teaching and research. The number of cadavers used for teaching on an annual basis between these anatomy institutions was quite disparate spanning from a minimum of 1 cadaver to a maximum of 170 cadavers. Over 50% of respondents indicated they had a body donor programme at their institution and of these a slightly higher number indicated that the Covid-19 crisis did not affect their donor programme. A large number indicated that their institutions had strategies in place to inform staff of the provenance of cadavers and that memorial services to honor the donors continued during the pandemic.

Conclusion: Generally the effects of the Covid-19 crisis had a negative impact on existing donor programmes but many institutions were able to continue and recover.

Keywords: body donation, cadavers, anatomy, provenance

FIPAE Symposium

Anatomy visualised

S-013

Anatomy through visual-rich social media: experiences, lessons, and opportunities

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It is well established that during the Covid-19 pandemic, many students struggled to feel a sense of belonging in their online university classrooms. Academics in the same token have struggled

creating an engaging classroom particularly in the hybrid setting. In the discipline of anatomy, perhaps the most challenging aspect during the pandemic was to find ways to transfer the non-traditional interdisciplinary skills to students through a screen and in the absence of the human donor element. Social media in some respects seems to fill this gap - albeit it fills this gap in a different sense. In 2020, a public online community aimed to increase anatomical awareness and education was established using the social media platform Instagram™. The online community is led by an anatomist, and the page is followed by students, medical professionals, academics, and members from the general public. The aim of this presentation is to demonstrate how using social media platforms that students are familiar with, such as Instagram™ can create a sense of belonging for students in both the fully online, and face to face setting. In addition, the aim is to demonstrate the need for further outreach within the community regarding anatomical concepts and understandings. Examples of the process of preparing content aimed at social media will be given. The presentation will also outline the limitations, the gray areas, and future directions of using such platforms to advance anatomical outreach to students, and the lay public.

S-014

Putting the 'fun' back in anatomy fundamentals with tabletop serious games

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S-015

Focused multisensory anatomy observation and drawing for three-dimensional spatial understanding

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The concept that multisensory observation and drawing can be effective for enhancing anatomy learning is supported by pedagogic research and theory, and theories of drawing. A haptico-visual observation and drawing (HVOD) process supports understanding of the three-dimensional (3D) spatial form of anatomical structures. The HVOD process involves exploration of 3D anatomy with the combined use of touch and sight, and the simultaneous act of making graphite marks on paper which correspond to the anatomy under observation. Findings suggest that HVOD can increase perceptual understanding of anatomy through memorization and recall of the 3D form of observed structures. Here, additional pedagogic and cognitive underpinnings are presented to further demonstrate how and why HVOD can be effective for anatomy learning. Delivery of a HVOD workshop is described as a detailed guide for instructors, and themes arising from a phenomenological study of educator experiences of the HVOD process are presented. Findings indicate that HVOD can provide an engaging approach for the spatial exploration of anatomy within a supportive social learning environment, but also requires modification for effective curricular integration. Consequently, based on the most effective research-informed, theoretical, and logistical elements of art-based approaches in anatomy learning, including the framework provided by the observe-reflect-draw-edit-repeat (ORDER) method, an optimized Exploring 3D Anatomy online course has been developed. This is with the aim of providing a widely accessible resource for supporting social learning and 3D spatial understanding of anatomy, in addition to improving specific anatomical knowledge.

S-016

So you want to create in xR: now what?

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The affordances of emerging xR technologies are opening new pedagogical possibilities for anatomy instruction. Anatomists are attracted to these approaches as we recognize the importance of understanding 3-dimensional structural relationships and want to make this accessible to our students. Many of these xR technologies are available commercially, and while they have clear strong suits, they may not work in every classroom. At the University of British Columbia's Faculty of Medicine, the HIVE (Hackspace for Innovation and Visualization in Education) is a multidisciplinary space where content experts collaborate with programmers and designers to co-create educational tools that leverage emerging technologies and meet the pedagogical needs of the classroom. The approaches to co-creation with emerging media and the development pipeline for these apps and tools is quite different from more traditional academic workflows. An agile approach with weekly scrums and design meetings requires that the multidisciplinary team has effective communication skills and an open mind for everyone's input and ideas. Co-creation is at times messy, but in our experience the integration of multiple ideas, backgrounds, and approaches yields better educational tools, in particular when it comes to xR experiences for education.

S-017

Are they learning with VR activities? A novel assessment tool for cognitive load

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The education delivery challenge posed by the pandemic has shone a spotlight on technology enabled learning in science, medical and health education. Immersive technologies such as Mixed Reality (xR), Virtual Reality (VR) and Augmented Reality (AR) have been particularly helpful in a range of disciplines, such as anatomy and clinical skills, that are highly dependent on visual content and/or real-world contexts. The evidence of the impact of these technologies on student learning is yet to be robustly analyzed. While some aspects of this evaluation, for example, fitness for practice, may take years to determine, a major challenge in this area of research is the lack of consistent and objective tools to assess the immediate impact on student learning. A deep dive into the literature demonstrates that evaluation tools for technology-enabled learning focuses on three main areas: observations of learning, surveys and focus groups, and assessments including pre- and post-tests. These evaluation tools, while valuable, do not satisfactorily account for the diverse impact of the technology itself on the learner's ability to focus on learning. Cognitive load assessment adds a valuable lens to the suite of evaluation tools. However, cognitive load is often measured using subjective measurement tools. To overcome this challenge, electroencephalography (EEG) can be used as objective measures of cognitive load. This presentation summaries our findings to date of a comparison of subjective (such as the National Aeronautics and Space Administration task load index, NASA-TLX) and objective (EEG recordings) assessments for cognitive load using a range of technology-enabled learning activities from pre-recorded video presentations to VR.

S-018

MSc in medical visualisation and human anatomy

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The world-leading unique MSc in Medical Visualisation and Human Anatomy is a joint collaborative degree partnering between the anatomy facility, School of Medicine, Dentistry and Nursing at the University of Glasgow (UofG) and the School of Simulation and Visualisation (SimVis), part of The Glasgow School of Art. This world leading innovative degree has been running successfully for 11 years and graduated over 140 students.

The degree is a one-year full-time MSc program and is divided into three key stages:

Stage 1 (at SimVis): Medical Visualisation (40 credits)

- Volumetric Visualisation – Here you will work with 3-D medical scan data e.g. CT/MRI or confocal microscopy to create 3-D models for use in the creation of animations or interactive applications
- 3D Modelling
- Interactive Medical Visualisation
- Human Computer Interaction and Extended Reality (Optional courses). A series of practical workshops are offered to explore specialized immersive and interactive technologies in the context of medical visualisation including virtual reality headsets, augmented reality, tracking systems and haptic devices.
- Academic Skills in Masters Research (20 credits)

Stage 2 (at the Anatomy Facility, UofG):

This block of study has access to a wide variety prosections of the whole human body, as well as cadavers. Training in this block covers embryology, neuroanatomy, histology as well as head to toe in-depth gross anatomy.

- Introduction to anatomy (20 credits)
- Structure and function of the human body (20 credits)
- Cadaveric dissection techniques

Stage three (60 credits):

- Supported through individual supervision by minimum two supervisors: one creative technologists/researcher from the School of Simulation and Visualisation and one life sciences scientist from the College of Medical, Veterinary and Life Sciences at the University of Glasgow.
- A unique combination of skills and knowledge that will help your development as an independent creative professional developing digital tools and technologies within your chosen domain.
- Past MSc projects have explored a wide range of fields within the College of Medicine, Veterinary and Life Sciences at The University of Glasgow including anatomy, anthropology, veterinary, molecular, microbiology, genetics and immunology research, and have had multiple clinical applications across surgical specialties including plastics, otorhinolaryngology, neurosurgery, orthopedics and dentistry.

Chinese Society of Anatomical Sciences Symposium

Development, stem cells and cancer

S-019

Centriole components' multi-site localization and involvement in spindle assembling and asymmetric positioning in mouse oocyte meiosis

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Objective: Centriole is degenerated at the early stage of oogenesis. This work investigated the subcellular localization and function of centriolar structure components during the subsequent meiotic progression in mammalian oocytes.

Methods: Mouse oocytes were processed with immunofluorescence, western blot, time-lapse imaging and microinjection of morpholino oligo or construct plasmid mRNA.

Results: Centriolar core elements, SASS6 (SAS-6 centriolar assembly protein), δ-tubulin, ε-tubulin, CCDC41 (centrosomal protein 83) and ODF2 (outer dense fiber of sperm tails 2), expressed stably during meiotic progression in oocytes, and persistently present on chromosomes, MTOCs (microtubule organizing centers) and spindle, as well as GM130 (golgin subfamily a, 2) / Rab11a (RAB11A, member RAS oncogene family) positive vesicles. Golgi inhibitor destroyed centriolar components aggregation on vesicles, meanwhile, suppressed the cortical migration positioning of the spindle. δ-tubulin knockdown induced abnormalities in spindle structure and position, while CCDC41 loss also destroyed MTOC focusing and spindle assembly, inhibited vesicle fusion and anchoring to oolemma membrane, blocking cytoplasmic F-actin network docking to cell membrane, therefore impaired spindle cortical migration and oocyte asymmetric division, giving rise to the forming of large first polar body. Additionally, CCDC41 knockdown pronouncedly accelerated the transition from meiosis I to meiosis II, which is associated with the altered protein levels of CDC20 (cell division cycle 20) and APC2 (anaphase promoting complex subunit 2), two key components of anaphase promoting complex, responsible for anaphase onset.

Conclusion: Centriolar components are still retained in multiple locations in oocytes and required for the orderly spindle assembly and asymmetrical positioning, as well as punctual anaphase onset in meiosis.

Keywords: centriolar proteins, oocyte, meiosis, spindle assembly and positioning

S-020

The AMPK–HOXB9–KRAS axis regulates lung adenocarcinoma growth in response to cellular energy alteration

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Objective: HOXB9 is an important transcription factor associated with unfavorable outcomes in LUAD. However, its natural degradation mechanism remains unclear.

Methods: IHC, co-IP, gene knockout mice, Xenograft tumor formation assay, RT-qPCR, Transcriptome Sequencing, In vivo ubiquitination assays, Dual Luciferase Reporter Assay, Chromatin Immunoprecipitation, PET Imaging of Glucose Uptake in Mice and LC-MS/MS analysis.

Results: Here, we showed that HOXB9 is a substrate of AMPKα and is phosphorylated at T133. Glucose deprivation and metformin treatment facilitated AMPKα-mediated HOXB9 phosphorylation, downregulating HOXB9 in AMPKα knockout mice and LUAD cells. Mechanistically, phosphorylated HOXB9 promoted E3 ligase Praja2-mediated HOXB9 degradation. Blocking HOXB9 phosphorylation by depleting AMPKα1/2 or using the HOXB9 T133A mutant promoted tumor cell growth in cell culture and mouse xenografts through upregulation of HOXB9 and KRAS, a newly identified target of HOXB9. Clinically, AMPK activation levels in LUAD samples were positively correlated with pHOXB9, and higher pHOXB9 indicated better survival of patients with LUAD.

Conclusion: These findings reveal the degradation mechanism of HOXB9 and presence of an AMPK–HOXB9–KRAS axis linking glucose level-regulated AMPK activation to HOXB9 stability and KRAS gene expression, ultimately controlling LUAD progression.

Keywords: AMPK, HOXB9 T133 phosphorylation, lung adenocarcinoma, metformin, ubiquitin-mediated degradation

S-021

Lepr+ mesenchymal cells sense diet to modulate intestinal stem/progenitor cells via leptin-Igf1 axis

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Objective: Increasing evidence indicates that distinct mesenchymal niches are essential for governing intestinal stem cell (ISC) function. However, little is known how the ISC mesenchymal niche responds to diet. We identify a novel mesenchymal niche that responds to diet and modulates ISC function.

Methods: Single-cell RNA-sequencing analysis was utilized to identify Lepr+ mesenchymal cells (MCs) as the niche for ISCs and to investigate the signal interaction between Lepr+ MCs and ISCs. Lepr-Cre;Rosa26-mTmG mice were used to characterize the features of Lepr+ MCs upon HFD and fasting. Lepr-Cre;Rosa26-iDTR mice and organoid were used to study the functions of Lepr+ MCs. Lepr-Cre;Igf1fl/fl mice were generated to study the function of Igf1 in modulating ISC at homeostasis and regeneration.

Results: Lepr+ MCs surround intestinal crypts where stem/progenitor cells localize. The abundance of these cells increased upon administration of a high-fat diet but dramatically decreased upon fasting. Depletion of Lepr+ MCs resulted in fewer ISCs,

compromised architecture of the crypt-villus axis and impaired intestinal regeneration. Furthermore, IGF1 derived from Lepr+ MCs was identified as an important effector for ISC function. Deletion of Igf1 in Lepr+ cells partially resembled Lepr+ cell-ablated intestinal phenotypes, while IGF1 supplement rescued it. Lepr+ MC-secreted Igf1 functions as a niche signal that promotes the proliferation of ISC and progenitor cells.

Conclusion: Lepr+ MCs sense diet alteration and function as a novel niche for ISCs via the stromal Igf1 - epithelial Igf1r axis. It reveals that Lepr+ MCs are an important mediator that links systemic diet changes to local ISC function.

Keywords: Lepr+ mesenchymal cells; niche, intestinal stem cells

FICEM Symposium

Anatomical disciplines as incubators for ethics and professionalism in healthcare education

S-022

The dissection room as a transformational education space

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Objective: The dissection room is the most powerful and transformative educational space that most pre-clinical healthcare students experience. The subject nature, rules, boundaries, challenges and expectations surrounding exposure to the dissection room all contribute to the environment having a profound impact on students. Yet despite the extant role the dissection room occupies in anatomy and health professional education, it remains unclear how this environment -and the 'transformation' that is subsequently experienced- can be effectively utilized to benefit students in their educational journey.

Methods: This work explores a novel perspective on the education of health professional training through their experiences in the dissection room. It investigates the role of the hidden and informal curriculum in shaping professional development and identity, highlighting that transformational benefits via this 'rite-of-passage' are often not contextualized or maximized for students, arguing that modern curricula design necessitates taking advantage of such an opportunity to do so.

Results: It navigates the experience of professional development in this context through a pedagogical lens, illuminating how elements of ethics and professional development education can be utilized to complement trends in curriculum design.

Conclusion: The corollary from this reflection of the dissection room as an educational space supports the theoretical argument that the boundaries of the liminal phase experienced by healthcare students could be further explored pedagogically. This supports the dissection room as a vehicle for delivering contextual, relevant educational opportunities that capitalize on the transformation that students experience, thereby enhancing educational interactions focused on professional development and identity.

Keywords: ethics, education, professional development, professional identity, pedagogy, dissection room

S-023

Reflecting on relational anatomy

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Objective: Anatomy education provides students with much more than knowledge of the structure and function of the human body, offering a first entry into the space of professional identity formation in the health professions. In a model of anatomy as the "first clinical discipline", relational interactions between anatomy educators, students, and the human body reflect the educational constellation for all learning throughout health professionals training.

Methods: Based on theories of trauma-informed care, team dynamics, and insights from medical anthropology, the concept of Relational Anatomy provides a framework for integrating ethics and reflection into the anatomy curriculum.

Results: In an expansion of this model, it will be argued here that Relational Anatomy with its triad of educator – learner – human body can be reflected upon within its place in history, and that such an inclusion of the historical dimension can productively inform an understanding of current questions of ethics in anatomy. Notable examples are such issues as gender, race and antisemitism, which have histories throughout anatomy, and whose legacies are present in tangible and intangible forms today, reaching from leagcy collections to diverse anatomical representation.

Conclusion: Including historical examples and ethics discussions in anatomy education simply depends on an open mindset by the educator, can be concise, and addresses many of the questions students tend to bring to anatomy education. By integrating insights from the history of anatomy into the learning process, anatomy education can model an approach to medicine that includes a full appreciation of the shared humanity of medical practitioners and patients.

Keywords: anatomy education, ethics of anatomy, history of anatomy, professional identity formation

S-024

Histology, embryology & neuroanatomy as transducers for ethics and professionalism

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Objective: Developing an encompassing ethos of ethics and professionalism within healthcare education requires that engagement with these topics occurs across curricula in a variety of educational settings. Gross anatomy education is increasingly being used as a vehicle for engaging students in ethical and professional development, yet other anatomical disciplines such as histology, neuroanatomy and embryology have not been utilized to deliver educational opportunities exploring these topics. These different subjects, including those representing both basic and clinical education, can all be utilized to both facilitate, explore and consolidate this ethos.

Methods: Examples of topics within histology, neuroanatomy and embryology that address ethical and professional concepts are presented, in conjunction with the ethical and professional concepts they illuminate.

Results: These include embryo provenance and embryo commodification in embryology; HeLa cells and bronchiolar exocrine cells (Club cells) / Clara cells in histology; and neural capacity to consent, the Charles Whitman and Gabby Giffords episodes and the contributions of Henri Molaison (HM) in neuroanatomy. By engaging such examples within the anatomical disciplines, students of anatomy can integrate an ethos of ethics and professionalism, a humanistic professional culture and identity, within their anatomical knowledge.

Conclusion: The IFAA community is encouraged to reflect on other areas in which this humanistic professional culture can be explored. By incorporating such examples across anatomical disciplines, a broad and deep understanding of this new ethos will be integrated into healthcare education and subsequent healthcare practice. It will be built into students' development as medical professionals and will become habitual in their practice of medicine.

Keywords: ethics, histology, embryology, neuroanatomy, medical education

President's Emergent Anatomists Programme Symposium

Establishing a professional profile and networking as an early career anatomist

S-025

Becoming involved in Academic Citizenship – Getting involved in societies and networking

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S-026

Linking in and getting out of the research gate

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Networking is fundamental to academia, as it leads to collaborations, papers, and grants. From a professional development standpoint, it is critical that early career anatomists establish and maintain in-person networks as well as global virtual networks made possible through the internet. This talk will guide early career anatomists on ways they can leverage social media apps such as Linkedin, Twitter, Facebook, and Instagram to establish an online professional profile and network, and will discuss opportunity costs associated with these social network platforms and others. It will provide insights on key information that should be included in professional social media platform profiles and will discuss possible frameworks for maintaining a professional presence online. The goal of this talk is to empower participants to use the technology available to expand their international networks for professional development.

Keywords: networking, social media, professionalism

S-027

Developing your curriculum vitae

Carol Hartmann

University of the Witwatersrand, Johannesburg, South Africa

Objective: The curriculum vitae (CV) or resume is a fundamental tool for communicating skills and achievements in academia. As a summary of one's work it facilitates the search for employment and is an important part of a professional profile. However, many emergent anatomists are uncertain about the content and structure of a CV.

Methods: This talk is part of a panel discussion for emergent anatomists.

Results: The talk highlights the key information required in a CV, including practical tips on developing a statement of one's teaching philosophy. It gives participants guidance on navigating the different CV formats across purposes, institutions, and countries. The talk illustrates how to craft an impactful CV that is easily read and effectively communicates the participants skills and achievements.

Conclusion: This will empower participants as they build up their professional profile and grow in their careers.

Keywords: emergent anatomists, professional development, capacity development

Chinese Society of Anatomical Sciences Symposium

Stem cell in adult tissue development: from reproduction to regeneration

S-028

The Phf2-cohesin complex promotes mitotic progression and DNA damage response for mouse and human neural stem cell activation

Jia Feng

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Objective: The activation of quiescent neural stem cells (qNSCs) in the dentate gyrus is required for lifelong neurogenesis. However, the mechanisms that promote the exit of neural stem cells (NSCs) from quiescence remain elusive.

Methods: we demonstrate that the expression of plant homeodomain finger protein 2 (Phf2) increases as qNSCs become activated, and it remains high in neural progenitor cells. NSC-specific deletion of Phf2 is partially embryonic lethal in mice, indicating that Phf2 is crucial for embryonic development. Loss of Phf2 prevents NSC activation and neurogenesis in postnatal 30 (P30) mice but does not decrease the label-retaining NSC pool, indicating that Phf2 is not required for the exit of NSC from quiescence. Moreover, PHF2 also regulates NSCs proliferation and neuronal differentiation in human cerebral organoids.

Results: Mechanistically, Phf2 directly binds to the cohesin complex, promoting mitotic progression in NSCs. Meanwhile, the Phf2-cohesin complex participates and regulates the DNA damage response in mouse NSC by associating with chromatin-bound PARP1 to enhance PARP1 activity. Phf2 depleted NSCs induce DNA Single-strand breaks (SSBs) and mitotic progression defects, thus experiencing nucleolar stress, activating p53 that contributes to their impaired proliferation.

Conclusion: Our study identifies the Phf2-cohesin complex promotes mitotic progression and DNA damage response for mouse and human neural stem cell activation

Keywords: Phf2, Cohesin complex, mNSC, Parp1, SSBs, p53

S-029

Dynamic mRNA degradome analyses indicate a role of histone H3K4 trimethylation in association with meiosis-coupled mRNA decay in mouse and human oocyte aging

Qianqian Sha

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Objective: A decrease in oocyte developmental potential occurs in most mammalian species, including humans, and is a major obstacle for successful pregnancy in women of advanced age. Transcriptome and translation changes related to spindle assembly and chromosome separation defects in aged oocytes have been described in prior studies. However, the mechanism underlying these abnormalities is unclear. The age-related epigenetic modifications associated with dynamic transcriptome changes, particularly meiotic maturation-coupled mRNA clearance, have not been adequately characterized in human oocytes.

Methods: This study generated a genome-wide database of meiotic maturation-coupled mRNA degradation in both young and aged mouse and human oocytes.

Results: The results of this study demonstrate a decreased storage of transcripts encoding key factors regulating the maternal mRNA degradome prior to the oocyte-to-zygotic transition (OZT) in fully grown oocytes of women of advanced age. A similar defect in meiotic maturation-triggered mRNA clearance was also detected in aged mouse oocytes but was more likely due to insufficient translation of mRNAs encoding these OZT factors. Mechanistically, the epigenetic and cytoplasmic aspects of oocyte maturation are synchronized in both the normal development and aging processes. For example, the level of H3K4me3 was high in fully grown mouse and human oocytes derived from young females but gradually decreased during aging due to the decreased expression of maternal epigenetic factors responsible for genomic H3K4me3 accumulation.

Conclusion: Taken together, these results suggest that H3K4me3, in association with mRNA decay competence, sets a timer for oocyte deterioration and plays a leading role in oocyte aging in both mouse and human oocytes.

Keywords: H3K4me3, mRNA degradation, oocyte-to-zygotic transition

S-030

Cell response to mechanical force in tissue environment: from stem cells to cancer cells

Yue Wang

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Objective: The physical cues in the extracellular environment play important roles in the developing cells, especially for the stem cells and cancer cells.

Methods: We investigated the cell responses to mechanical force by developing substrates with different mechanical properties to simulate the extracellular mechanical environment of various human tissues.

Results: We found the prostate cancer (PC) cells derived from different cancer metastasis sites show heterogeneity in mechanical response. This heterogeneity mediates two distinct metastasis patterns. High stiffness promotes individual cell migration and proliferation by inducing transcriptional factors (TFs)

nuclear localization in bone metastasis-derived cells such as Yes-associated protein and tafazzin (YAP/TAZ), whereas low stiffness promotes cell migration and proliferation by inducing lymphatic metastasis-derived cells to form clusters characterized by high expression of CD44. The different metastasis patterns induced by the mechanical properties of the extracellular environment are crucial in the development of PC. We also found that the stem cells in different mechanical environments had distinct growth and secretion characteristics, which may have a significant impact on the biological characteristics of stem cells in the different tissues or on the surface of biomaterials. We also found that the mechanical microenvironment significantly changed the epigenetics of stem cells, mainly the open regions of chromatin and microRNA expressions.

Conclusion: The mechanical response pattern of stem cell and cancer cell may be of great significance for understanding the interaction between developing cell and tissue microenvironment.

Keywords: mechanical force, tissue environment, stem cells, cancer cells, epigenetic regulation

S-031

Differential diagnosis and treatment of azoospermia in men

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Objective: Infertility affects more than 10% of couples of childbearing age worldwide, with male factors accounting for about 50%. The most severe clinical manifestation of male infertility is azoospermia, yet the diagnosis and treatment are still challenging.

Methods: We isolated the extracellular vesicles from human seminal plasma by differential centrifugation, and analyzed the size, morphology and markers of extracellular vesicles. We further performed quantitative proteomic analysis of extracellular vesicles of seminal plasma from individuals of non-obstructive azoospermia, obstructive azoospermia and normal sperm. To generate sperm in vitro, the embryonic gonads were cultured in vitro, and the morphologies and expression of meiotic markers were analyzed together with the haploid state, methylation of imprinting genes. This study was approved by bioethics committees, and informed consent was obtained.

Results: We isolated the extracellular vesicles from human seminal plasma by differential centrifugation, and analyzed the size, morphology and markers of extracellular vesicles. We further performed quantitative proteomic analysis of extracellular vesicles of seminal plasma from individuals of non-obstructive azoospermia, obstructive azoospermia and normal sperm. The differential proteins were verified by Western blot, immunohistochemistry and targeted quantification by mass spectrometry. To generate sperm in vitro, the embryonic gonads were cultured in vitro, and the morphologies and expression of meiotic markers were analyzed together with the haploid state, methylation of imprinting genes. This study was approved by bioethics committees, and informed consent was obtained.

Conclusion: We identified biomarkers for differential diagnosis of azoospermia, and explored possible treatment strategies for azoospermia by in vitro culture system.

Keywords: azoospermia, biomarker, meiosis, in vitro culture

Korean Association of Anatomists Symposium
3D printing and digital anatomy

S-032

3D and digital technology in clinical anatomy

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Objective: Covid-19 pandemic brought a difficult time for both anatomy educators and researchers. At the same time, 3D and digital technology has been widely used since then in medical/dental schools because of the social distancing. In this presentation, I will share our experience how we have applied these technologies to clinical anatomy education as well as the clinical anatomy research.

Methods: Online tools, 3D scanner, 3D models, and extended reality were applied to clinical anatomy education and research for the healthcare providers in different fields.

Results: Each material had an advantage on its own. We found none of the single teaching materials is sufficient for either clinical anatomy education or research, but combination of them can be the best materials.

Conclusion: As many 3D materials exist in the market these days, there might be confusion about what materials to choose. However, we should think about how to use materials.

Keywords: digital, virtual reality, clinical anatomy, teaching materials

S-033

The sectioned images and three-dimensional models for digital anatomy

Chung Yoh Kim, Jin Seo Park

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Objective: In Visible Korean Project (VK), the sectioned images and three-dimensional (3D) models of various cadavers of human, dog, cat, and monkey have been produced for digital anatomy. Using the sectioned images, minute structures could be observed in real color. Using 3D models of VK, structures were visible stereoscopically. The purpose of this study was to introduce all products of VK from the sectioned images of various cadavers during the past 20 years for digital anatomy.

Methods: Human and animal cadavers were serially sectioned and photographed. In Photoshop, structures were segmented in the sectioned images. In Mimics, segmented images were reconstructed into surface models. In Maya, virtual joints were placed in surface models to simulate movements. In MRIcroGL, volume models were produced using the sectioned images.

Results: Sectioned images (≥0.05 mm intervals ≥0.024 mm sized pixel; 48 bits color) of humans (whole bodies of two males and two females, male head, female pelvis) and animals (whole bodies of one female beagle, one female cat, one rhesus monkey) were produced. Using sectioned images, analogue and digital atlases were presented. Various surface models were produced for anatomy education. In movable surface models, movements of bones and muscles could be scrutinized with joint axes. Real color volume models of cadavers could be cut freely even in oblique planes. The 3D models were utilized for virtual electromagnetic wave experiments.

Conclusion: The sectioned images and 3D models of this study will be helpful for digital anatomy. Funding resource: This research was supported by the Ministry of Education (NRF-021R1F1A1063044).

Keywords: cross-sectional anatomy, three-dimensional imaging, visible human project

S-034

The digital transformation and education equality in anatomy learning with female and male 3D anatomy models

Grace Kim, Anna Shin

Elsevier Korea Health Solutions, Seoul, South Korea

Objective: Since Covid-19, there has been various discussions and research for the effectiveness of 3D anatomy learning. We will present how a digital anatomy platform with female and male 3D models bridges the gap between real cadaveric dissection and 2 dimensional textbooks, and provides a more comprehensive teaching approach to improve the understanding of human bodies equally and maximize learning outcome.

Methods: We look at the cases of how the digital 3D human anatomy platform soft-landed in anatomy learning. Also, we look at the cases of how the digital 3D human anatomy platform, which enables us to overcome all learning restrictions, contributed to education equity in another challenging environment, Covid-19. Finally, by examining the recently developed digital 3D female anatomy model, we present the possibility of in-depth learning of the female anatomy.

Results: We found that the digital 3D anatomy platform is a great complement to the cadaveric dissection, and the students were quite satisfied with the use of the digital 3D anatomy platform. It enabled the students to improve their understanding of human anatomy, deepen their knowledge, and improve their self-confidence. In addition, the female 3D anatomical model is in the spotlight as an innovative update for learning equity.

Conclusion: The digital 3D human anatomy platform is a new wave of anatomy education. By overcoming the limitations on the effectiveness of cadaveric dissection and 2D anatomy learning materials, the digital 3D human anatomy platform and female anatomy model will further improve the students' knowledge and understanding of human anatomy for all humans.

Keywords: digital 3D human anatomy, digital anatomy education, virtual anatomy, virtual dissection, 3D anatomy application, 3D female anatomy platform

Anatomical Society Symposium

Part to part, part to whole: fitting the pelvis into the evolutionary puzzle of the human body

S-035

Understanding the evolution of the human birth canal through geometric morphometrics: insights from a Brazilian contemporary sample

Maria Rita Carvalho

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Objective: The bony pelvis has accommodated a series of new functional demands during the recent evolution of the genus Homo, related to thermoregulation, birth, bipedal locomotion, upright posture, and its actual morphology supposedly reflect all of them. The relationship between birth and pelvic morphology, however, is of special interest because of some unique features of the species, like the high cephalo-pelvic proportion and the rotational mechanism of birth. The objective of this research was to understand the variation in pelvic morphology within the sample and its possible covariations with other body dimensions, especially head shape.

Methods: The sample includes CT scans of head and pelvis from 100 patients of a Brazilian hospital. They were analyzed

through geometric morphometrics and tested for statistical covariations. This research was approved by the ethics committee of the University of São Paulo (CAAE: 45130021.8.0000.5464).

Results: The results obtained support the hypothesis that pelvis shape is primarily associated with sex in humans, presumably because of its obstetric function, but is not associated with head shape or any other body dimensions.

Conclusion: As covariations can tell about skeletal integrations, they could be the answer to the problematics of birth, allowing delivery in humans despite the tight fit. Special attention was given to a possible integration with the head because the dramatic enlargement of the brain in our lineage (1.8 Ma years) is often suggested to be the main reason why birth has become so complex. However, none of these hypotheses were corroborated by this study.

Keywords: geometric morphometrics, birth, pelvis, obstetric dilemma

S-036

Application of geometric morphometrics in predicting hominin pelvic morphology

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Objective: The curvature of the pelvic girdle makes it vulnerable to fragmentation and distortion during fossilization and this has impeded research on the evolution of human critical biological processes like childbirth, locomotion, and thermoregulation. 3D geometric morphometrics (3DGM) offers researchers a suite of tools to systematically estimate these missing shapes from incomplete fossil specimens. In this study, we used 3DGM to build a statistical model to predict the position and orientation of missing hip bones within the pelvic girdle.

Methods: We collected shape data from medical CT scans of 103 adults throughout the University of California Health system. We used this data to train a statistical model to predict the translational and rotational values that would be required to convert one of each individual's hip bones into its pair on the other side and we compared our results to the actual data of the excluded side. Finally, we tested our model on 2 reconstructions of the Kebara 2 Neanderthal pelvis to assess its effectiveness on predicting hip bones in other hominins with different morphologies.

Results: Our results showed that statistical modeling can be used to effectively recreate missing hip bones within the pelvic girdle of a human training sample with minimal error. Furthermore, the accuracy with which it predicted Kebara 2 pelvis gives us confidence that it can make accurate predictions for other hominin pelvises.

Conclusion: We believe that this method can be employed alongside other physical and virtual reconstruction techniques to reduce researcher's subjectivity in fossil reconstructions.

Keywords: geometric morphometrics, predictive modeling, hip bones, pelvis

S-037

A new reconstruction of the pelvis of KNM-WT 15000 reveals new insights into the body shape of Early African Homo erectus

Nicole Torres-Tamayo

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Objective: The thorax, spine, and pelvis compose a morphofunctional complex –the torso– that is integrated in primates. Magnitude of integration and patterns of covariation are influenced by different factors that need to be examined for reconstructing the body shape of extinct hominins. In this research I assess patterns of thoraco-pelvic morphological covariation in an ontogenetic human sample and an adult chimpanzee sample shared by these two taxa and probably maintained since the last common ancestor Pan-Homo. These potentially maintained covariation patterns are used to perform the first quantitative reconstruction of the torso of KNM-WT 15000 (H. ergaster, dated to 1.6 Ma).

Methods: 3D torso models of an ontogenetic H. sapiens male sample (n=52) and 10 adult P. troglodytes were segmented from CT scans. One thousand and thirty (semi-)landmarks were measured on the resulting models to collect overall thoracic and pelvic anatomical relationships within the torso. Patterns of thoraco-pelvic morphological covariation were computed using two-block partial least squares analyses. The statistically significant models were used to predict the pelvic morphology of KNM-WT 150000 from its previously reconstructed thoracic morphology.

Results: The resulting pelvis morphology is compatible with the long femoral neck of KNM-WT 15000 and its mediolaterally wide thoracic morphology. When aligned to the thorax, the resulting torso supports a wide (and deep) body shape for KNM-WT 15000.

Conclusion: This reconstruction is consistent with high body weight and metabolic rate in H. ergaster and lays the ground for functional interpretations that must be evaluated with appropriate methods in future studies.

Keywords: covariation, integration, Homo ergaster, fossil, landmark

Panel
The anatomy of medical terminology

S-038
Teaching anatomical terminology: a systematic approach

Kyle Mcleister
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Objective: Despite its importance as a system of international anatomical nomenclature, the Terminologia Anatomica generally receives no attention in medical terminology courses. I present a more systematic method of teaching anatomical terminology, which better prepares students to both learn medical terminology and use the TA.

Methods: To begin, students are taught the meanings of combining forms (e.g. hepat-) and terminations (e.g. -itis), as well as the general principles for how these component parts are combined to form medical terms, with a consistent focus on real-world usage. Building on their knowledge of combining forms, students are then introduced to the Latin phrases of the TA and learn the grammatical principles (e.g. noun-adjective agreement) upon which they're based. Later on, students are introduced to phrases which include prepositional prefixes (e.g. recessus subhepaticus) and possessives (e.g. ligamenta hepatis), which enables them to define even the most complex TA phrases accurately and confidently.

Results: Using this method, students gain a better understanding of medical terminology and the ability to accurately define the Latin phrases of the TA.

Conclusion: A systematic approach to teaching the TA as a core part of teaching medical terminology, beginning with the basic component parts (combining forms and terminations) and outlining the principles by which they are combined to form medical terms and Latin phrases, makes the TA much more accessible to students by presenting it as a fundamental part of medical terminology, rather than as a series of mysterious labels that they struggle to understand when reading their anatomy textbooks.

Keywords: medical terminology, terminologia anatomica, teaching, etymology

S-039
Bridging the gap: anatomical and clinical medical terminology

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Objective: Galic et al. 2018 are among the most recent commentators who have noted the unnecessary difficulties faced by students learning medical terminology, as well as by anatomists and clinicians communicating with one another. These obstacles are due, in part, to the use of Latin combining forms by anatomists and Greek ones by clinicians. In this talk, I offer a possible solution to this issue at the educational level.

Methods: I teach (pre-)medical students both Latin and Greek combining forms for each body part, along with terminations and prefixes, as well as the principles governing their combination. For example, students taught using this system, knowing that Latin muscul- and Greek myo- are synonyms, can easily translate both musculi linguales ("muscles pertaining to the tongue") and myocardium ("the part of the heart involving muscle").

Results: This approach allows students to move more easily between clinical and anatomical terminology and decreases potential communication errors, whether they specialize in anatomy or clinical medicine.

Conclusion: Learning the combining forms and how complex medical words and phrases (both clinical and anatomical) are put together will also cut down on the amount of memorization for students, facilitate communication between medical disciplines, and increase the accessibility of the TA while keeping it relevant to clinicians.

Keywords: anatomical terminology, clinical terminology, Latin & Greek, medical education, Terminologia Anatomica

S-040
Notes from a philologist: when the English equivalents of TA terms are inconsistent with the original Latin terms

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Objective: The TA is a list of Latin anatomical names, but often it doesn't provide a proper English translation of those terms, instead presenting "English equivalent names" which can easily be mistaken for translations.

Methods: Using pages from the TA, I focus on terms listed under one heading – vena – and demonstrate how the use of English equivalent terms reveals a number of problems, and why there's a need to also provide an official English translation that is consistent with the Latin term.

Results: The English equivalent names are often inconsistent if viewed as translations of the accompanying Latin phrases, which can lead to confusion. Some possessive nouns are consistently rendered as adjectives; some are presented inconsistently, sometimes as nouns and sometimes as adjectives; some are missing; and many anatomical phrases are not rendered into acceptable English (lacking articles, for example). Moreover, the lack of proper translations often prevents users

of the TA from appreciating the logic of the original Latin phrase, forcing them to needlessly memorize a Latin term whose meaning is not obvious.

Conclusion: I propose that the TA also include an official (and literal) English translation for each Latin phrase, one that's consistent with the grammar of the Latin phrase. This will make the TA more accessible to instructors, students, and clinicians, since each translation will show the precise meaning of its Latin phrase. It will also help the TA remain relevant, since the translation will act as a logical connection between the Latin term and the vernacular English equivalent.

Keywords: Terminologia Anatomica, grammar, teaching, Latin, translation, anatomical terminology

S-041

Arteries don't got noses! (and the TA does not have 'non-concordant adjectives')

Lewis Stiles

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Objective: As a Latinist who has taught Medical Terminology courses and studied anatomical terminology for the past 35 years, I have noticed various inconsistencies and other problems. This paper is limited to a description of one egregious pattern of errors (along with systemic misinterpretations underlying it), and some possible solutions.

Methods: Focusing on grammar rather than anatomy, I scrutinized a large sample of genitive singular nouns (along with their English equivalents) looking for patterns of problematic usage and interpretation.

Results: The pattern found and discussed here is typified by this entry in Dorland's Medical Dictionary (emphasis added): "ramus lateralis nasi arteriae facialis [TA] lateral nasal branch of the facial artery." While the English equivalent does name a real-world body part, the Latin phrase unfortunately does not: the Latin possessive noun nasi clearly means "of the nose," whereas English "nasal" (like Latin nasalis) means "pertaining to the nose."

Conclusion: Several fixes for this erroneous pattern are possible. But its roots are in a more widespread systemic problem: a tendency for users of the TA to regard these distinct grammatical structures--one a Latin noun in the genitive (nasi), and the other the adjectivalization of that same noun base (nasalis)--as synonymous. Latin genitive nouns can never be construed as "non-concordant adjectives," so that a word like nasi must always be understood as "of the nose" rather than as "pertaining to the nose," regardless of context, and regardless of the anatomical importance of this grammatically obligatory distinction.

Keywords: Latin grammar, anatomical nomenclature, anatomical terminology, Terminologia Anatomica

S-042

Giving the province of Quebec a taste of its own medicine: diversity of dialect in the medical field

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Objective: The Terminologia Anatomica (TA) is not well established in French, and French medical terminology shows more variability than its English counterpart. In addition, Quebec's French has its own peculiarities. This situation has consequences when it comes to teaching medical terminology; such courses are often offered by Classics departments nowadays, and philologists can play a critical role in addressing the problems of medical language.

Methods: Using examples of French terms from my introductory medical terminology course at the bilingual University of Ottawa, I discuss the problematic relationships among the English and French vernacular equivalents of the Latin phrases of the TA.

Results: The variations of French medical terminology in Quebec, compared to that of Standard French, illustrate some of the problems in the TA. In this francophone province situated in a mostly English country, medical terminology sometimes adheres to English structures rather than true French ones. Other issues include linguistic regionalisms, a large number of unnecessary synonyms, and the fact that the same term occasionally has different meanings in the different varieties of French. Medical students today face a great challenge: in addition to Latin and English, they must also understand all the variations within French.

Conclusion: This challenge usefully illustrates some of the difficulties of translating the TA into other languages. However, understanding these difficulties can facilitate the translation of the TA into French, which is a desideratum.

Keywords: Terminologia Anatomica, dialects, french, teaching, medical terminology, translation

S-043

Meet the Terminologia Carcinomatosa: a proposed addition to the Terminologia Anatomica family

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Objective: Past research has shown that certain oncological medical terms have proven to be confusing. In particular, the subset of tumors called carcinomas are inconsistently named. The International Federation of Associations of Anatomists has

made significant improvements in the standardization of nomenclature through the creation of the Terminologia Anatomica (TA) and related publications. However, limited efforts have looked to apply a systematic approach to clinical anatomy. The Terminologia Carcinomatosa (TC) is the first attempt to bring standardization and coherence to carcinomas, a new set of quasi-anatomical structures.

Methods: A comprehensive search was conducted in the 33rd edition of Dorland's Medical Dictionary for terms containing "carcinoma". Then each carcinoma was researched to determine the clinical relevance of each of its English names. A standardized data extraction form was developed a priori to achieve consistency in naming.

Results: 265 unique entries of "carcinoma" in Dorland's were identified and individually analyzed to generate entries in the TC. Each entry consists of a proposed Latin name, currently recognized names, clinical definition, and remarkable characteristics of the tumor (e.g., affected organs, etiology, and location). Many of these tumors had multiple names, including eponyms, and nearly all of them lacked Latin names. Due to the inconsistency among related tumors, significant changes had to be made when naming carcinomas featuring specialized cell types, specifications of size or shape, or names requiring Latinate participles.

Conclusion: The TC is a standardized body of names, based on the principles underlying the TA, that offers increased simplicity and clarity for clinicians, medical learners, and patients.

Keywords: anatomical nomenclature, anatomical terminology, carcinoma, clinical anatomy, oncology, Terminologia Anatomica

FICSP Symposium
Ethical considerations in the publication of anatomy manuscripts

S-044

The ethicality of publishing anatomical research: perspectives from an author, reviewer, and editor

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S-045

Data integrity and ethical publishing behavior in the anatomical sciences

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Objective: The primary goal of this presentation will be to discuss ethical behaviors associated with publishing research in anatomical journals.

Methods: This talk will review the best practices of ethical behavior in anatomical research and publication. Details regarding research misconduct, data integrity, conflicts of interest, ethical approvals, and data sharing will be discussed. Examples of high-profile misconduct cases will be provided to demonstrate the possible consequences when data integrity is disregarded. Finally, procedures and best practices will be discussed that can be implemented during research and publishing to facilitate ethical oversight.

Results: Questionable research practices can range from unintentional misconduct to serious fraud. It is important that we uphold ethical behavior in anatomical publishing in order to maintain integrity of the scholarly record and to minimize wasteful redundancy. If false data are published, subsequent studies may magnify the errors leading to a cascade of inaccurate, compounding Conclusion. It is therefore crucial that researchers publishing in anatomical journals maintain high standards of data integrity. Transparency achieved through data sharing can also reduce duplication efforts and facilitate external validation of results by future studies.

Conclusion: It is incumbent upon all researchers and educators in the anatomical sciences to maintain ethical publishing behavior in order to uphold the integrity of the anatomical publication record and ensure positive progression of the discipline.

Keywords: ethics, publishing, anatomy journals, data integrity

S-045

Ethics in experimental animal research

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Animal science research covers a variety of experimental techniques for many different purposes leading to a multitude of diverse ethical issues. The key tenets of humane experimental use of animals are often referred to as the 3Rs: reduction, refinement and replacement. Animal experiments are considered acceptable only if human benefits are gained which could not be obtained by using other methods and only if suffering is minimized. Studies must have realistic and achievable aims of increasing our knowledge and research protocols must seek to answer specific questions, rather than just collecting data. Researchers must follow relevant literature to avoid needless duplication of experimental work. Authors must have the relevant approval for their study from an appropriate ethics committee and/or regulatory body before the work starts and provide the name of the ethical review committee or equivalent. The species, strain, sub-

strain, sex, weight, and age of animals, experimental groups used and details of housing and husbandry conditions including any environmental enrichment should be include. For each experimental group, animals, experimental units or data points not included in the analysis should be stated and the reasons should be described. Using a validated method of randomization helps minimize selection bias and reduce systematic differences in the characteristics of animals allocated to different groups. Failure to disclose all the outcomes that were measured should be avoided and it is important to interpret the results of the study in the context of the study objectives. Authors are encouraged to use the ARRIVE guidelines for animal research (https://arriveguidelines.org/arrive-guidelines) and COPE guidelines on publication ethics (https://publicationethics.org).

TEPARG Symposium
Hybridising anatomy education

S-047

Evaluating learner gain and student satisfaction of teaching anatomy online using 3D digital models as compared to 2D illustrations.

Rohan Bhate, Noor Haddad, Renna Zazai, James Hayes, Yasmin Taghvaipour, Connor James Holmes, Anahita Dadali, Georga Longhurst

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Objective: The use of 3D digital models in anatomical education has accelerated due to the Covid-19 pandemic. However, the educational value and level of student satisfaction from using digital 3D models compared to 2D images remains under-evaluated. The first aim of this study was to compare student satisfaction and learner gain of 2D versus 3D visualization tools, using Kirkpatrick's model of evaluation. The second aim was to assess how teaching anatomy online using these visualizations translates into an accurate interpretation of cadaveric images.

Methods: Students studying medical sciences (n=173) were randomly allocated into peer-led teaching groups using either 2D or 3D visualisations. Student satisfaction was evaluated through Likert scale pre-/post-tutorial questionnaires. Learner gain was calculated from pre-/post-tutorial test scores, using cadaveric image-based questions. The post-tutorial test contained seven supplementary questions, to determine translation into understanding cadaveric anatomy.

Results: Students responded positively to all levels of Kirkpatrick's model. After the tutorials, 100% (2D group) and 83% (3D group) agreed that satisfaction would be higher if 3D models were incorporated into teaching. There was no significant difference in average learner gain between the 2D (+0.17) and 3D (+0.11) tutorials. Students correctly answered 53.01% and 55.49% of the supplementary questions after 3D and 2D tutorials, respectively.

Conclusion: Our results show that student satisfaction is higher when teaching anatomy online using 3D digital models but does not necessarily result in any perceived educational advantage over 2D illustrations. This study was given a favorable ethics opinion by St. George's, University of London Research Ethics Committee (ref. number - 2021.0082).

Keywords: learner gain, anatomy education, Kirkpatrick model, 3D anatomy

S-048

Educator perspective: educational sources for distance teaching in anatomy during the Covid-19 pandemic

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Objective: In March 2020, SARS-CoV19 hit the world, Face to Face on-site teaching was suspended. Our question therefore was, what happened to the anatomists? In this presentation we will focus on educational sources used by anatomists for distance teaching.

Methods: TEPARG performed an online survey for anatomists. The questionnaire focused on the changes they have experienced as a result of the pandemic, accompanied by questions about their personal estimations on the influence of distance teaching on anatomical education.

Results: Thirty-three anatomists answered the questions to be presented here (48% males, 52% females). In most cases, recorded lectures and other forms of presentations, i.e. institutional materials, were streamed. Only few external sources of anatomical educational material was used, among them Bob Acland's videos, Complete Anatomy®, Visible Body®, and Anatomage® tables.

Conclusion: Despite the availability of commercial educational materials most anatomists rely on self-produced institutional recordings and streams.

S-049

Innovation in imaging: an innovative online resource for learning radiology and anatomy

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Objective: Digital anatomy learning requires innovation to adapt to the changing landscape of medical education. Online resources enable students to engage with material beyond static images and lengthy description found in textbooks. An online radiology module was created for preclinical students at the University of Oxford, which includes coronal, sagittal and axial scrolling CT and MRI images of different organ systems.

Methods: Key structures are labeled with color and identified with a key. Students can scroll through sections, zoom in and out on each image and select individual sections from a drop-down list. The module contains labeled abdomen and brain scans, as well as regularly spaced quizzes to reinforce active recall. We have devised the novel 'Oxford Method' – pathology is covered by a newly implemented tool that allows students to slide between images of the same organs in both non-disease and disease states. This side-by-side comparison is an effective way to train students to identify pathognomonic features on imaging.

Results: Student feedback has indicated that overlaying color onto radiology scans is particularly effective for visual learners. Labels on their own, although helpful, do not distinguish the boundaries of adjacent structures, which can be confusing for students who have had little radiology and anatomy teaching. The juxtaposition tool works to bridge the knowledge gap between preclinical theory and applied anatomy.

Conclusion: This new digital model, if used in conjunction with traditional teaching methods, could greatly enhance current resources for students. We hope to develop this resource for students studying anatomy globally.

*These authors contributed equally to this project.

S-050

Adopting a flexible approach to professional anatomy spotter exams during Covid

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At the start of the Covid pandemic in March 2020, Dental Sciences staff worked with our Faculty technology team to rapidly move all summative examinations to an online, at home format. Our regulator, the General Dental Council requires us to continue with all our summative examinations and for these to be conducted in as robust a fashion as possible. In consultation with students and the Specialist Learning Team to first determine the best approach, we have delivered around 100 formative and summative assessments online, across two regulated degree programmes and eight year groups. This included converting our Anatomy Objective Structured Practical Examinations to digital spotters. This talk details the challenges we have faced and solutions we have utilized, offering practical advice for those who may wish to run digital spotter exams in the future on any platform.

- Sourcing high quality cadaveric images.
- Delivering timed, monitored, online summative exams.
- Establishing ease of use for students, including exam format and design through practice exams and detailed feedback.
- Supporting students with examination adjustments in an un-invigilated environment.
- Addressing concerns about probity, including use of an examination declaration.
- Preparing students to undertake examinations in the at-home environment.
- Supporting students undertaking examinations remotely, including e-mail support before exams and a live helpline during examinations.
- Marking and moderation when tutors are often working remotely.

Importantly, adoption of online assessment has allowed us to maintain a flexible approach, whilst we try to return to campus exams, but continue to face uncertainty. The online assessments are readily converted between invigilated campus exams and at-home exams as circumstances dictate.

S-051

The role of human cadaveric dissection and hybrid medical education in the post-Covid-19 pandemic era

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Objective: Covid-19 presented numerous challenges in dissection-based human anatomy teaching at the University of Cambridge. Novel solutions were necessary to comply with social distancing rules whilst maximizing the benefits of cadaveric dissection and maintaining high teaching standards. As Covid-19 restrictions begin to ease, it is anticipated that a number of these changes will be retained in future

Methods: Adaptations have included reducing the number of students from 6–8 to 2 at one donor table dissecting at once, while another group of students would work in pairs at different stations, including osteology, prosections, VH Dissector® and ultrasound. Concurrent ZoomTM sessions for the remaining students have enabled students to apply their anatomical knowledge to clinical scenarios, engage in small group discussions and practice presentation skills

Results: By changing the format of the practical sessions we have observed that students had a more meaningful dissection

experience and exhibited more focused learning, as well as developing excellent manual dexterity. They also engaged in more discussion and collaborative learning. This hybrid approach has received positive feedback from the students.

Conclusion: The hybrid programme both preserves the unique advantages of hands-on cadaveric dissection while providing students with complementary online learning. It is anticipated that this improved format will continue to be integrated into the anatomy teaching programme beyond the Covid-19 era. All donors had provided written consent before death for the use of their bodies for anatomical research in compliance with the Human Tissue Act 2004. The Human Anatomy Centre operates under License No.12146 issued by the Human Tissue Authority

Keywords: Covid-19, hybrid, anatomy

S-052

Online solutions to the delivery and assessment of a clinical anatomy and medical imaging unit

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Objective: Pandemic restrictions forced a rapid transition online of a new clinical anatomy and medical imaging unit. This presentation reviews the effectiveness of an online approach designed around contextual relevance, constructive alignment and assessment for learning.

Methods: Online approaches included (i) anatomy and physical examination videos, (ii) in-house voice-overs of freely available medical image stacks, (iii) interactive HTML 5 content for asynchronous learning and assessment and (iv) video conferencing with breakout rooms for synchronous learning and assessment. Online assessments emphasized problem-solving over recall and used generic images and videos where possible to prevent reverse image searching. Assessment of physical examination was restricted to recognizing and explaining the key elements. The invigilation of online assessments was done by university staff as students found this less stressful than commercial options.

Results: Narrated medical image stacks and embedded HTML5 content and quizzes easily transferred online to drive asynchronous learning. Weekly quizzes immediately followed by feedback and synchronous explanations were very popular and had almost 100% attendance. Students recognized that virtual physical examination classes were a poor substitute for on-site classes. Without prompting, students recognized and praised the educational approaches adopted. Assessment results were excellent, and no breaches of academic integrity were found.

Conclusion: Unit success reflected its solid educational design. Most of the online approaches were successful and can be adapted to future hybrid courses. Online physical examination is no substitute for on-site delivery but may have a place as an adjunct resource. This study had local ethics approval.

Keywords: online, clinical anatomy, medical imaging

Chinese Society of Anatomical Sciences Symposium

Multi-model analysis of the brain and neurodegenerative disorders

S-053

Probabilistic atlas of human brainstem pathways and its application

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Objective: Fiber pathways in the brainstem are essential for sensory and motor functions, and they are known to be affected in a wide spectrum of neurological disorders. While diffusion MRI has been successfully applied to map various brain pathways, there has been limited research on the in vivo mapping of the brainstem connectomes. In this study, we aim to develop a probabilistic atlas of human brainstem pathways and explore its application.

Methods: By leveraging the high-resolution and multi-shell diffusion MRI data from the Human Connectome Project (HCP), we develop a novel method including rigorous quality control, fiber orientation distribution (FOD) reconstruction and ROIs based fiber tractography for the reconstruction of the 23 main fibers in the brainstem and the locus coeruleus pathway to transentorhinal cortex (LC-TEC pathway).

Results: A novel probabilistic atlas of 23 brainstem pathways were developed. And we also developed a probabilistic atlas of the LC-TEC pathway and applied it on clinical imaging data form the Alzheimer's Disease Neuroimaging Initiative (ADNI) and demonstrated the detection of the decreased fiber integrity in the LC-TEC pathways with increasing disease severity.

Conclusion: We built a probabilistic atlas of 23 main brainstem fibers which can be valuable in brain imaging studies of various neurological disorders and serving as a basis for segmentation of other brainstem structures. We also developed a probabilistic atlas of the LC-TEC pathways that can be used by researchers interested in the development of early AD imaging markers.

Keywords: brainstem, connectome, pathways, atlas, tractography

S-054

Genetic and phenomic architecture of the human brain torque

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Objective: Hemispheric asymmetry is a core element of the human brain's organization, which is required for optimal functioning and influenced by genetic factors. However, the functional significance and mechanisms determining the development and individual variability of structural brain asymmetry remain unclear.

Methods: Here, we systematically analyzed all relevant components of the most prominent structural asymmetry - brain torque (BT), and their relationships with potential genetic and non-genetic modifiers in a sample comprising 24,112 individuals. BT features were directly modeled using a set of automatic three-dimensional brain shape analysis approaches. Age-, sex-, and handedness-related effects on BT were assessed. The genetic architecture and phenomic associations of BT were investigated using genome- and phenome-wide association scans.

Results: Our results confirmed the population-level predominance of the typical anticlockwise torque and suggested a "first attenuating, then enlarging" dynamic across the lifespan (3–81 years) primarily for frontal, occipital and perisylvian BT features. Sex/handedness differences in BT were found and were related to cognitive sex/handedness differences in verbal-numerical reasoning. We observed differential heritability of up to 56% for BT, especially in temporal language areas. Individual variations of BT were also associated with various phenotypic variables of neuroanatomy, cognition, lifestyle, sociodemographics, anthropometry, physical and mental health. Our genomic analyses revealed possible genetic basis for these phenotypic associations, and reflected an important role of neurodevelopment- and cytoskeletal-related genes in the development of BT.

Conclusion: This study provides a comprehensive description of BT and insights into biological and other factors that may contribute to the development and individual variations of BT.

Keywords: age, big data discovery, brain asymmetry, handedness, heritability, sex

S-055

Uncovering the genetic profiles underlying the intrinsic organization of the the human cerebellum

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Objective: Converging evidence has tended to support the view that the renewed functional diversity of the human cerebellum is derived from its extensive afferent and efferent connections to extracerebellar structures, with a preference for motor control, cognition, and emotion, rather than being limited to a uniform cerebellar cortical cytoarchitecture. Whether and how the hypothesized determination of connections in cerebellar functional heterogeneity interact with microscale gene expression is still an open question.

Methods: To address this, we combined the Allen Human Brain Atlas transcriptome data with cerebellar functional parcellation atlas to investigate the neurobiological genetic mechanism underlying the functional organization of the human cerebellum. To further discover the biological functions of these genes, we performed a "virtual gene knock-out" by observing the change in the coupling between gene co-expression and FC.

Results: We not only identified 443 network-specific genes but also discovered that their co-expression pattern correlated strongly with intra-cerebellar FC. Of these genes, 90 were also linked to the FC of cortico-cerebellar cognitive-limbic networks. We divided the genes into two subsets, i.e., a positive gene contribution indicator (GCI+) involved in cerebellar neurodevelopment and a negative gene set (GCI-) related to neurotransmission. A more interesting finding is that GCI- is significantly linked with the cerebellar connectivity-behavior association and many recognized brain diseases that are closely linked with the cerebellar functional abnormalities.

Conclusion: Collectively, our results could help to rethink the genetic substrates underlying the cerebellar functional organization and offer possible micro-macro interacted mechanistic interpretations of the cerebellum-involved high order functions and dysfunctions neuropsychiatric disorders.

Keywords: cerebellum, functional MRI, gene expression, networks, connectivity

S-056

Spatial-temporal brain structure change during the progression of sporadic Alzheimer's disease

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Objective: We are facing tremendous socio-economic pressure brought by Alzheimer's disease (AD). Understanding the disease progression of AD, especially sporadic AD (accounting for more than 90% of AD) is one of the keys to our response to this major disease. It is generally believed that the interaction of Aβ and Tau causes neurodegenerative changes and leads to the occurrence of Alzheimer's disease (AD). However, it is very hard to directly research the interaction between Aβ and Tau, because of the longer latent-period for AD and the un-parallel change pat-

terns for Aβ and Tau. Thus, studying the spatiotemporal anatomical basis of the structure changes will make it possible to fundamentally understand the mechanism of sporadic AD disease progression.

Methods: Here, we analyzed longitudinal data from the ADNI dataset. By aligning normal cognition (CN) baseline with a clinical diagnosis of mild cognitive impairment (MCI) or AD, we studied the progression of AD using a linear mixed model to estimate the brain spatial-temporal brain structure changes from stable CN to MCI to AD.

Results: The results showed that the medial temporal lobe is the first change brain region before MCI onset, and the primary cortex are late change regions after AD onset.

Conclusion: Our main contribution is: revealed the brain structure anatomical change pattern from CN to AD in the progression of sporadic AD.

Keywords: Alzheimer's disease, brain atlas, neuroimaging, brain structure

Chinese Society of Anatomical Sciences Symposium

Synaptic and circuit plasticity and behavior

S-057

Mechanisms underlying descending modulation on pain and negative emotion through the pathway between prefrontal cortex and midbrain periaqueductal gray in the mouse

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Objective: To reveal the involvement of the descending connection between dorsal medial prefrontal cortex (dmPFC), a key cortical area for both pain perception and negative emotion, and the midbrain ventrolateral periaqueductal gray (vlPAG) neural pathway in pain and antianxiety behavior under different conditions.

Methods: Multiple tracing, optogenetic manipulation and pharmacological approaches as well as behavioral observation were used under the anesthesia with sodium pentobarbital during all surgical procedures. After being anesthetized with an overdose of the same anesthetic agent, the mice were perfused and fixed with fixative solution, and the mouse brains were cut into sections for the morphological observations. All these operations meet the ethical requirements of animal experiments in the local university.

Results: It was demonstrated that the descending connection between the dmPFC and vlPAG were involved in maintenance of pain thresholds and antianxiety behaviors under normal condition, while silencing or suppressing the dmPFC-vlPAG pathway might affect the initial stages and maintenance of chronic pain and the emergence of anxiety-like behaviors. It was also revealed that the enhancement and weakening of the inhibitory regulation of GABAergic inhibitory interneurons on excitatory glutamatergic projection neurons in dmPFC are directly related to these different effects.

Conclusion: These results are essential to understand the mechanisms underlying chronic pain and to clarify the causes of negative emotion related with chronic pain through the prefrontal cortex and midbrain pathway as well as the functions of the local neural circuits constituted by the specific inhibitory and excitatory neuronal types within the prefrontal cortex.

Keywords: mouse, negative emotion, pain, periaqueductal gray, prefrontal cortex

S-058

Glutamatergic synapses from the insular cortex to the basolateral amygdala encode empathic pain

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Objective: Empathic pain has attracted the interest of a substantial number of researchers studying the social transfer of pain in the sociological, psychological and neuroscience fields. However, the neural mechanism of empathic pain remains elusive. Here, we established a long-term empathic pain model in mice and studied the neural mechanism of empathic pain.

Methods: Morphological, behavioral, molecular biology, electrophysiological methods were combined in this study.

Results: We found that glutamatergic projection from the insular cortex (IC) to the basolateral amygdala (BLA) was critical for the formation of empathic pain. Selective activation or inhibition of the IC-BLA projection pathway strengthened or weakened the intensity of empathic pain, respectively. The synaptic molecules were screened, and the upregulated synaptotagmin-2 and RIM3 were identified as key signals in controlling the increased synaptic glutamate transmission from the IC to the BLA.

Conclusion: These results reveal the molecular and synaptic mechanisms of a previously unidentified neural pathway that regulates empathic pain in mice.

Keywords: empathic pain, insular cortex, basolateral amygdala, synaptotagmin-2, RIM3, synaptic mechanism

S-059

Roles and neural circuits of the striatum on sleep-wake regulation

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Objective: Patients with Parkinson's disease (PD) suffer from severe sleep disorders. Pathophysiology of the basal ganglia (BG) underlies PD, and the dorsal striatum represents the major input pathway of the BG. However, the roles and mechanisms of the dorsal striatum in controlling sleep-wake cycles remain unknown. The striatum contains GABAergic medium spiny neurons, including dopamine D1 receptor (D1R) neurons and adenosine A2A receptor (A2AR) neurons.

Methods: Therefore, to demonstrate the contribution of D1R neurons or A2AR neurons within the striatum in sleep-wake regulation, we combined chemogenetic, optogenetic manipulations and fiber photometry with electroencephalography/electromyography recording in transgenic Cre mice.

Results: Here we showed that chemogenetic activation of A2AR neurons in the striatum induced a remarkable increase in non-rapid eye movement (NREM) sleep, and A2AR neurons innervated the PV neurons in the GPe. Moreover, chemogenetic inhibition of A2AR neurons led to a significant decrease of NREM sleep. Furthermore, optogenetic activation of striatal D1R neurons induced immediate transitions from non-rapid eye movement (NREM) sleep to wakefulness, whereas inhibition of striatal D1R neurons attenuated wakefulness by chemogenetics. In addition, optogenetic manipulations revealed a prominent contribution of striatal D1R neurons in control of wakefulness via downstream, striato-entopeduncular, or striatonigral pathways. Taken together, our findings revealed A2AR neurons control NREM sleep via projecting to GPe PV neurons, and D1R neurons promote wakefulness by innervating striato-entopeduncular or striatonigral pathways.

Conclusion: Our work investigates the role and neural circuits of the striatum on sleep-wake regulation for the first time, and helps us to understand the pathogenesis of sleep disorders along with PD.

Keywords: sleep, neural circuits, A2AR neuron, D1R neuron

S-060

Rostromedial tegmental nucleus nociceptin/orphanin FQ (N/OFQ) signaling regulates anxiety- and depression-like behaviors in alcohol withdrawn rats

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Objective: Repeated alcohol drinking and withdrawal induce negative affective states, promoting alcohol use disorders (AUDs) development, linked with mesolimbic dopamine (DA) hypofunction but lack clear mechanisms. The present study explores the role of nociceptin (N/OFQ) signaling of GABAergic VTA-projecting neurons in the rostromedial tegmental nucleus (RMTg) on the adverse behaviors associated with AUDs.

Methods: Adult Long-Evans rats were trained to chronically intermittently consume water (Naive) or alcohol (Post-EtOH). The approaches, including FISH and immunostaining combined with retrograde tracing, LCM coupled with qPCR, chemogenetic and pharmacological tools combined with behavioral tests, and electrophysiological recording, were used in this study.

Results: The RMTg neurons express Pnoc and Oprl1 genes and exert an inhibitory input onto VTA DA neurons. Chemogenetic inactivating RMTg decreased the cFos expression, mitigated anxiety and depressive symptoms, and reduced alcohol consumption in Post-EtOH rats, which was mimicked by local activating nociceptin receptors (NOP). Moreover, blocking RMTg NOP increased cFos expression and elicited the above aberrant behaviors in naïve rats. Additionally, chemogenetic inactivating RMTg neurons reduced GABA release and accelerated VTA DA neurons' spontaneous firings. Finally, pharmacological inhibiting unilateral RMTg combined with activating DA D1/2 receptors in the contralateral (but not ipsilateral) NAc mitigated the negative moods in Post-EtOH rats.

Conclusion: RMTg N/OFQ signaling plays a crucial role in the aversive behaviors during AUDs. Intervention targeting RMTg NOP may help those suffering from AUDs. These results help us understand the molecular and neural circuits mechanisms of DA hypofunction linked with negative emotion associated with AUDs.

Keywords: rostromedial tegmental nucleus; nociceptin receptor; alcohol use disorders; affective disorders

S-061

Mechanically evoked defensive attack is controlled by GABAergic neurons in the anterior hypothalamic nucleus

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Innate defensive behaviors triggered by environmental threats are important for animal survival. Defensive attack toward threatening stimuli is often the last line of defense. How the brain regulates defensive attack remains poorly understood. Here, noxious mechanical stimulus was used to evoke defensive

attack, cfos immunostaining, fiber photometry of Ca signal, and single-unit recording with optrode were used to measure neuronal activity. ChR2 was used for photostimulation of neuronal activity, while GtACR1 and hM4Di were used for inhibition of neuronal activity. The biting attack was indicated using EMG recording from masseter muscles. Retrograde tracing was performed using the recombinant rabies virus. Picrotoxin delivered through implanted cannula was applied to inhibit GABAergic signal. We show that noxious mechanical force in an inescapable context is a key stimulus for triggering defensive attack in laboratory mice. Mechanically evoked defensive attacks were abrogated by photoinhibition of vGAT+ neurons in the AHN. The vGAT+ AHN neurons encoded the intensity of mechanical force and were innervated by brain areas relevant to pain and attack. Activation of these neurons triggered biting attacks toward a predator while suppressing ongoing behaviors. The projection from vGAT+ AHN neurons to the periaqueductal gray might be one AHN pathway participating in mechanically evoked defensive attack. Together, these data reveal that vGAT+ AHN neurons encode noxious mechanical stimuli and regulate defensive attack in mice.

Keywords: defensive attack, noxious mechanical stimulus, anterior hypothalamic nucleus, vGAT+ AHN neurons, periaqueductal gray

Anatomical Society Symposium
Augmented and virtual reality in anatomy

S-062

Scaleable, accessible and affordable utilization of extended reality (virtual reality, augmented reality and the metaverse) in surgical education and global health and its scientific rationale

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Objective: Training surgeons is time-consuming, expensive and requires supervision. Extended Reality (Virtual Reality, Augmented Reality and the Metaverse) increases opportunities for surgical training and demonstration of surgical anatomy.

Methods: VRiMS is a free for trainee resource delivering surgical education from Brighton and Sussex Medical School. Cadaveric surgical procedures are filmed in 360VR, with an overlay of additional camera perspectives (camera in camera) in the 360 space to maximize the educational benefit this resource offers. Six one-week VRiMS courses have been live-streamed for trainees to participate with smartphones and low-cost headsets. The programme covered 15 surgical specialties and has created a platform with over 400 procedures for restream events. Procedural steps and operative anatomy were demonstrated using fresh frozen cadavers and virtual presentations. A recent 4-day event hosted 12 East African low to middle income country delegates with a parallel VR event in Kampala, Uganda using low-cost headsets for a cross-continental VR and in-person hybrid conference. The event was hosted in the metaverse and delegates participated in a qualitative evaluation of using extended reality in surgical training.

Results: VRiMS to date has had a total of 5,800 individual views of its streaming content with 1,200 hours of content playback and viewers from 81 countries. The Global VRiMS course we have just held had 1359 individual live views, 350 hours live playback and 61 countries participated.

Conclusion: VRiMS has demonstrated how this technology can be scalable, accessible and affordable and the scientific validation will further rationalize its value in medical education. True VR apps have been developed including a basic life support app that will be validated using physiological sensors, eye tracking and motion capture for both quantitative and qualitative validation of extended reality.

S-063

Medical visualization: from medical art to xR visualization

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Historically, medical illustration, as an artistic practice within the realm of medicine,m has conveyed anatomical, medical and related knowledge and information to specific target audiences. Medical Illustration relies on the combination of traditional and digital drawing skillset along with the thorough understanding of the specific biomedical processes, to create original illustrations for presentation purposes. On the other hand, medical visualization has been traditionally defined as the visual outcomes from harnessing the "horsepower" of modern computer graphics for the creation of tri-dimensional imagery from medical dataset. Despite being a relatively new field of research, it has profoundly changed modern medicine, enhancing our abilities to understand and analyze complex spatial interactions between anatomical structures. With the advent of computer graphics technologies and notably powerful mobile devices being more widely available among the general population, new forms of demand for biomedical communication are emerging. This eventually translates into novel paradigms of visualization for medical dataset, pushing medical illustration way beyond the purpose of presentation, and taking advantage of computer

graphics technologies to offer opportunities to all audiences to engage with biomedical content at different levels. Digital outcomes from the realm of Extended Reality applied to biomedical sciences have the potential to provide an audience with self-paced exploration and advanced interactions, and promote a higher degree of understanding and critical thinking. Extended Reality defines a technological spectrum which includes Augmented Reality, a technology able to overlay digital content on one's experience of the real world, and Virtual Reality, a technology able to immerse one into a fully digitally generated environment. However, the implementation of such technologically advanced solutions requires a new set of knowledge and abilities which include, of course medical insights into the specific procedures and creative skillset, but also strongly technologically grounded expertise. From a long-standing strategic research-led partnership, the School of Simulation and Visualisation at The Glasgow School of Art, and the Anatomy Facility at the University of Glasgow, have implemented a unique methodological and technological framework that combines training in creative and interactive visualization technologies with intensive full-body anatomical training, including cadaveric dissection, for the generation of anatomically accurate and interactive digital reconstructions, into an MSc degree in Medical Visualisation and Human Anatomy. This degree trains creative technologists specialized in human anatomy who actively contribute to the disruptive transformation of biomedical communication. This presentation aims to provide more insights into emerging technologies such as Extended Reality, applied to biomedical communication.

S-064

Using cognitive load theory and visual elements of art to design anatomy learning resources

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Objective: Extended reality, a cutting-edge technology, is increasingly being used by researchers who believe that it can be beneficial in creating learning resources in anatomy education. This innovative technology is showing great promise, and it has already been tested in a number of trials to determine its wider applicability. This technology is capable of visualizing intangible structures, particularly at the cellular level, in the most challenging area of neuroanatomy, and is being shown to have great educational value. Cognitive load theory (CLT), which integrates concepts to improve the design of learning materials by following the principles to limit load and promote overall learning, is one of the important features when designing interactive educational applications. If attention is not paid to the CLT in instructional design for digital applications, it can hamper the effectiveness of app-based learning. This gap highlights the necessity for this study to build a methodological framework guideline that integrates cognitive load principles and visual elements from fine arts theory in order to improve the efficacy and aesthetics of learning resources in the neuroanatomy discipline.

Methods: An augmented reality (AR) neural pathway learning application has been created using Unity technology for the Android platform. This app was designed using the cognitive load reduction principles and will be evaluated to form the methodological framework guidelines. For data collection, this study employed quantitative methodology and the counterbalanced experiment. Initially, the experiment would randomly divide participants into two groups to evaluate academic performance, cognitive load, usability, and motivation using two distinct learning resources: an augmented reality (AR) application and self-study PowerPoint slides.

Results: A total of 79 undergraduates participated in the experiment, including 34 in group A and 45 in group B. A Mann-Whitney U and Wilcoxon signed-rank tests were used for analysis. Using the Wilcoxon signed-rank test, preliminary findings indicate that both learning resources promote a significantly improved performance in knowledge. However, the Mann-Whitney U test demonstrated that the application greatly outperformed the traditional resource in terms of learning performance when comparing the two groups.

Conclusion: Overall, the preliminary results are encouraging and support that implementing the concepts of reducing cognitive load throughout the application design process can improve student's learning performance, and further analysis will be presented to inform a methodological framework.

FIPAE Symposium
Anatomy and sexism

S-065

Feminist theory within education

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Objective: Within health sciences and medical education, focus on gender bias and inequality is increasing. This is critical to ensuring equity within academic institutions, within healthcare, and within the workforce in regards to career progression. Gender bias within healthcare kills, with women,

especially Black women, more likely to suffer discrimination and poor healthcare outcomes.

Methods: Though 'feminism' is difficult to define, feminist theory is an umbrella term for theory concerned with equal rights across the spectrum of gender, often illuminating the unequal experiences of people of various genders in order to do so. Despite the critical importance of challenging gender bias, and the focus of feminist theory being on securing gender equality, the health sciences, including anatomy education and research, lags behind the social sciences in regards to utilising feminist theory within teaching and educational reform. Feminist theory is diverse and multifaceted, and it can be difficult to know where to begin when considering how the theory maps to issues of education.

Results: This talk will provide a theoretical foundation for the discussions within this symposium, providing an overview of the history of feminist theory (grounding this history alongside advances in anatomical sciences), and considering the types of feminist theory that might help us view anatomy education in new and illuminating ways.

Conclusion: Through this talk and subsequent discussion, attendees should feel more confident applying feminist theory to examine health sciences curricula, and in using feminist theory as a basis for session and curricula design.

Keywords: feminism, education, women, sexism, gender, theory

S-066

Sex and sexism in anatomy education

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Objective: Gender discrimination has long been documented within the executive professions literature. Indeed, there are known patterns of bias faced by women including the maternal wall bias, the tightrope bias, the tug of war bias and the prove-it-again bias.

Methods: We will consider the common patterns of bias and examine how they may impact those working and learning within the field of anatomy education.

Results: We will look at the practical considerations for educators, including the impact of the hidden curriculum and the physical environment.

Conclusion: This talk will end with a call to arms, and consideration of practice points for educators.

Keywords: anatomy, gender, bias

S-067

Female genital cosmetic surgery: the role of anatomical knowledge in decision making

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Female genital cosmetic surgery (FGCS) is a non-medically indicated procedure mainly aimed at changing the aesthetics or functionality of the female genitalia. Labiaplasty is one such procedure which has seen an increase in global demand and popularity. In Australia there has been a significant increase in labiaplasty procedures offered and in the number of adolescent girls between the ages of 15–24 undergoing these procedures. Though rates are said to be on the rise, more investigation is needed into the prevalence of these procedures in Australia both in the public and private sectors. The literature and society mainly comment on the social motivations for women requesting these procedures but lack a complete understanding of the factors that influence a women's decision to undergo surgery. This may be due to limited knowledge in normal female anatomy or persuasive advertisements in the media or a woman's underlying mental health issues. As a multidimensional issue, the current standards for FGCS presents issues of patient safety; hence the need to incorporate the complexities of this issue to determine what needs to be implemented to regulate these procedures.

S-068

Inspiring and supporting women in anatomy: beyond stereotypes

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Promoting and supporting professional development of women in anatomy has come a long way. Historically, women's participation in anatomical sciences was very limited. Teaching anatomy and practicing dissections were mostly prohibited to women. Somehow, many of them managed to develop these activities either secretly or through the arts. Even though women can dedicate themselves nowadays to any area related to science, stereotypes halt them from achieving base and leader roles in these activities. Adolescent women report having heard derogatory statements or comments about women regarding mathematics, science, or technology (STEM). Stereotypes influence the decision-making process and perception of girls and adolescents, discouraging them from searching careers where women are underrepresented. This situation may vary depending on the cultural context of each region. In

Mexico, only 20% of Anatomy educators are women. At our university, there were no women professors in the Anatomy Department until 2019. More impressive is that in 65 years there had not been any women professors. This might lead other women to think that women were not accepted within the department and might mistakenly think that will be rejected because of their sex. Due to these reasons, we recently implemented a training course for Near-Peers (NPTs) focusing on a gender perspective, sexism, and sexual harassment. We are also working on distributing equally the role and functions of NPTS that work from leadership positions. Promoting women in anatomy and making their role visible in teaching, research, and leadership positions may inspire young women to take an active role in the field. That would certainly set aside preconceptions of gender-bias and have a positive effect on future decisions. Being in front of a group of people at our activities with students gives us the ability to play a role that was hidden for a long time in anatomy. Representation matters and getting more women to see themselves occupying those spaces will motivate them to reach them. For a future with more women scientists. For a future with more women anatomists.

S-069

Challenging gendered norms: how might we drive change in and through anatomy education

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Inclusive and diverse workplaces have been shown to be innovative and productive. Research has shown that when systemic barriers exist, the retention and progression of women in academia has been negatively impacted. Nevertheless, higher education institutions are regarded as both gendered and gendering organizations. Anatomy itself, has a long 'gendered' history and while beginning to adapt, remains inherently skewed to maleness. This is partly due to the historical exclusion of women as contributors of scientific knowledge creation and dissemination, and the perception of women as defective except for the purpose of reproduction. The philosopher Aristotle for example, described female genitalia as a mutilated male form. Even early illustrations of anatomy and art have emphasized women as reproductive beings, with a smaller skull and wider pelvis than that of a male. This perception is so deeply rooted that for a long-time, reproductive organs were considered the only significant difference between males and females such that, even today, we know much less about female biology than that of the male. These historical perceptions have resulted in society's systems like education institutions and healthcare preferencing those that identify as male. Universities and faculty through their education and research activities can be drivers of change, and empowerment. As academic institutions and societies begin to change, the change is reflected in the discipline. However, these historical perceptions remain so deeply rooted and include a 'power-imbalance' and behavior expectations of women in academic roles. This talk will provide some examples of the multifaceted burden of anatomy's gendered history with a view to understanding where we are and how we got here so that we can impact change in the future.

ISCAA Symposium

Recent advances in clinical and applied anatomy: from the bench to clinical practice

S-070

Surprising anatomical facts as a troubleshooter for saphenous nerve block

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The saphenous nerve block is a selective block for any surgical interventions distal to the knee joint level and therefore used in regional anesthesia frequently. Different block techniques exist: either a "femoral nerve" block in the femoral triangle or mid-femoral block, adductor canal block or block at leg level. Nevertheless, inefficient blocks are reported although a thorough spread around the saphenous nerve is observed. The reason for such inefficient blocks are due to two reasons: the femoral branch of the femoral nerve, who can provide anastomoses to the femoral nerve distal to the inguinal ligament and very differing courses of branches of the saphenous nerve or cutaneous branches of the femoral nerve. These facts should be taken into consideration. Therefore, adaptations of existing block techniques are recommended.

S-071

Surgical anatomy for suboccipital retrosigmoid approach

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Suboccipital retrosigmoid approach remains one of the most widely used neurosurgical approaches that provides the access to lesions involving mainly the cerebellopontine angle. This region houses many critical neuro-vascular structures like the

cerebellum, cranial nerves, brain stem, venous sinuses and arteriovenous structures. Familiarity to the anatomical construction of such a region is mandatory to perform safe surgeries with no or acceptable complication rate. Placing burr holes that preserve the integrity of the venous sinuses, planning the boundaries of craniotomy or craniectomy, rotation of the head and projection of the field regarding the neural structures are all among the anatomy-based issues that must be known and be oriented during early phases of the surgery. Literature defines the landmarks to identify the courses and locations of the transverse and sigmoid sinuses on the outer surface of the skull and inner surface of the scalp. And the natural and palpable landmarks to determine the ideal location to open the initial burr hole during surgery were also discussed. The most recent literature-based anatomy to the retrosigmoid field will be discussed in order to help a better understanding of the surgical anatomy of the retrosigmoid approach.

S-072

The anatomy and sonoanatomy for ultrasound-guided nerve blocks in the head and neck

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Ultrasound allows direct visualization of the target tissue structures, needle placement and medical administration without radiation exposure. With sonography guidance, nerve blocks in the head and neck are useful techniques in pain management. In head and neck, US has an expanded role in guidance of the neural interventional procedures, and main US-guided pain interventions such as trigeminal and occipital nerve blocks, selective cervical root blocks, cervical facet and medial branch blocks, cervical sympathetic blocks, sphenopalatine and glossopharyngeal nerve blocks, and myofascial trigger point injections can be applied successfully by experienced physicians. Ultrasonographic visualization of nerves requires excellent anatomical knowledge and experience. The major limitations of US are artifacts created by bone structures and decreased resolution in deep structures and obese patients, so the identification of the nerves is frequently difficult. Adequate training is mandatory before ultrasound is used for the pain intervention, especially pain medicine in head and neck, where the neural and vital soft tissue structures and vessels are compacted in a limited area.

S-073

Interdisciplinary clinical anatomy education

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It has been repeatedly proved, discussed, and agreed that interdisciplinary learning is a desirable element of healthcare education as preparation for inter-professional collaboration in the workplace. Participation of members from different specialties co-teaching students in multiple environments can be a successful way to demonstrate teamwork and effective interdisciplinary interactions. Developing the way through their individual performances and attitudes is a positive method of ensuring that students learn how to be useful healthcare team collaborators. Recently, there are limited opportunities for peer-to-peer and interdisciplinary learning and teaching interactions at the level of higher education. As such, an attempt to implement these pedagogical approaches was trialed at a college level in Swansea University. Graduate-Entry Medical (GEM) students acted as volunteer anatomy demonstrators, working alongside anatomists to run practical workshops as part of an undergraduate (UG) module. The GEM demonstrators reported a benefit alongside refining their teaching skills. Anatomists identify a pedagogical benefit to both demonstrators and enrolled students. They recognise the great advantage for GEM students who can enhance teaching skills essential to their early professional careers. Although proper interdisciplinary healthcare education is still somewhat vague, it should be a focus for us at different levels across the higher education levels.

Keywords: interdisciplinary teaching, medical education, healthcare team

S-074

Erector spinae plane blocks: same block with sonoanatomical differences

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With the increasing use of ultrasound technology in regional anesthesia and pain medicine, the newly defined interfascial plane blocks (IFB) has gained popularity. The erector spinae plane block (ESPB) is a novel regional anesthetic technique with significant potential for clinical benefit in perioperative analgesia. There are several sonoanatomical and application differences in ESPB performance when performed at different vertebral levels. Even injection of small volumes of local anesthetics in thoracic ESPB provides multilevel analgesia, affecting both the ventral and dorsal rami in several levels. However, the paravertebral area in the lumbar vertebrae levels does not have such clear boundaries in the lumbar area. In lumbar ESPB, local anesthetic spreads in a wide area compared the thoracic ESPB, to the anterior of the paravertebral space with

most of LA surrounding the psoas muscle and lumbar plexus. ESPB is defined in the cervical region for shoulder and cervical spine surgeries and chronic headache syndromes. Prevertebral compartment includes the phrenic nerves, brachial plexus, and vertebral column and the deep cervical muscles of the erector spinae muscle group posteriorly. Given the theoretical risk of bilateral phrenic nerve paresis, one should be cautious about performing bilateral nerve blocks in the cervical region. The injection site should be determined by taking the interfascial space between the ESP muscles and transverse processes as the center in separate segments of the lumbar, thoracic, and cervical levels.

Keywords: sonoanatomy, erector spinae plane block, fascia, pain

S-075

Surgical anatomy for intracranial and intracanalicular course of the optic nerve: anatomical comparison of different surgical approaches

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Objective: Various pathologies such as tumors, traumas, vascular pathologies and inflammatory processes can affect the optic nerve and the optic canal, resulting in vision loss. Resection and optic nerve decompression is performed for many of these pathologies.

Methods: Optic nerve decompression can be performed for the superior, lateral, inferior and medial walls of the optic canal. Transcranial approach is particularly suitable for intracranial pathologies extending to the optic canal and can be performed by unroofing the optic canal and also anterior clinoidectomy is performed to decompress the optic canal laterally. On the other hand, the endoscopic optic nerve decompression via transnasal transsphenoidal approach is both an effective and a relatively minimally invasive method which is more suitable for pathologies affecting the optic canal inferiorly and medially.

Results: The transcranial approach is slightly more advantageous by means of longitudinal decompression of the entire optic canal and also optic nerve mobilization compared to the transsphenoidal approach. Endoscopic optic nerve decompression via transnasal transsphenoidal approach has many advantages such as providing a good exposure, no incision scar and not requiring brain retraction. Transcranial or transsphenoidal approaches should be preferred according to the location of the pathology and anatomical and histological characteristics of this region.

Conclusion: It is extremely important to know the anatomy of this region to easily identify the optic nerve during surgery, to avoid ophthalmic artery injury, to provide orientation to the endoscopic anatomy, to prevent serious complications and therefore to determine the safe surgery limits.

Keywords: optic nerve, decompression, endoscopic, transcranial, transsphenoidal

S-076

The microsurgical anatomy of the Sylvian fissure

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Objective: After the interhemispheric fissure visualization at the 8th week of gestation, the Sylvian fissure is the first significant landmark on the human cerebrum, it appears at the 14th-17th gestational weeks.

Methods: Sylvian fissure is a complex structure, with its peculiar anatomical properties. The sylvian fissure has two parts: superficial and deep. On superficial view the Sylvian fissure splits frontal and parietal lobes of the cerebrum from temporal lobes when approached from the lateral surface of the cerebrum. From the anterior cranial base the fissure starts medially from anterior clinoidal process of the sphenoid ridge and continues laterally until the pterion, where the frontal and the temporal lobes intersect. After the pterional region the fissure continues superiorly and posteriorly in three parts: anterior horizontal, anterior ascending and posterior.

Results: From the point of view of neurosurgery, Sylvian fissure approach makes it possible to approach many pathologies. From this approach at the apex of the pars triangularis, a natural superficial corridor proceeds in an upward direction over the sylvian fissure convexity. The circle of Willis and vascular projections, sellar and parasellar areas, insular lobe, mediobasal temporal region are the accessible areas with sylvian fissure approach.

Conclusion: The Sylvian fissure and Sylvian cistern have unique anatomical, vascular, genotypical properties than the other areas of the cerebrum so it makes the area complex and special. Complexity of the area increases with the evolution of humankind and opens a gate for human cognitive processes.

Keywords: Sylvian fissure, lateral fissure, micro anatomy

S-077

Ultrasound-guided cervical sympathetic ganglion block: anatomical considerations

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Objective: Ultrasound-guided cervical sympathetic ganglion block (USG-CSB) is a frequently used interventional procedure for pain syndromes, including neuropathic pain and sympathetically-maintained pain, that affect the head, face, neck, or arms.

Cervical sympathetic block (CSB) can be used as a procedure for both diagnostic and therapeutic purposes in such cases.

Methods: The most commonly used approach to the cervical ganglion block is at C6 and C7 levels and the suggested ideal location for needle tip is superficial to the longus colli muscle and between the two laminae of the prevertebral superficial fascia.

Results: Since the anatomical proximity of the carotid artery, inferior thyroid artery, trachea, and esophagus can be in the needle trajectory during CSB, for interventional practice, the anatomical feature of the cervical sympathetic ganglion has a significant importance. Even though CSB can also be performed with blind injection or fluoroscopy techniques, ultrasound offers the critical advantage of real-time visualization of the inferior thyroid, vertebral, cervical and carotid arteries. Color Doppler function of ultrasound can be utilized for effective evaluation of vascular structures when planning the injection.

Conclusion: Consequently, ultrasound guidance can significantly improve the safety of interventional procedures to avoid possible complications, such as involuntary intravascular injection, vessel injury, hematoma formation, temporary paralysis of the recurrent laryngeal nerve, inadvertent injury of the esophagus, thyroid gland, mediastinal emphysema and infectious complications (mediastinitis, local abscess, cellulitis, and osteitis of the vertebral body or transverse process). This presentation will review clinical anatomy, sonoanatomy, and USG-CSB techniques for pain management practices.

Keywords: ultrasound-guided cervical sympathetic ganglion block, pain syndromes, neuropathic pain, sympathetically-maintained pain

Chinese Society of Anatomical Sciences Symposium

Brain Development and Regeneration

S-078

Long-term intravital single cell tracking under 2-photon microscopy

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Objective: Classic histological and cell culture methods permit morphological and molecular characterization of cells, but they preclude direct and longitudinal observation of live cells within their intact native environment in live animals. Cell properties may undergo substantial change when taken out of context. Thus, it is desirable to perform intravital imaging and gain insights on cell behavior in their native living environment. Visualizing and tracking cells over time in a living organism has been only a dream before the invention of intravital microscopy. However, the opaque nature of tissue is a major hurdle that was overcome by the invention of multiphoton microscopy.

Methods: With the advancement of optical imaging and fluorescent labeling tools, intravital 2-photon microscopy has become increasingly accessible over the past few years. Long-term intravital single-cell tracking (LIST) under 2-photon microscopy has become a power tool to gain insight into the longitudinal changes in the morphology, migration, or function of cells or subcellular structures in live animals. It is particularly suitable for studying slow-evolving cellular and molecular events during development, regeneration or disease progression, without losing the opportunity of catching fast events such as calcium signals.

Results: In this talk, I will present examples of applying LIST under 2-photon microscopy and introduce state-of-the art optical and genetic tools to enhance its power.

Conclusion: Overall, LIST under 2-photon microscopy is a burgeoning field that will have a huge impact in the coming decades to reveal essential molecular and cellular events in health and disease.

Keywords: 2-photon microscopy, intravital imaging, single-cell tracking, fluorescent indicators

S-079

A neural circuit from thalamic paraventricular nucleus to central amygdala for the facilitation of neuropathic pain

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Objective: Paraventricular thalamic nucleus (PVT) belongs to the midline nuclei of thalamus, whose function has attracted more and more attention. It has been reported that PVT is involved in a series of activities, such as fear, anxiety, feeding behavior and drug-seeking. Recent study has demonstrated that the PVT is implicated in acute visceral pain response, but it is unclear whether the PVT plays a critical role in central processing of chronic pain.

Methods: Here, an integrative approach of behavioral tests, electrophysiology, and immunohistochemistry was used to advance the novel concept that the activation of the posterior portion of the PVT (pPVT)-central nucleus of amygdala (CeA) pathway causes facilitatory effect on neuropathic pain processing.

Results: We first identified the parabrachial nucleus (PBN)-pPVT-central nucleus of amygdala (CeA) pathway, a brain stem-thalamus-limbic system, is important for nociceptive transmission and modulation on the supraspinal level. Lesion or inhibition of pPVT neurons alleviated the mechanical allodynia induced by spared nerve injury (SNI). The excitability of pPVT-

CeA projection neurons were significantly increased in SNI rats. Importantly, selective optogenetic activation of the pPVT-CeA pathway induced obvious mechanical allodynia in naïve rats. In addition, we used rabies virus-based and cell-type-specific retrograde transsynaptic tracing techniques to define a novel neuronal circuit, in which the glutamatergic neurons in the vlPAG were the target of the pPVT-CeA descending projection facilitating pathway.

Conclusion: Our data suggest that this pPVT-CeA-vlPAG circuit mediates central mechanisms of the descending pain facilitation underlying persistent pain conditions.

Keywords: paraventricular thalamic nucleus, the central amygdaloid nucleus, periaqueductal gray, DREADDs, optogenetics

S-080

Understanding normal and diseased human basal ganglia using combinatory indexing single nuclei RNA sequencing

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Objective: With the advent of single cell technology and its rapid applications in the biomedical field, it becomes possible to identify, categorize and characterize each single cell in the brain. Shanghai Brain Bank is accumulating donor brains very fast (estimately 110 brains till now) from people with normal aging or various neurodegenerative diseases. The basal ganglia is critical for movement control, behavior, cognition, emotion and reward. Many neurodegenerative diseases are related to the abnormality or aging of human basal ganglia. Single-nuclei transcriptomic profiles of both normal and diseased human basal ganglia are still limited.

Methods: In our study, we systematically examined different nuclei (caudate, putamen, globus pallidus, and substantia nigra) in human basal ganglia from 6 control and 5 diseased donors (2 psychiatric diseases, 2 PD and 1 AD) using combinatory indexing single nuclei RNA sequencing.

Results: Gene expression was measured on a total of 22,309 control and 42,590 diseased single cells. 21 clusters were identified and the proportion of different cell types was compared between control and diseased cohorts. Differential gene expression, functional pathways, WGCNA analysis, and hub gene analysis were subsequently performed.

Conclusion: The mapping of cellular composition and functional significance in the control and diseased human basal ganglia can deepen our understanding of those basal ganglia-related diseases.

Keywords: human postmortem brain, basal ganglia, single nuclei RNA Seq, psychiatric disease, Parkinson's disease

S-081

Crosstalk between astrocytes and oligodendrocytes in an early life stress-related mouse model

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Objective: Astrocyte maldevelopment is implicated in various neuropsychiatric diseases associated with early life stress. However, the underlying astrocytopathy mechanism, which could result in the psychiatric symptoms, remains unclear.

Methods: In this study, the traditional maternal isolation mouse model was improved to induce depression-like behavioral changes, but exclude the effects of nutrient-supply difference, under the institutional guidelines and protocols approved by the animal welfare and ethics committee of the Third Military Medical University. The interaction between astrocytes and oligodendrocyte precursor cells (OPCs) and its outcomes were assessed by the histological (immunostaining) and functional (gap-FRAP assay, calcium imaging) experiments. To identify the underlying mechanism, RNA-seq was used to profile the transcriptome and analyze the pathway enrichment, followed by specific conditional knockout mice generation and osmotic mini pump-mediated pharmacological intervention.

Results: Our results show that a reduced OPC population accompanies hindered hippocampal astrocytic development in our improved parental isolation mouse model, reveal that the loss of OPC suppresses astrocytic network formation and activity, and further demonstrate that OPC-derived Wnt ligands, in particular Wnt7b, are required for Wnt/β-catenin pathway mediated astrocytic development and subsequent effects related to neuronal function. In addition, focal replenishment of Wnt7a/b is sufficient to rescue astrocytic maldevelopment.

Conclusion: Our results elucidate a Wnt-paracrine-dependent but myelin-independent role of OPCs in regulating astrocytic development, which provides a unique insight into the astrocytopathy mechanism in early life stress, and could be implicated in the pathogenesis of human early life stress-related neuropsychiatric disorders.

Keywords: astrocytic network, glial interaction, parental isolation, depression, neuropsychiatric disorder

S-082

Poly-L-ornithine reverses the inhibitory effect of fibronectin on oligodendrocyte differentiation and promotes myelin repair

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Objective: Extracellular matrix plays important roles during myelination/remyelination.

Methods: In many cases, the microenvironment of demyelination lesions contains non-permissive molecules which lead to remyelination failure. Accordingly, attempts to reverse the activity of these inhibitory factors in the extracellular matrix are essential to successful remyelination. Fibronectin (FN), one type of extracellular protein, is highly expressed during demyelination/remyelination.

Results: Our studies showed that FN could promote the proliferation of oligodendrocyte progenitors, while inhibiting oligodendrocyte differentiation. Further, we found that poly-L-ornithine (PLO) could reverse the inhibitory effects of FN on oligodendrocyte differentiation without compromising its pro-proliferation function. PLO can activate the Erk1/2 signaling pathway in the early stages of differentiation, and PI3K signaling pathways in the mid-late differentiation stages. The beneficial effects of PLO on myelin formation were also demonstrated in the lysolecithin-induced focal demyelination animal model. PLO enhanced myelin regeneration and promoted motor function recovery.

Conclusion: These findings suggested that PLO might have medical potential and is valuable for further studies.

Keywords: poly-L-ornithine, fibronectin, myelination

S-083

Neuronal requirements for the initiation of myelination in the central nervous system

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Objective: Long-standing evidence suggests that neuronal signaling is crucial for oligodendrocyte myelination in the CNS, however this role is unclear during early development. We sought to test whether dynamic neuronal signaling was necessary for the initiation of myelination along the developing mouse optic nerve.

Methods: We eliminated dynamic neuronal signaling along developing optic nerves on postnatal day 7 (P7) via transection/enucleation and examined oligodendrocyte differentiation and myelination five days later. To keep axons intact following transection, we used Wallerian degeneration slow (Wlds) mutant mice for all experiments. To maintain large axon diameters we used Cre/lox technology to specifically knock out Pten from retinal ganglion cells (RGCs) whose axons pass through the optic nerve.

Results: Following enucleation in Wlds mice, there were no differences in oligodendrocyte densities compared to intact control nerves five days later. However, there was a significant decrease in the percentage of myelinated axons. To determine whether this decrease was due to loss of neuronal signaling or reduced axon diameters, enucleations were performed on RGC-specific, Pten cKOs. These experiments revealed a rescue of the myelination reduction previously observed suggesting that the loss was due to small axon diameters and not a lack of dynamic neuronal signaling.

Conclusion: By eliminating dynamic neuronal signaling along the developing mouse optic nerve our findings indicate that the initiation of myelination is exclusively dependent on a permissive substrate, namely a large axon caliber. We propose that oligodendrocyte differentiation is regulated by non-neuronal factors during development, whereas myelination is sensitive to the biophysical properties of axonal diameter.

Keywords: oligodendrocyte, myelination, central nervous system development, neuronal signaling

Korean Association of Anatomists Symposium

Anatomy in forensic sciences

S-084

The applicability of two forensic dental age estimation for Japanese children and the comparison with the Korean population

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Objective: This study aimed to examine the applicability of Willems' and Lee's methods in a Japanese population and to find the differences in teeth development between Japanese and Korean children by comparing the accuracy of their estimated age using the two methods.

Methods: The developmental status of the lower left permanent teeth in 1,475 orthopantomograms of Japanese children were

evaluated based on Demirjian's criteria, the estimated age was calculated with Willems' and Lee's methods which are the formulas for forensic age estimation, and compared with Korean children's data. Protocols for the study were approved by the Ethics Committee of Iwate Medical University, School of Dentistry (approval No. 01352). It was also conducted in accordance with the ethical standards laid down by the Declaration of Helsinki.

Results: The accuracy of both age estimation methods for Japanese population was similar with Korean population except that of Lee's method for Japanese males. The accuracy of Lee's method for Japanese males was slightly lower than that of other subjects. The results showed that there might be the possible differences in teeth development between Japanese and Korean boys.

Conclusion: Due to possible differences in the growth and development of children even among East Asians, the age estimation method that is derived from their own country's population data should be applied in forensic practice.

Keywords: age estimation, dental development, panoramic radiography, Korean, Japanese, forensic odontology

S-085

Forensic anthropology from a practitioner's view

Reza Gerretsen

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The story of forensic anthropology from a Dutch practitioner's point of view will be told. From 2004 onward the forensic anthropologist is working within a team of forensic specialists in the Netherlands Forensic Institute. Insight will be given to the kind of caseload in the Netherlands and how this has changed over the years. The use of anatomy of bone in identification as well in burned or dissolved state will be addressed. Developments in Tooth Cementum Annulation (TCA), microanalysis of trace elements in trauma will be discussed and rare casework will be presented in order to show developments in the forensic anthropological practice.

Keywords: forensic anthropology, identification

S-086

The use of alternating light sources for discrimination of bone material in common soil

Frank van de Goot

Private Practitioner

Finding long bones in soil is not exceptionally difficult. This will dramatically differ when searching for small bone splinters, parts or teeth. Recently a marine ship sank to the bottom of the ocean. Yet at a depth of over 1000 meter she still is waiting for salvage. On board are over 30 crew members. By the use of alternating light sources it is possible to visualize bony remains of crew members located near the wreck itself. This lecture will explain the system behind this way of visualization and will give some consideration to other purposes in order to increase the chances of finding even very small bony parts of human remains.

S-087

DPAA Korean war identification project: bringing them home

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The Defense POW/MIA Accounting Agency (DPAA) is a government agency in the U.S. Department of Defense with a mission to recover, identify, and repatriate American military personnel from past conflicts from around the world. The Korean War Identification Project (KWIP), located in DPAA's Joint Base Pearl Harbor-Hickam scientific laboratory, is a large, investigative project that focuses on the recovery and identification of U.S. soldiers who died during the Korean War (1950–1953). At the end of this war, there were an estimated 37,000 U.S. casualties, and today, more than 7,500 Americans are still unaccounted for 70 years later. DPAA-KWIP works both in its scientific laboratories and recovery field sites to account for those still missing. Out in the field, DPAA works with its partners, including the Ministry of National Defense Agency for KIA (Killed in Action) Recovery and Identification (MAKRI) in South Korea, to continue recovery operations on the Korean peninsula as well as participating in disinterment operations on Oahu, Hawaii. In the lab, the KWIP team engages in holistic anthropological, historical, and biological approaches to best investigate U.S. remains and repatriate them back to their families. Joint events and review meetings, including the recent Korean War Remains Joint Repatriation Ceremony in the fall of 2021, have further solidified collaborative efforts in identifying remains and bringing them home.

Keywords: forensic anthropology, identification, repatriation, conflict

S-088

Thermal alteration and trauma in human bones

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Objective: One of the accepted processes fundamental to the recognition of normal human body burn patterns includes body position and tissue shielding often referred to as the pugilistic posture. Commonly accepted perspectives assume a final pugilis-

tic posture characterized by predominance of stronger flexor muscles. Current burn experiments indicate the pugilistic pose should not be defined as a single, final, characteristic posture and not all bodies achieve this expected pattern. In addition, deviations from the pugilistic posture are thought to indicate the presence of pre-incineration trauma, though this has not been tested.

Methods: As part of a larger research project focused on the identification of blunt force trauma on burned human bones, the lower arm and lower leg of 14 human cadavers were impacted. Following the blunt force (perimortem) trauma, the cadavers were exposed to controlled burns using a forensic pyre. During the burn, body positioning and movement was documented to examine whether the presence of perimortem trauma affects the expected final pugilistic patterning.

Results: Initial results show that bodies do not always achieve the expected pugilistic pattern and there is no consistent or uniform body positioning during a fire. Further, the presence of trauma (perimortem) does not dictate an abnormal body posture.

Conclusion: The presence of the pugilistic posture on burned remains should not be expected, nor should the failure to achieve this posture be interpreted to assume the presence of perimortem trauma. However, knowledge of anatomy and muscle groups will add to the understanding of the body positioning. Statement about Ethical Approval: The human cadavers in this research are from the Forensic Anthropology Center Body Donation Program. Human donors complete paperwork to be donated to the FAC for research. They also indicate if they would like to be included in trauma research. Only donors who confirmed they wanted their bodies to be used for trauma research were enrolled in this project.

Keywords: fire, forensic anthropology, perimortem trauma

Symposium
Animal modelling in the anatomy of human disease

S-089

Investigation of preeclampsia induced autism-like behavior in Sprague Dawley rats

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Objective: Preeclampsia, a pregnancy complication characterized by hypertension, oedema and proteinuria, is a major cause of maternal and fetal mortality and morbidity. Preeclampsia has been associated with the advent of Autism from previous studies. Autism, a neurodevelopmental disorder that is marked by restricted repetitive patterns of behavior, verbal and non-verbal communication deficiencies and impaired social interaction. To assess the appearance of autism in response to intrauterine exposure to preeclampsia, we employed an array of behavioral studies in the progeny from cadmium chloride-induced preeclamptic pregnancies and those of normal pregnancies.

Methods: 10 Pregnant Sprague Dawley (SD) rats and 44 pups were used in this study. The experimental pregnant group received an intraperitoneal injection of 0.125 mg/kg/day of cadmium chloride (CdCl2) dissolved in 1ml sterile saline for every animal, while the control group received same volume of sterile saline for a successive period of 6 days (gestational day 9–14). Systolic blood pressure and body weight of pregnant dams were measured in the morning of GD 0,9,13,16,19 and 20. BCA protein assay was conducted to assess protein level in urine. The resulting pups from the two groups were assessed for autistic behavior such as repetitive tendencies, cognition, gross motor coordination, sensory impairments and anxiety.

Results: The systolic blood pressure (SBP) of the treated group was significantly higher than the control group. There was a gradual increase in SBP from 132 mmHg to 143 mmHg in the treated group, whereas in the control group the SBP increased and later dropped toward gestational day (GD) 20 from 133.30 mmHg to129.38 mmHg. The proteinuria analysis revealed higher protein concentration in the cadmium exposed dams. The mean body weight of the treated group was 306.7g and that of the controls was 291.2g. We observed reduced exploratory behavior, increased anxiety-like behavior, and excessive repetitive behaviors in the preeclampsia exposed group as compared to the control group, which was evident in a variety of tests conducted, 70% of whose parameters were statistically significant.

Conclusion: Preeclampsia induces autism-like behaviors in SD rat offspring.

S-090

Animal models of FASD: important considerations when developing FASD model using animals

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Fetal Alcohol Spectrum Disorder (FASD) is the commonest neurodevelopmental disorder affecting children born to mothers who consumed alcohol during pregnancy. It affects many children around the world, especially in Africa. To understand this disorder (and develop ways to eliminate/reduce prevalence), several FASD-related animal studies are conducted. Even when there seems to be no generally accepted standards for animal models of FASD, there are some important considerations that must be adhered when developing a FASD model using animals to mimic a FASD-like scenario in order to address the study objectives. These factors will be discussed in the seminar.

S-091

The Zucker Diabetic Sprague Dawley (ZDSD) rat as a translational rodent model of type 2 diabetes

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Objective: Type 2 diabetes (T2D) is a worldwide problem with a high morbidity and mortality rate and translational animal studies are continuously being developed. In research animals, diabetes can be induced chemically (streptozocin), surgically, genetically or with combined diet and genetic means. We used a relatively new model of type 2 diabetes, ZDSD rat to assess if it could be a translational model for diabetic bone research.

Methods: Twelve-week-old ZDSD rats (n=22) and their Sprague Dawley controls (n=18) were used in the study conducted at the University of the Witwatersrand (Ethics: AERC 2015/07/28/C). Animals were monitored for weekly weight, fasting blood glucose and triglycerides. Oral glucose tolerance test was performed monthly. All the animals within the respective groups were terminated using a lethal pentobarbital dose at either 20 and 28 weeks of age as per respective group allocation. Femora were removed and stored in 10% buffered formalin and scanned with a Nikon XTH 225/320 LC X-ray microtomography for 3-dimensional Micro-focus X-ray Computed Tomography (3D- MicroCT). The samples were then processed for histology, and immunohistochemistry (TRAP, ALP TGFBeta1).

Results: We noted increased adiposity in the ZDSD, compromised osteoblastogenesis and reduced TGFBeta1 expression among both 20- and 28-week-old rats. The ZDSD rat had narrower femoral head diameters and smaller femoral necks, reduced trabeculae thickness, increased trabeculae numbers, increased spacing and lower bone volume fractions.

Conclusion: All these findings are consistent with what is known about human diabetic bone, therefore, the ZDSD rat is an appropriate translational model for studying T2D.

Keywords: type 2 diabetes, bone, femur

S-092

A Sprague Dawley rat model used to investigate the effects of binge gestational alcohol exposure in skeletal health: is it translational?

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Objective: Various animal species are used to investigate the effects of gestational alcohol exposure, due to challenges prohibiting use of humans in a controlled setting. We sought to investigate whether bone growth, development and structural integrity disturbances would persist through postnatal life in 3 and 12-week-old femora in a binge drinking rat model to assess its translationability.

Methods: Ethics approval was received from University of the Witwatersrand (AESC Number:2015 07 27C). Time-mated (n=15) pregnant Sprague Dawley dams were assigned to either the ethanol (n=6), saline control (n=6) or untreated control (n=3) group. The former two groups were treated with 0.015 ml/g of 25.2% ethanol and 0.9% saline for the first 19 days of gestation respectively. The untreated group received no treatment. Once born, the pups remained with their dams for 21 days or 12 weeks before termination by a lethal dose of pentobarbital. Each group was assigned 12 pups. Left femora were processed for routine histology and serial sections cut and stained with H&E, and immunolabelled with anti-Ki-67 antibody for cell proliferation as well as immunolocalization of chondrocytes expressing TGFβ1. Then, we used MicroCT to assess trabecular morphometry. Finally, we tested bone strength using 3-point bending tests.

Results: TGFβ1 immunopositive chondrocytes were fewer in the alcohol group. This was coupled with smaller epiphyseal growth plates containing fewer chondrocytes and displaying compromised proliferation rates. No bone strength parameters were affected at 12weeks.

Conclusion: Our binge drinking rat model is translational and appropriate to study the effects of gestational alcohol exposure on bone.

Keywords: binge drinking, femur, chondrocytes

Symposium

Bone-deep anatomy: from the bench to clinical practice

S-093

Bone composition in Wistar rats and its composition after infrasound exposure and glucose intolerance

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Some chemical elements are involved in important physiological processes. Their concentrations may differ between the healthy and diseased tissues. The aim of this study was to evaluate the elemental composition of calcium (Ca) and phosphorus (P) in the bone of rats subjected to glucose intolerance and/or infrasound

Glucose intolerant rats had lower bone P concentration and unaltered bone Ca concentration compared to non-glucose intolerant rats. Infrasound exposure was not associated with changes of bone Ca or P. The reduction of bone P concentration may be connected to the augmented risk of bone fractures in diabetes.

S-094

Assessment of intraosseous arterial vascularization of the L1 vertebral body – Differences between human and Wistar rat

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Intraosseous L1 vascularization is made of anterolateral branches coming directly from the aorta and posterior branches coming from the spinal arteries, which, when reaching the center of the body, send vertical branches towards both vertebral platforms. The dominance of posterior or anterior vascularization is variable. The similarity of intraosseous vertebral vascularization anatomy makes it possible to use Wistar rats as adequate models to simulate the fracture and test the importance of vascular biology in its healing.

S-095

Arterial blood supply to the Wistar rat iliac bone

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Arguably, the rat is the most widely used experimental model in the realm of surgery. Surprisingly, there are few studies regarding its supplying arteries. In this study, the authors analyzed the arteries of the iliac bones of 20 Wistar rats using multiple anatomical techniques. Although there were several homologies with human structures, there were also some striking differences worthy of note while using this region of the rat in experimental procedures.

S-096

Gross and microscopic anatomy of the human medial femoral condyle: new grounds to improve old flaps in this region

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The most common complications associated with the harvesting of the medial femoral condyle (MFC) flap are nerve-related and might be increased when a skin paddle is incorporated in its dissection. Although MFC flap is commonly accepted as a good ground for skin grafts to take, the histological characteristics of it were never studied before. This study describes the presence of a thick adipose tissue layer over the periosteum. This makes the MCF flap an ideal option for reconstruction of bone in hand and fingers, as it will provide a good match to the thin subcutaneous tissue of these areas.

S-097

Digital anthropometric analysis of the phylogenetic evolution of the female pelvis: contributions to the understanding of labor

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The morphology of the female pelvis is crucial for the effectiveness and safety of labor, both for the mother and the fetus. It is generally agreed that the shape of the pelvis is subject to strong pressure from natural selection. With this work, the authors obtained digital models of the contemporary female pelvis and of several female pelvis models from different phylogenetic ancestors. These models were anthropometrically evaluated to find morphological patterns. Throughout the phylogenetic evolution, the change in the general morphology of the basin was observed, from an anthropoid, longilinear pattern with a narrow lower part of reduced dimensions, in the oldest hominids to the platypelloid basin, proportionately shorter and wider, in Homo sapiens and in Homo sapiens sapiens.

S-098

Digital evaluation of the congruency of the shoulder joint surfaces in patients with brachial plexus lesions

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Brachial plexus lesions have an important deleterious impact on the lives of those affected. One of the main culprits is the precocious manifestation of glenohumeral joint dysplasia whose effects tend to be permanent. The authors produced digital representations of the shoulder joint surfaces of pediatric and adult patients with brachial plexus injuries. Both surfaces were evaluated for congruency with resort to a dedicated software. The data lend numerical support to the empirical clinical observation

that the joint surfaces rapidly become incongruent after a brachial plexus lesion. This information seems promising for tailoring nerve and tendon transfers for individual patients.

S-099

Comparison of the 3-dimensional shape of the joint surfaces of the proximal interphalangeal joints of the fingers and the surfaces of the hamate and the base of the fifth metacarpal bone

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Defects of the proximal interphalangeal joint of the fingers are common and difficult to treat. Recently, some authors have proposed to use part of the dorsal and distal aspect of the hamate for reconstructing the base of the middle phalanx. Subsequently, Cavadas proposed to use the base of the fifth metacarpal bone to reconstruct individual condyles of the proximal phalanx. However, the anatomical studies supporting these options are scarce and present conflicting data. We analyzed the 3D surface congruency of the mentioned surfaces using 3D virtual representations derived from hand CT scans of patients presenting no injuries in these regions.

S-100

Anatomical basis of elongating bone transfers useful for pediatric bone reconstruction

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Bone defects in children are relatively rare. However, they are difficult to treat definitively, due to children's growth. In this work the authors review the literature on the anatomical possibilities of bone flaps allowing bone elongation as the child develops after the reconstructive procedure. The advantages and pitfalls of each option are discussed. In addition to the review, the authors present data from dissections and other anatomical studies they conducted at their institution.

Korean Association of Anatomists Symposium

A new era of clinical anatomy: from the classical dissection to the advanced medical imaging corresponding to clinical needs

S-101

Challenge to unlanded territory: ultrasonographic anatomy of the face for the minimally-invasive procedures

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Objective: With the development of clinical procedures, the anatomical research techniques should be also evolving. Existing classical anatomy studies alone cannot support these clinical procedures, and classical anatomy studies alone cannot predict better clinical outcomes. For these reasons, I would like to explain the area of clinical anatomy research that the anatomists should pursue for the future by introducing some advanced research tools that have not been conducted.

Methods: Sihler's staining allows visualization of the nerve distribution within soft tissues without extensive dissection and does not require slide preparation, unlike traditional approaches. This technique can be applied to the mucosa, muscle, and organs that contain myelinated nerve fibers. In particular, Sihler's technique may be considered the best tool for observing nerve distribution within skeletal muscles.

Results: Furthermore, 3D scanned images of the face are now widely used for the various diagnosis and surgical- or non-surgical evaluations due to easy measurement and high accuracy. In-depth morphological studies of the human body have employed various diagnostic imaging devices. It is now possible for the obtained data to be displayed as three-dimensional (3D) images to facilitate the presentation of locational information in both research and clinical applications. Lastly, use of ultrasonography (US) guidance to perform diagnostic and therapeutic injections is increasing rapidly. Recently, the importance of facial anatomy has been reconsidered as the interest on facial aesthetics is increasing.

Conclusion: For this reason, it is speculated that the utilization of the facial US will be soon broadened to prevent the side effects.

Keywords: face, Sihler's staining, 3D scanning, ultrasonography

S-102

Progressive methodologies for the anatomical structures: microdissection, microcomputed tomography, and numerical simulation

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Objective: The comprehensive approaches combining macro- and microscopic analyses have revealed morphologic charac-

teristics of the anatomical structures and unique arrangement of the muscle fibers, utilizing microdissection, histology, and micro-CT.

Methods: The faces, prostates, and stomachs of formalin-fixed Korean adult cadavers were dissected. Some of the specimens were scanned using micro-CT.

Results: The present study utilized microdissection and micro-CT to reveal the general pattern and variations of spatial relationships of the facial muscles. In the prostatic urethral wall, the application of dissection, histology, and micro-CT imaging to construct a 3D model have allowed the visualization of the longitudinal muscular column morphology and unique arrangement of the smooth muscle fibers relative to the ejaculatory ducts. The present study also has revealed the general pattern of the muscular architecture of the stomach. Numerical simulations were performed to elucidate the function of the longitudinal and circular bundles of the pyloric sphincter, contractions of the facial muscles and the longitudinal muscular column in the prostatic urethral wall.

Conclusion: The obtained data can enable a better understanding of their functions and physiology.

Keywords: anatomical structures, microdissection, microcomputed tomography, numerical simulation

S-103

Dynamic coordination of the smooth and skeletal muscles in the pelvic floor: meso-anatomical examination

Keiichi Akita

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Objective: Our studies have tried to clarify the three-dimensional configuration of the skeletal muscles of the pelvic floor and the detailed histological properties of the smooth muscle structures on the pelvic floor.

Methods: We tried to analyze the pelvic floor by combining the macroscopic, histological, and immunohistochemical examinations. In addition, we made the 3-D reconstruction images by using the serial histological sections. Such combination analyses should be the intermediate research area between the macroscopic anatomy and the microscopic anatomy, which we named "Meso-anatomy."

Results: In males, a series of smooth muscle structures are continuous with the longitudinal muscle of the rectum in the central region of the pelvic floor and the anterior bundle of the longitudinal muscle projected downward from the rectourethral muscle. In addition, hypertrophic tissue with smooth muscle fibers extended from the longitudinal muscle in the anterolateral portion of the rectum and contacted the levator ani. In females, the smooth muscle fibers of the internal anal sphincter and longitudinal muscle extended anteriorly in the anterior anorectal wall. The anterior extending smooth muscle fibers are distributed subcutaneously in the vaginal vestibule and perineum and spread to cover the anterior surface of the external anal sphincter and the levator ani muscle.

Conclusion: The pelvic floor comprises a series of skeletal muscles and smooth muscle structures. These muscle structures are tightly attached in the broad areas. The widespread arrangement of the combinations suggests a mechanism of dynamic coordination between the smooth and skeletal muscles.

Keywords: pelvic floor, smooth muscle, skeletal muscle, meso-anatomy

FICSAP Symposium

Growing anatomists: anatomists perceptions of needs and provision of support

S-104

What support do anatomists need to develop their careers? Outcomes of the FICSAP/FIPAE 2021 survey

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Objective: Internationally, there is a shortage of anatomists, and variability in the availability of resources and level of support, across all career stages. The aim of this project was to investigate what support anatomists at differing stages in their career would find helpful.

Methods: An anonymous mixed-methods survey was employed to gather data from anatomists across the world using the online survey tool Qualtrics. The survey gathered demographic, quantitative and qualitative information, with responses analyzed by stage of career: emerging (received PhD since 2016 and/or teaching <10 years), mid (received PhD in last 5–16 years and/or teaching <16 years) and senior (received PhD and/or teaching >16 years), using descriptive statistics. Ethical approval was granted by University of Otago's Human Ethics Committee.

Results: Complete survey responses were received from 406 anatomists from 44 countries, with 164 emerging, 104 mid-career and 138 senior anatomists. While anatomists across all stages of their career ranked highly being able to network with international anatomists for teaching and research (65–74%), differences were identified across the three groups in what they had found helpful in the past and what support would be useful in the future. These differences included access to funding and training in teaching and research.

Conclusion: The data suggest that there are some common areas where support would be helpful for all anatomists. However, there are also topics that emerging and mid-career anatomists seek specific support. This talk will set the scene for workshops to explore in more detail the support that could be provided.

Keywords: anatomists, career development support, teaching and research

Chinese Society of Anatomical Sciences Symposium

Preparation for the colorful life

S-105

Misregulation in protein O-GlcNAcylation contributes to neurodevelopmental defects

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Objective: Protein O-GlcNAcylation, a monosaccharide post-translational modification maintained by two evolutionarily conserved enzymes, O-GlcNAc transferase (OGT) and O-GlcNAcase (OGA), is a major nutrient sensor integrating key metabolic pathways. Recently, mutations in OGT have been genetically associated with X-linked intellectual disability (XLID). However, the underlying mechanisms remain unclear. This talk aims to summarize current genetic evidence for the involvement of OGT mutation in XLID, and showcase our recent findings with the Drosophila intellectual disability model to highlight the importance of a balanced O-GlcNAcylation level for the development of the nervous system.

Methods: We combined Live-imaging and genomics approaches to delineate the function of protein O-GlcNAcylation during embryogenesis.

Results: We develop a new fluorescent probe to visualize O-GlcNAcylation levels in live Drosophila early embryos. Our study shows that protein O-GlcNAcylation declines as the embryos develop to the mid-blastula transition when the facultative heterochromatin makes its first appearance. Lowering O-GlcNAcylation levels by exogenous OGA activity promotes the polycomb group O-GlcNAc protein Polyhomeotic (Ph) to form nuclear foci and K27 trimethylation of histone H3. This enhanced facultative heterochromatin formation influences the expression of several neurodevelopmental genes including short of gastrulation (sog).

Conclusion: We provide evidence that perturbation of O-GlcNAcylation during early embryogenesis affects learning ability in adulthood, highlighting the importance of O-GlcNAcylation homeostasis for the development of the nervous system.

Keywords: O-GlcNAcylation, drosophila, embryogenesis, neuroectoderm, learning

S-106

Loss of Atoh8 attenuates murine skeletal myogenesis

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Objective: The bHLH transcription factor Atoh8 (murine homologue 'Math6') is involved in organogenesis during murine embryonic development. Findings in humans and chickens suggested a regulatory role of Atoh8 in skeletal muscle development. Atoh8 was found to counteract TGFβ-signaling thereby facilitating efficient reprogramming towards iPSCs. Myostatin, another member of the TGFβ-superfamily, is known to reduce the ability of myoblasts to fuse by inhibiting the function of key fusion regulators. It was the aim of this study to understand the influence of Atoh8 on skeletal myogenesis in detail using gain-of-function and loss-of-function studies in vitro and also by analyzing mutant muscles histologically.

Methods: We investigated differentiation in primary myoblasts derived from wildtype and Atoh8 knockout mice, and myoblasts derived from directed differentiation of pluripotent stem cells. Gain-of-function studies were performed in a commercially available myoblast cell line (C2C12). We monitored muscle differentiation in vitro and analyzed gene expression of MRFs, Myomixer, Myomaker and Myostatin during myogenesis using RT-PCR. Mouse experiments were approved by the local authorities.

Results: We found that Atoh8 regulates the proliferation and onset of differentiation in myoblasts by regulating Myostatin expression. We have also identified that Atoh8 regulates Myostatin dependent AKT/TORC1 signaling that controls protein synthesis in myoblasts. Confirming these results, Atoh8 knockout mice disclosed atrophy with reduced muscle mass and significant changes to the fiber types.

Conclusion: We conclude that Atoh8 influences skeletal myogenesis by counteracting Myostatin and is thus required for the proper timing and progression of muscle differentiation including myotube formation and choice of fiber types.

Keywords: skeletal muscle, bHLH transcription factor, Atoh8, Math6, myostatin

S-107

Atg7 is involved in the neural development of the early embryo

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Objective: Neural development is the precise process of embryo, which is spatiotemporally regulated by a variety of genes. The disturbance of protein synthesis and degradation during embryogenesis will lead to congenital nervous system disease.Cell autophagy is one of effective ways of protein degradation within cells. Atg7 plays an important role in activating autophagy.

Methods: In this study, using Atg7 conditional knockout mouse embryo, combined with the chick embryo which specifically over-expression or down-regulation Atg7 using in ovo electroporation, we systematically carry on the morphological, conventional cellular and molecular biological experiments.

Results: We found that Atg7 overexpression promoted the neural differentiation and neural crest cell migration in the chick embryo. Furthermore, using nervous system Atg7 conditional knockout mouse embryos, we found that the Atg7 also plays an important role in self-renewal and fate determination of neural stem cells during the development.

Conclusion: We revealed Atg7 plays an important role in the neural tube and neural crest development of the early embryo.

Keywords: Atg7, chick embryo, neural tube, neural crest, autophagy

S-108

The function of connexin in OL development and myelin repair

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Objective: Myelin in the CNS is formed by oligodendrocyte (OL), which originates from oligodendrocyte precursor cells (OPC). Connexin (Cx) is a transmembrane channel protein which could form hemichannel and gap junction channels. A typical feature of oligodendroglial cells and astrocytes is their high expression of Cxs. To elucidate the role of Cx in OPC development and myelin regeneration,

Methods: We use patch clamp and cell co-culture methods and take advantage of a lysolecithin demyelination model with Cx43 cKO mice.

Results: We find that Cx-based hemichannels and gap junctions contribute to glucose uptake in oligodendroglial lineage cells and that astrocytic Cx43 hemichannel is negatively involved in the remyelination process by favoring local inflammation.

Conclusion: Our work identified dual functions of Cxs-based channels as glucose transport pathways in oligodendroglial cells, which may provide valuable insights in therapeutic strategies for energy-related diseases. On the other hand, our results indicated that inhibiting astrocytic Cx43 hemichannel functionality may be a potential therapeutic approach for demyelinating diseases in the CNS.

Keywords: connexin, glucose, myelin regeneration, oligodendrocyte, oligodendrocyte precursor cells

S-109

The role of Eph-ephrin signaling in axon guidance of serotonin raphe neurons during development

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Objective: Serotonin (5-HT) neurotransmission in the brain relies on a widespread axon terminal network originating from the hindbrain raphe nuclei. These projections are topographically organized such that the dorsal (DR), and median raphe (MnR) nuclei have different brain targets. However, the guidance molecules involved in this selective targeting in development are unknown. Here, we show the implication of Eph-ephrin signaling in this process.

Methods: In utero electroporation.

Results: We find that the EphA5 gene is selectively expressed in distinct raphe regions. Accordingly, ephrinA induced a dose-dependent collapse response of 5-HT growth cones cultured from rostral but not caudal raphe. In vivo gain and loss function studies confirmed the repulsive signaling from ephrinAs and exhibit the disruption of 5-HT innervations in distinct regions in the forebrain.

Conclusion: Present results show for the first time the role of a guidance molecule for the region-specific targeting of raphe neurons.

Keywords: amygdala, culture, Ephrin, hypothalamus, in utero electroporation, olfactory bulb

FIPAE Workshop

Active learning in anatomical sciences education: emerging from the pandemic

S-110

Active learning in anatomical sciences education: emerging from the pandemic

Diogo Pais[1], Gülgün Şengül[2], Jason Organ[3], Joy Balta[4], Quentin Fogg[5], Natasha Flack[6], Annalise Hulme[7], Joyce El-Haddad[7], Nalini Pather[7,8]

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The workshop is designed to maximize audience participation and dialogue. The discussion is scaffolded by the prompt questions (below) with initial responses from a panel of experts from different geographical regions, and sub-disciplines of the anatomical sciences. Audience responses, views and experiences are welcomed and encouraged in this dialogue.

The outcome of this session is to:

- Appreciate the diverse experiences of teaching and learning in the anatomical sciences during the pandemic, and
- Identify common areas that we might collaboratively share and develop practice to advance anatomical sciences education globally.

Discussion questions:

- What teaching strategy did you previously use for active learning that was difficult to use during the pandemic? What was the limiting factor in using that strategy during the pandemic? What solution did you use to overcome this limitation?
- What is your favorite educational technology/tool for teaching anatomy? What does the use of that technology/tool promote: critical thinking, teamwork, reflection, feedback on learning, etc.? How might that learning tool be adapted to make it even more effective in the future?
- Once teaching during the pandemic is behind us (and it will be) what have you learnt or adapted during the pandemic that might be useful to continue in your teaching/program/institution? Can you share this with other anatomists?
- What have you learnt from the pandemic delivery about how anatomy could be innovatively taught in the future?
- What do you desire for the future of anatomy education in your region or globally? How might we as a collective group of academics collaboratively support an innovative future for anatomy education?

Chinese Society of Anatomical Sciences Symposium

Tissue engineering and regenerative Medicine: to restore tissue functions

S-111

Applications of multifunctional hydrogels in tissue engineering

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Nature morphology shows unique adhesive properties on a range of surfaces. Hydrogels inspired by these interface mechanisms can be self-healing and tissue-adhesive. This talk aims to introduce the recently synthesized materials for potential applications in sutureless surgery, wound healing, cardiovascular sealing, orthopedic reconstruction, soft robot, and smart electronic skin.

S-112

Dimensionality-dependent mechanical stretch regulation of cell behavior

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Objective: Mechanical stretch plays a critical role in the function and homeostasis of cells, tissues, and organs, and deviation from the physiological stretch is often associated with organ dysfunction and some diseases. Although mechanical stretch is provided in some in vitro cell culture models, the effects of stretch dimensionality on cells are often overlooked and it remains unclear whether and how the stretch dimensionality affects cell behavior. We thus investigated the effects of mechanical stretch dimensionality on cell behavior.

Methods: Cell culture platforms were fabricated to provide cyclic 1D uniaxial, 2D circumferential, or 3D radial mechanical stretch. Human alveolar basal epithelial cells (A549) and human cerebral microvascular endothelial cell line (hCMEC/D3) were cultured on these platforms, and the expression of tight junction proteins and adherens junction proteins were examined using immunostaining and western blot.

Results: The immunofluorescence images and western blot analysis showed that the mechanical stretches significantly increased the expression of ZO-3 and occludin in the epithelial cells compared with the static control. Surprisingly, the expression of ZO-3 and occludin undergoing the 3D radial stretch was generally higher than those exposed to the 1D and 2D

stretches. Strikingly, the hCMECs undergoing the 2D stretch expressed the highest levels of ZO-1, occludin, and VE-cadherin.

Conclusion: The cell behavior was sensitive to and responded to the mechanical stretch in a stretch dimensionality-dependent manner. This study underscores the importance of recreating physiologically relevant mechanical stretches in the development of in vitro tissue/organ models. No ethical approval was required.

Keywords: mechanical stretch dimensionality, tight junction, mechanosensing, epithelium, endothelium

S-113

Mechanical regulation of metabolic reprogramming of vascular smooth muscle cells in vein grafts

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Objective: Coronary artery bypass grafting (CABG), that restores normal blood flow to the heart by creating vascular access around the blocked arteries, has been the gold standard for the treatment of three-vessel or left main coronary artery disease. Autologous saphenous vein is commonly used for grafting; however, it undergoes adverse remodeling within days after implantation and develops obliterative neointimal hyperplasia that ultimately leads to vein graft (VG) occlusion. Vascular smooth muscle cell (VSMC) activation in the form of excessive proliferation, migration, and apoptosis has been demonstrated in occluded VGs. One prominent factor that causes VG VSMC activation is the arterial blood pressure-induced mechanical cyclic stretch; yet, our understanding of the molecular mechanisms underlying the mechanical regulation of VSMC activation remains rudimentary.

Methods: A 'cuff' mouse model was used to VG hyperplasia. 15%–1 Hz uniaxial cyclic stretch, 5%–1 Hz uniaxial cyclic stretch or a static condition were applied to the cultured VSMCs.

Results: We have investigated gene expression profiling in VGs vs. the control inferior vena cava (IVC) in a mouse model and identified downregulation of a mechanoresponsive gene, Mitofusin 2, in VGs. We have discovered that dysregulation of Mitofusin 2 causes metabolic reprogramming of VSMCs, in terms of utilizing aerobic glycolysis rather than mitochondrial oxidative phosphorylation. We have further demonstrated how arterial mechanical stretch downregulates Mitofusin 2 expression and how Mitofusin 2 downregulation leads to metabolic reprogramming and activation of VG VSMCs.

Conclusion: Mitofusin 2 modulates VSMC metabolic remodeling.

Keywords: mechanical stretch, mitofusin 2, vascular smooth muscle, glycolysis

S-114

Endothelium-mimicking coating engineered cardiovascular stents for regulating vascular tissue regenerative repair

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Objective: Nitric oxide (NO), is a cell signaling molecule, which is endogenously synthesized by endothelium. It has been proposed to be an ideal candidate for improving biocompatibility of blood-contacting devices because of its key role in a number of signaling pathways associated with important biological functions. However, there are certain cases where the developed NO-releasing or -generating materials show significant defects, such as uncontrollable therapeutic doses and release kinetics of NO, limited application in broad-spectrum of substrates and poor adhesion strength to vascular stents.

Methods: In this talk, we will present recent works in trying to address the issues of nowadays strategies associated with accurately controllable release of NO by using material-independent, mussel-inspired metal-phenolic-(amine) network (MPAN) surface chemistry strategy. Furthermore, based on MPAN surface chemistry, we developed endothelium-mimicking surface engineering strategy for addressing the issues of vascular stents associated with stenosis.

Results: Based on the endothelium-mimetic concept, the novel nitric oxide (NO)-generating coating used in stents with endothelium-mimetic NO release behavior has been successfully constructed, which showed long-term, persistent, stable and controllable NO production behaviors. The NO-generating coating endows the vascular stent with multiple functions to combat thrombosis, selectively inhibit intimal hyperplasia and enhance re-endothelialization.

Conclusion: Combination with the synergistic molecular conjugation technology, the applicant has developed a new generation of stents with abilities to selectively regulate inflammatory response, intimal hyperplasia, and promote the regeneration of a new endothelial layer and repair the lesion, hence addressing the long-term complications of restenosis and thrombosis.

Keywords: biomaterials, vascular stents, surface modification, nitric oxide, regenerative repair

S-115

Stem cells and the regeneration of tissue engineered blood vessels

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Endothelial cells (ECs) are essential seed cells of engineered blood vessels, which directly affects the long-term patency and functional maintenance of engineered blood vessels. Stem cells-derived-ECs have attracted much attention as a new source of seed cells for vascular engineering. However, the endothelial cells induced by IPSC are still unstable and inefficient. At the same time, the heterogeneity of iPSC-EC also leads to differences in the responsiveness to biomaterials and compliance to blood flow stimulation. This talk suggests that there may be an optimal iPSC-EC subgroup suitable for small diameter engineered arteries.

Korean Association of Anatomists Symposium

Craniofacial development and regeneration

S-116

Hierarchical levels of gene regulation in the development and evolution of jaw length

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Objective: Developmental control of jaw length is critical for survival and human jaws are often affected by size-related birth defects like hypoplasia, asymmetry, and clefting. Jaws form in the mandibular primordia from neural crest mesenchyme (NCM), which is a precursor population that governs jaw length. However, mechanisms through which NCM establishes jaw length remain unclear. We hypothesize that NCM differentially regulates ligands, receptors, and effectors of the Transforming Growth Factor-Beta (TGFβ) pathway, especially Runx2 and Mmp13, which then modulates jaw length.

Methods: We quantify TGFβ pathway members in duck (Anas platyrhynchos), quail (Coturnix japonica), and chick (Gallus gallus), which are birds with different jaw lengths. We perform culture experiments to test for differences in sensitivity to TGFβ. We also examine the structure and function of Runx2 and Mmp13 to test for regulatory mechanisms. We adhere to accepted practices for the humane and ethical treatment of avian embryos.

Results: Quail shows higher expression of Tgfβ1, Tgfβr1, Smad2, Runx2, and Mmp13, and greater sensitivity to TGFβ signaling. Species-specific variation arises from the structure and function of Runx2 and Mmp13. We identify eight isoforms of Runx2 that show species-specific expression and distinct effects on transcriptional activation versus repression. We discover a SMAD binding element and SNPs near a RUNX2 binding element in the Mmp13 promoter that distinguish quail from duck. Altering the SMAD site and switching the SNPs abolishes TGFβ-sensitivity in the quail promoter but makes the duck promoter responsive.

Conclusion: Multiple levels of gene regulation in the TGFβ signaling pathway mediate species-specific variation in jaw length.

Keywords: jaw development and evolution, TGFβ signaling, RUNX2, MMP13, transcriptional regulation

S-117

Distinct BMP-Smads signaling outputs confer diverse functions in the dental mesenchyme

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Objective: which engages Smad proteins to regulate gene expression plays a crucial odontogenic regulatory role in tooth development. We have previously reported the functional operation of an atypical canonical BMP signaling that is Smad4-independent but Smad1/5-dependent in dental mesenchyme. We then tried to clarify the mechanism underlying the operation of atypical canonical BMP signaling in the dental mesenchyme.

Methods: Transgenic BRE-GFP reporter mouse to monitor the canonical BMP signaling activity in the dental mesenchyme; Tooth germ culture, tissue recombination and Inhibitor treatment; In-situ hybridization, Immunofluorescence, and co-immunoprecipitation (co-IP); RNA-seq for identification of differential expressed genes. ChIP-seq and Cut&Run to profile the genome-wide Smads binding landscape.

Results: With the BRE-GFP mouse line, we revealed a restricted activity of the canonical BMP signaling in the neu-

rovascular cells surrounding the condensed dental mesenchyme where pSmad1/5 form complexes with pSmad3 to prevent canonical BMP signaling activity. Cut&Run assay revealed a genome-wide co-occupancy of pSmad1/5 and pSmad3, suggesting that pSmad1/5-pSmad3 complexes are functional units for transcriptional regulation. Genome-wide mapping of the potential transcriptional targets point to the functions of the atypical canonical BMP signaling in tooth innervation guidance. Disruption of the atypical canonical BMP signaling led to the failure in the innervation and to the loss of the odontogenic inductive potential in the dental mesenchyme.

Conclusion: Our studies not only unravel functional mechanism of the atypical canonical BMP signaling, but also clarify how the BMP-Smads signaling exerts distinct functional specificity to regulate different cell types in the dental mesenchyme, shedding light on the future design and fabrication of bioengineering teeth.

Keywords: pSmad1, pSmad3, tooth, innervation

S-118

Epigenetic regulation of palate formation

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Objective: Kabuki syndrome (KS) is a human developmental disorder caused by haplo-insufficiency of MLL4 (also known as KMT2D), which is a histone H3-lysine 4 (H3K4)-methyltransferase. KS patients may show palate anomalies, such as complete or submucous cleft palate. The aim of this study is to understand the function of MLL4 in palatogenesis and gain insight into the pathogenesis of CP in KS patients.

Methods: We employed the Cre/loxP system to generate three different Mll4-conditional knockouts (KOs): where Mll4 was specifically deleted in either the neural crest cells, which give rise to the palatal mesenchyme (nKO, Mll4fl/fl;Sox10-Cre/+), the palatal mesenchyme cells (mKO, Mll4fl/fl;Osr2-Cre/+), or the palatal epithelium cells (eKO, Mll4fl/fl;Krt14-Cre/+). Palatogenesis was histologically analyzed by using either hematoxylin and eosin or Azan trichrome on paraffin sections of the mouse heads. Whole-mount staining with alizarin red and alcian blue and micro computed tomography (micro-CT) were used for skeletal analysis of the palate.

Results: Palatogenesis in the Mll4-nKO mouse was similar to the control group at E12.5–13.5. However, elevation of the palatal shelves occurred at a significantly lower rate at E14.5. By E15.5, although delayed, the palatal shelves of the Mll4-nKO mouse were able to elevate but failed to fuse with each other. Interestingly, mKO and eKO mice showed normal palatogenesis up to E15.5. However, patterning of the palatal bones and rugae were disrupted at birth.

Conclusion: We conclude that MLL4 is essential for timely elevation and successful fusion of the palatal shelves, as well as bone and rugae patterning during palatogenesis.

Keywords: MLL4, KMT2D, palatogenesis, bone, rugae, patterning

S-119

Lower jaw bone length is altered by pharmacological inhibition of embryonic avian osteoclast activity

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Objective: Craniofacial abnormalities are one of the most common birth defects; among these are defects in jaw bone length. Micro- and macro-gnathia negatively affect quality of life by interfering with mastication, breathing and speech, but the only available treatment option is multiple invasive surgeries, making pharmacological interventions highly desirable. Previous data from our lab has demonstrated a developmental role for altering the differentiation of bone-resorbing osteoclasts in establishing lower jaw length. The aim of this study was to determine the effect of inhibiting only the activity of proteolytic enzymes secreted by active osteoclasts on establishing lower jaw bone length.

Methods: Quail (Coturnix coturnix japonica) embryos were given a single dose of an inhibitor or vehicle at a developmental stage when viscerocranium bone deposition is beginning to occur. At a developmental stage when the viscerocranium is largely calcified, the heads were collected, scanned via micro-computed tomography and reproducible landmarks were placed on 3D-reconstructed skulls.

Results: Approximately half of the quail given either an inhibitor of matrix metalloproteinase-9 (iMMP9) or cathepsin K (iCTSK) demonstrated an overt lower jaw phenotype, characterized by longer lower jaw bones and a greater lower to upper jaw ratio than control treated embryos. Additionally, iMMP9-treated embryos exhibited a significantly shorter midface length and iCTSK-treated embryos had significantly longer nasal bone length.

Conclusion: Our data suggest manipulating bone resorption through pharmacological modulation of osteoclast activity by proteolytic enzymes may be a potential option for altering lower jaw length developmentally.

Keywords: osteoclasts, viscerocranium, jaw length, bone resorption

S-120

Injury induced transient dedifferentiation of taste receptor cells in mice

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Objective: Taste buds are clusters of taste receptor cells that aid in detection of taste by transmitting the taste signal to the brain. Taste receptor cells are continuously renewed by resident tissue stem/progenitor cells during homeostasis and are dependent on the innervation for their continuous renewal. Transection of the innervating nerve leads to degeneration of the taste buds including taste receptor cells. However, a subset of the taste receptor cells was observed to be maintained independent of nerve after transection of the glossopharyngeal nerve in the circumvallate papilla in adult mice. The role and the fate of these remaining taste receptor cells in regeneration remains to be elucidated.

Methods: BrdU Pulse chase was used to identify label-retaining cells in the taste bud. Lineage tracing using inducible Cre knock-in with Rosa26-tdTomato was performed to identify progeny of differentiated cells in regeneration of the taste bud. Surgical procedures were performed under deep anesthesia. Mice were sacrificed using CO_2 asphyxiation.

Results: This study revealed that injury to the taste bud by glossopharyngeal nerve transection triggers the dedifferentiation of remaining differentiated K8-positive taste receptor cells to acquire transient progenitor cell-like state during regeneration. These dedifferentiated cells are proliferative, express the progenitor cell markers, and form organoids in vitro. These data indicate that the differentiated taste receptor cells can enter cell cycle, acquire stemness, and participate in regeneration.

Conclusion: We propose that stem/progenitor cells in combination with dedifferentiated taste receptor cells harmoniously participate in regeneration of the taste bud following nerve injury

Keywords: epithelial plasticity, glossopharyngeal nerve transection, label retaining cells, regeneration, stem cells, taste bud

Chinese Society of Anatomical Sciences Symposium

Adaptive learning and teaching in the post-Covid-19 era

S-121

Unpacking the relationships between teacher-led and learner-led mobile learning activities and their impacts on teacher evaluation in a blended medical program

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The impact of mobile learning activities on increasing learning outcomes and their motivation level has previously been reported as effective. These activities can be categorized into two types: teacher-supervised and learner self-directed. However, the relationship between them remains unclear. This study investigated the relationship between two types of mobile learning activities and their impact on teacher evaluation and learning outcomes in medical schools. In this study, we investigated the relationship through survey (n=366) and interview (n=7) data collected from undergraduate students in one of the most prestigious medical schools in China. Structural equation modeling was used to check their relationship and interviews were conducted to gain more insights behind the four proposed variables. Our confirmatory factor analysis validated a two-factor model on the use of mobile devices for academic purposes. The participants reported that they spend more time on studying with teacher-led activities than student-led activities. Second, structural equation modeling results suggest that the use of teacher-led mobile learning activities has a positive impact on learner-led activities and students' satisfaction with overall teaching quality. Third, our interview data reinforced the above finding by revealing that students perceive mobile devices as useful learning tools when teacher-led activities are present, whereas in the absence of teachers' involvement, student-led mobile learning activities are perceived as less efficient than other forms of learning (e.g. face-to-face instructions).

S-122

Surgical boot camp improves clinical and surgical competencies in senior medical students: before and after study

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Objective: Surgical preparation for internship is very crucial. Many senior medical students feel unprepared for surgical procedures when they begin an internship. This study sought to introduce and evaluate a clinical practice skills training curriculum for senior medical students.

Methods: A 40-hour surgical boot camp program composed of lectures on clinical issues, clinical practice simulation, anatomical dissections, and simulated operation using fresh cadavers was designed, implemented and evaluated during 2018 to 2019 academic year to senior medical students.

Results: More than 93% of students were satisfied with the surgical boot camp. Most students felt that it was appropriate for them, and that the training curriculum gave them valuable clinical practice experience. After six pieces of training, the evaluations revealed that 85.3% of the students performed better in some procedures and their self-confidence has significantly increased. However, less than 15% of the students performed below expectations. The Mini-Clinical Evaluation Exercise results showed that the students' clinical skills, attitudes, and behaviors had significantly improved after the surgical boot camp training ($p<0.01$). Ninety-eight percent of students felt that the anatomical knowledge met their needs and was beneficial to the next simulation operation. The scores of the Operative Performance Rating System demonstrated that the students' surgical skills had increased significantly following the surgical boot camp (all $p<0.01$).

Conclusion: The surgical boot camp curriculum improved students' core clinical practice competencies. Short-term trainings like this one are a good way to integrate basic and clinical knowledge for medical students prior to internship.

Keywords: medical students, surgical boot camp curriculum, the core competitiveness of clinical practice

S-123

The anatomists' perceptions of blended learning changed by Covid-19 pandemic: a national survey in mainland China

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Objective: The faculty development program focused on professional training related to online/blended learning during the past two years because of the impacts of Covid-19 pandemic. However, the effects of training are closely associated with the trainee's perspective and attitudes towards the training program. The aim of this research is to ascertain the perceptions of the anatomists in mainland China on blended learning influenced by Covid-19 pandemic.

Methods: A national survey was distributed via a respondent invitation on social media, with the collaboration of the Chinese Society for Anatomy Sciences (CSAS), which is the national organization of anatomists. It was conducted with ethics approval from the Research Ethics Committee of Jinan University (No. JNUKY-2021-038).

Results: A total of 297 answers were received from the respondents, which cover all the provinces in mainland China. The survey results demonstrated that Chinese anatomists' preferences on the aspect of online/blended learning were most concentrated in learning flexibility, learning community, and learning management. Further analysis manifested that the professional faculty development training and the support from mentors/institutes prominently contribute to the better training outcome of online/blended learning. The extent of the support obtained from in-service institutes would depend on the learning management ability and features of anatomists.

Conclusion: This national survey revealed the perceptible general characteristics of anatomists in mainland China on the aspect of online/blended learning approach in the post-Covid-19 pandemic era, which will not only help understanding their teaching strategies, but also more effectively perform faculty development programs.

Keywords: anatomy education, Covid-19 pandemic, online/blended learning, faculty development, national survey

S-124

The Chinese anatomists' perceptions towards blended learning approach in anatomy education: a national survey in the post-Covid-19 era

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Objective: Covid-19 has tremendously urged anatomists to reconsider the pedagogy strategy of anatomy in the post-pandemic age. Blended learning, the combination of traditional face-to-face lecture and online learning, is proposed by many educators as the most suitable teaching approach of the new era. This study aims at investigating the acceptance of blended learning by the Chinese anatomists, to grasp the changes and what are conductive to encourage adoption of implementation of blended learning in the coming post-Covid-19 era.

Methods: A nationwide survey was conducted among the anatomists through invitations on social media, collaborating with the Chinese Society for Anatomy Sciences (CSAS). The study was conducted with ethics approval from the Research Ethics Committee of Jinan University (No. JNUKY-2021-038).

Results: A total of 297 questionnaires were received from the respondents, covering the medical schools from all provinces in mainland China. The respondents consist of 56.2% male and 43.8% female anatomy teachers, the majority are middle-aged and experienced in teaching anatomy. The survey showed that Chinese anatomists experiencing online teaching and related training dramatically increased during these two years. Meanwhile, the importance of professional training is valued to implement blended learning, as well as the increased online assessments and corresponding professional training. There are still significant percentages of opponents towards blended learning on anatomy education for various reasons.

Conclusion: The survey data provided the perceptible information about the changes and trend of anatomy education on blended learning and knowing the anatomists' attitudes towards the pandemic-accelerated shift in the post-Covid-19 era.

Keywords: anatomy education, post-Covid-19 era, online teaching, blended learning, online assessments, professional training

S-125

Blended learning approach improves active learning and academic performance in a human embryology course

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Objective: While blended learning has been growing in popularity in recent years, the effectiveness of this procedure remains controversial. To evaluate the effectiveness of blended learning for the course of "Human Embryology", a survey within international medical students was conducted.

Methods: The blended learning group consisted of students (n=43) in the 2018–2019 academic year, taught with a blended learning model via a customized small private online course (SPOC). The control traditional teaching group consisted of students (n=48) in the 2017–2018 academic year, taught with a traditional teaching model. Academic performance, including mean scores and passing ratios on the final exam of two groups were compared and analyzed with a t-test. In addition, a questionnaire directed toward evaluating student's perceptions with the blended learning was administered to students in the blended learning group.

Results: The majority of students in the blended learning group actively participated in online self-study activities and discussion in face-to-face class sessions. The mean score and passing ratio were significantly greater than those of students in the traditional teaching group ($p<0.01$).

Conclusion: The blended learning model that integrates SPOC with face-to-face class lectures proved a more effective means for the teaching of Human Embryology than the traditional lecture-based teaching model. This blended learning approach may serve as a feasible model that can be readily applied for use in other medical courses.

Keywords: human embryology, blended learning, SPOC, active learning

S-126

Modulations of the autonomic nervous system and hormone-physiological changes in response to Covid-19-related adaptations of different learning environments

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Objective: The aim of this study was to investigate differences in physiological parameters of students when participating in online or face-to-face learning and to determine whether these can be identified as possible mediators between learning experience and achievement emotions.

Methods: In a randomized experimental field study, medical students (n=82) either participated in regular face-to-face learning or experienced the same practical course in online participation. The present study investigated Heart Rate Variability (HRV) measurements and salivary cortisol concentrations within the context of online and face-to-face learning and compared these parameters with a control group that was measured at rest. Aiming to link these physiological measurements to psychological constructs, subjects filled out a standardized questionnaire regarding their experienced achievement emotions and subjectively perceived stress levels.

Results: Compared to online learning, a significant reduction in HRV was found in face-to-face learning indicating stronger stress responses in the face-to-face learning environment.

Higher parasympathetic activation was shown to be associated with the discrete negative emotion of boredom. Increased sympathetic activation was shown to be related to the discrete positive emotion of enjoyment exclusively within the face-to-face condition. Subjects who participated in face-to-face learning expressed significantly higher cortisol concentrations than those who participated in online learning.

Conclusion: These results provide preliminary evidence that the transfer of a face-to-face practical course in Microscopic Anatomy to an online learning environment is associated with basal differences in the physiological state of arousal, which is directly related to the expression of associated achievement-related emotions.

Keywords: online vs. face-to-face teaching, heart rate variability, stress in academic settings, online anatomy teaching

FICEM Symposium
Historical anatomical collections – Treasure, legacy, and challenges

S-127
Provenance of collection items from the early 19th century in an anatomical collection: history and ethics

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Objective: The anatomical collection of Berlin University includes a "phrenological" skull of unknown provenance called a "Gall's skull". This name refers to the founder of phrenology, Franz Joseph Gall (1758–1828). The history and ethical status of this specimen will be explored.

Methods: Historical research.

Results: The skull has an inscribed number which refers to a handwritten catalog that, however, was lost in World War II. No further documentation exists, but a partial reconstruction of this catalog from diverse sources could establish that the skull came into the collection in the 1830s. This was a time when bodies for dissection mostly came from the Berlin poor if their families could not afford burial. Most likely, a skull from this source was macerated and areas of the surface were demarcated and annotated in black ink to demonstrate Gall's theories. Details of the acquisition remain unclear, but a link to Gall himself seems unlikely.

Conclusion: This collection item will serve as an example to discuss what provenance research can achieve when no specific documentation is available and to discuss the ethics of preserving and displaying human remains from times when the concepts of body donation and "informed consent" were unknown. In Berlin, as in many parts of the world, body donation in today's sense only developed in the second half of the 20th century.

Keywords: provenance research, anatomical collection, body donation, informed consent, skull, phrenology

S-128
Ethical parallels in the amassing and curation of human remains for research purposes between anatomy-based and cemetery-based skeletal reference collections

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S-129
Restitution of indigenous bodies: the ethics of what remains

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Objective: Over the last decades, it has been increasingly accepted that human remains, in particular the remains of Indigenous people that were collected under colonial rule, should be returned to their communities and/or territories. One of the claims made by Indigenous peoples argues that these should not be considered objects available to the scrutiny of science. The objective is to discuss the ethical issues and difficulties that are faced throughout restitution processes and after these have been completed, in order to reconcile the demands of indigenous people and of researchers.

Methods: The experience developed at the Museo de La Plata (Argentina) is debated, along with claims expressed by Indigenous people in different forums. In the Museo de La Plata,some protocols have been developed to the end of preserving images and DNA samples of the returned body. However, informed consent has been obtained to perform computed tomography of the skulls.

Results: Restitutions are not straightforward processes. Several claimants may be in dispute over the same remains and/or their interests may be in opposition to some scientific research.

Conclusion: Even when informed consent can be obtained, the research of what remains (for instance, images) must be open to dialogue and new permissions.

Keywords: digital images, handling, informed consent, indigenous rights, dialogue

S-130

Collections of the unborn

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Historical collections of embryologic and fetal specimens face a wide variety of challenges ethically. Most significant though may be changes in cultural attitudes that are running opposite to those facing many other collections, namely a desire to remove these collections from public discourse and history. Many of these collections were amassed prior to the era of informed consent and for the purpose of spectacle as much as for the advancement of science and almost all collections occurred when society placed little more value on human tissue than it did medical waste. Independent of these concerns is the sphere that these collections of materials occupy philosophically. While these collections undoubtedly contain human remains, depending on individual cultural beliefs, they might not contain humans that ever existed. This caveat creates a dilemma about what, if any, rights should be afforded to these collections. Further complicating the vast majority of these collections is the knowledge that their provenance is not related to the identity of the specimens themselves through heredity or cultural connections, but often only through the clinician that supplied the material. Simple disposition of these collections, as is most often the case, ignores the significance of these collections historically and their educational potential in the fields of fetology, anatomy, ethics, philosophy, and law. Treated respectfully, these collections can form a nexus for scientific communication independent of culture and society given that these specimens have never definitively existed within them.

S-131

Congdon's Anatomical Museum: from educational collections to Thailand's first anatomical museum

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Human anatomical specimens are necessary for studying anatomy. However, in its early stage of anatomical education, Thailand encountered difficulty in preparing specimens, both in sufficient quantity and of adequate quality. Professor Edgar D. Congdon, a professor of Anatomy at Siriraj Hospital in the late 1920s, overcame the challenge by collecting human specimens from body donors for primary use as educational materials in his teaching class and for medical students at Siriraj Hospital. His collections at the old Anatomy building were later developed into the Congdon's Anatomical Museum, Thailand's first anatomical museum that houses over 2,000 human specimens, including organs system, preserved fetus, and bone collection. In this presentation, we discuss the historical context, as well as ethical and managerial aspects, of Congdon's Anatomical Museum. Masterpieces of the exhibits, delicate dissection of the whole-body nervous and arterial systems, are also presented. The museum is now open to the public and continues to benefit medical professionals and anyone interested in visiting, learning, and doing research in human anatomy.

Keywords: museum, anatomical museum, anatomy, history, Siriraj, Thailand

S-132

African life and death masks in the Raymond A. Dart Collection

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Objective: The purpose of the study is to provide a concise history of an African-based face mask legacy collection highlighting the unethical inception of the collection through brutish and manipulated acts of informed consent used to propagate racial typology.

Methods: To provide a comprehensive inventory of the demographic profile of the life masks as well as death (i.e. cadaveric) masks and their associated skeletal elements. Additionally, supplemented by a literature based historical account of the inception and scientific value of this collection which was embedded within an evolutionary and anthropological framework. Ethical clearance was not required for this study.

Results: The results indicate the representation of a diverse group of indigenous African populations that exceed over 1000 life and death masks. The life masks are predominantly of SAN "Bushmen" origin and the death masks derived mainly from Bantu speaking individuals of southern Africa. Overall, males were largely represented within the demographic profile of the collection. Unequivocal evidence of nefarious and unethical behavior was noted in the creation of this face mask collection.

Conclusion: Whilst the history of this extensive face mask legacy collection is riddled with inappropriate and unethical acts, it retains scientific value (e.g. forensic facial reconstruction and superimposition studies) and with the correct oversight and ethical consideration for the use of the collection the lives that were negatively affected by its creation will not be forgotten or in vain.

Keywords: casts, ethics, consent, anthropology, forensics

Symposium
Forensic clinical anatomy: an update 5 years later its proposal

S-133

Forensic clinical anatomy: introduction

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S-134

Forensic clinical anatomy: definition and perspectives

Andrea Porzionato

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S-135

Imaging in forensic clinical anatomy

Veronica Macchi

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S-136

Forensic clinical anatomy and surgery

Carla Stecco

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Anatomical education and surgical training with cadavers reduce the learning curve in a safe environment and the risks for patients. Really, up to now it isn't clear if the non-use of the cadavers for anatomical education and surgical training can also have forensic implications. A non-systematic search strategy was used for this review, based on the PubMed and Web of Science database. From this review, it is clear that the cadaveric training could be considered mandatory, both for surgeons and medical students, leading to a series of questions with forensic implications. Indeed there is much evidence that a cadaver-lab can improve the learning curve of a surgeon, above all in the first part of the curve, in which frequent and severe complications are possible. Consequently, a medical responsibility for residents and surgeons which perform a procedure without adequate training could be advised, but also for hospitals that have to guarantee a sufficient training for its surgeons and other specialists through cadaver-labs. Surely, this type of training could help to improve the practical skills of surgeons working in small hospitals, where some procedures are rare. Cadaver studies can permit a better evaluation of safety and efficacy of new surgical devices by surgeons, avoiding using patients as «guinea pigs». Indeed a legal responsibility for a surgeon and other specialists could exist in the use of a new device without an apparent regulatory oversight. Forensic clinical anatomy can supervise and support all these aspects of the formation and of the use of cadaver training.

S-137

Forensic clinical anatomy and clinical anatomy

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FICEDA Symposium
Equality and diversity in anatomy

S-138

Colonisation, cadavers and colour: is there a case for decolonising the anatomy curricula?

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S-139

Policies for equality and diversity in anatomy across different anatomical societies within the IFAA

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S-140

The development of guidelines for equality and diversity by the IFAA

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S-141

Teaching female anatomy in the medical curriculum

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Anatomy has often been regarded as an immutable discipline where everything that needs to be known is known. This paper focuses on the teaching of female genital anatomy, the diversification of gender in contemporary society and the increasing

popularity of the Female Genital Cosmetic Surgery (FGCS) industry. Traditional anatomical knowledge about female genital anatomy is nowadays rendered exclusive and incomplete. A series of thirty-one semi structured interviews with Australian anatomy teachers identified barriers and facilitators for teaching female genital anatomy to contemporary student cohorts that include both cis-gender females considering FGCS and queer identifying students. Barriers included lack of connection to contemporary clinical practice, time and technical difficulty involved in regularly updating online presentations, the crowded curriculum, and personal reluctance to teach genital anatomy and to experiment with inclusive terminology. Facilitators included lived experience, use of social media and institutional initiatives towards inclusivity including the support of queer colleagues.

Keywords: curriculum, anatomical variation, female genitalia, inclusion, LGBTIQ+

Chinese Society of Anatomical Sciences Symposium

Morphology and function of myodural bridge

S-142

The biomechanics, and physiological function of MDBC in dog

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Objective: The myodural bridge (MDB) connects the suboccipital musculature to the spinal dura mater (SDM) as it passes through the posterior atlanto-occipital and the atlanto-axial interspaces. It has recently been proposed that head movement may assist in powering the movement of cerebrospinal fluid (CSF) via muscular tension transmitted to the SDM via the MDB.

Methods: The present study utilized dogs as the experimental model to explore the MDB's effects on the CSF pressure (CSFP) during stimulated contractions of the suboccipital muscles as well as during manipulated movements of the atlanto-occipital and atlanto-axial joints. Additionally biomechanical tensile strength tests were conducted.

Results: The tensile strength of the collagenous fibers passing through the dorsal atlanto-occipital and atlanto-axial interspaces were 0.16±0.04 MPa and 0.82±0.57 MPa, respectively. Passive head movement, including lateral flexion, rotation, as well as flexion–extension, all significantly increased CSFP. Furthermore, the CSFP was significantly raised from 12.41±4.58 to 13.45±5.16 mm Hg when the obliquus capitis inferior (OCI) muscles of the examined specimens were electrically stimulated. Head movements appeared to be an important factor affecting CSF pressure, with the MDB of the suboccipital muscles playing a key role in this process.

Conclusion: The present study provides direct evidence to support the hypothesis that the MDB may be a previously unappreciated significant power source (pump) for CSF circulation.

Keywords: cerebrospinal fluid, myodural bridge complex, biomechanics

S-143

The myodural bridge in humans: discovery and potential Implications

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Objective: Based on prior reports of a potential relationship between the suboccipital musculature and the spinal dura mater in humans, an anatomical investigation was initiated in the 1990's to explore the relationship of these structures utilizing dissections from non-surgical orientations.

Methods: Cadaveric dissections of the suboccipital region were performed in 10 embalmed and one fresh hemisected head and neck specimens and the relationship between suboccipital musculature and the spinal dura was explored.

Results: Fibers connecting the rectus capitis posterior minor muscle to the spinal dura were observed and appeared to be oriented primarily perpendicular to the dura. The name "myodural bridge" (MDB) was used to identify this underappreciated connection.

Conclusion: The MDB appears to resist folding of the spinal dura toward the spinal cord during extension of the neck, which may compromise cerebrospinal fluid (CSF) flow. The presence of a connective tissue bridge, attaching the suboccipital musculature to the dura mater, is now recognized as a feature of normal human anatomy and has been identified in multiple studies. The role that this MDB plays in headache production is uncertain; however, a new conceptual model is emerging. Postsurgical MDB adhesions have been reported as a complication resulting from excision of acoustic tumors. Extensive research now exists implicating these pathologic MDB adhesions as a possible source of postoperative headache. Thus, integrating two types of MDB unions (anatomic and pathologic) into a unified theory of headache production seems reasonable.

Keywords: myodural bridge (MDB), headaches, CSF flow, neurosurgery, suboccipital musculature

S-144

Study on the developmental of myodural bridge of human and SD rats

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Objective: To illustrate the developmental process and the morphological characteristics of myodural bridge (MDB) in human and SD rats, provide the developmental morphological basis for further MDB functional studies.

Methods: In this study, histological section and immunohistochemical staining, scanning electron microscope(SEM) and transmission electron microscopy(TEM) were used to study the MDB of of human fetus and SD rat embryos(E), choroid plexus and arachnoid granules of SD rat embryos(E).

Results: The MDB appeared at E15w, completed about at E19-25w in humans, appeared at E18d and completed at about 7d after birth in rats. The tissue differentiation of rat embryos and human fetuses is similar. Cells differentiated from mesenchymal cells to fibroblasts and fibroblasts, followed by the maturing of type I collagen fibers. TEM shows that mesenchymal cells differentiate into fibroblasts at E14d, and collagen fibers appear in the extracellular matrix at E17d of rats. SEM shows that secreted vesicles appeared on the epithelial surface of choroid plexus after E16d of rats, and arachnoid granules appeared in the transverse sinus 3d after birth in rats. Damaging the suboccipital region on P0 newborn rat, the height of microvilli, secretory granule and on the surface of the choroid plexus epithelium cell were more than the control group at postoperative 3, 5, 7 weeks.

Conclusion: Morphological development of MDB of human and rats is similar, but shows obvious spatial and temporal differences. The development of MDB, choroid plexus, the arachnoid granules have time intersected. It is speculated that the development of these structures is interrelated.

Keywords: myodural bridge (MDB), development, morphology

S-145

The myodural bridge and other influences on CSF flow in Crocodylians

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Objective: As part of a developing quantitative model of CSF fluid dynamics in the American alligator (Alligator mississippiensis), this study quantified the relative influence on CSF pressure of a variety of physical, physiological, and behavioral factors.

Methods: Sub-adult (approximately 2m) alligators were anesthetized with isoflurane, then a pressure catheter inserted into their cranial subdural space. While the animal was anesthetized, CSF pressures were recorded associated with the cardiac cycle, passive ventilatory cycle, orthostatic gradients, and manual deflection of the body. A second round of CSF pressure recordings were taken (post-recovery) while the animal locomoted on a treadmill; these recordings were associated with cardiac cycle, active ventilatory cycle, sound production, defensive sweeps of the body, and locomotor kinematics.

Results: In the non-anesthetized, actively moving animals, the CSF pressure was more volatile than previously described. Lateral oscillation of the alligator's head during steady walking produced pulses of CSF pressure with amplitudes 16 times greater than those associated with the cardiac cycle (cardiac mean=3.7 mm Hg, locomotor mean=59.5 mm Hg).

Conclusion: Few previous studies have documented the impact of active movement on the CSF flow dynamics; the results of this study indicate that, at least in the alligator, the CSF pressure is far more variable and dynamic in the moving animal than what is recorded from the animal at rest. Ethical Declaration: The housing and use of the live Alligator mississippiensis adhered to all national guidelines and was approved by an Institutional Animal Use and Care Committee.

Keywords: body cavity, locomotion, ventilation, cardiac output, fluid mechanics

S-146

Effect of myodural bridge management on postoperative results and complications during decompression of subcerebellar tonsillar hernia

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Objective: To investigate the management of myodural bridge during small bone window decompression and atlanto-occipi-

tal fasciolysis of Chiari type I malformation (CMI), and to analyze the relationship between intraoperative myodural bridge protection and postoperative complications.

Methods: All patients received surgical treatment and were divided into two groups according to the surgical methods. Group A was treated with posterior cranial fossa Decompression, and dural incision and expanded plasty,a total of 26 cases; Group B was treated with small bone-flap decompression of posterior fossa, and cephalic 2/3 release of posterior atlanto-occipital fasciolysis, a total of 12 cases.

Results: (1) In terms of short-term efficacy, the overall improvement of group B was slightly higher than that of group A, but there was no statistical difference (80.77% improvement rate of group A, 83.33% improvement rate of group B, p>0.05). (2) The KPS score in group A was significantly lower than that before surgery, while the KPS score in group B was not significantly different from that before surgery. (3) The incidence of recent headache in group A (55.35%) was significantly higher than that in group B (8.33%); (4) The intracranial infection rate and cerebrospinal fluid leakage rate (66.25%, 11.53%) in group A were significantly higher than those in group B (0%, 0%).

Conclusion: The protection and management of myodural bridge during the operation of CMI is beneficial to reduce postoperative complications.

Keywords: CMI, MDB, decompression

Symposium
Methodologies in applied anatomy: clinical, forensic, and evolutionary anatomy

S-147

Evolving mathematical methodologies: struggles from a biological perspective

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Objective: A key aim of forensic anthropology is to reconstruct the biological profile of deceased individuals. Traditional methods - that rely on subjective categorical classification and frequentist data analysis - have reported disadvantages, including unquantified error ranges, low accuracy and observer agreement. Advanced mathematical methods are increasingly emerging, which allows measurable accuracy and precision of the results obtained. We aim to open discussion within the international anatomical sciences community regarding best practices for conducting these complex computational analyses and explore the training and collaborations necessary to include these mathematical methodologies within a biological field.

Methods: Some advanced mathematical approaches that are currently favored in forensic anthropology research include Bayesian analysis, geometric morphometrics and machine learning. This presentation briefly discusses an example of each technique and its impact on the field.

Results: When comparing results between advanced mathematical methods and traditional methods, some controversy exists regarding the accuracy and precision obtained. Although some studies claim that advanced methods improve performance, others contradict these findings. Additionally, as new methods are continuously emerging, not all these methods have undergone the crucial step of independent validation.

Conclusion: With rapid and continuous advances in mathematical analysis, an appropriate question might be whether emerging researchers are equipped with the necessary training and collaboration needed to employ these techniques. We would like to open a discussion around how to better equip researchers to handle advanced mathematical techniques to ensure quality research.

Keywords: advanced mathematical methods, Bayesian analysis, geometric morphometrics, machine learning, methodology training

S-148

Assessing age-related bony pelvis variation in humans from CT scans

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Objective: Understanding age-related differences in pelvic morphology has implications for obstetric clinical practice and paleoanthropological interpretations of pelvic fossils. Previous studies have addressed the possibility of age-related differences in pelvic morphology using geometric morphometric methods. Here we sought to address this question using linear measurements instead of landmarks.

Methods: Our sample consisted of full-body CT scans of deceased humans from the New Mexico Decedent Image Database. We selected scans to represent three age categories – young (15–30 years), middle (25–50), and older (≥54). We developed a workflow using free open source software to measure the pelvic cavities of the individuals in the sample. Our workflow uses 3D Slicer to extract a 3D model of the bony pelvis, CloudCompare to measure the resulting model, and RStudio to statistically compare the measurements with respect to age.

Results: Significant differences were found between individuals of different age groups, supporting previous geometric morphometric based research. However, some of our findings challenge the Conclusion of these previous works, suggesting that linear measurements provide additional information that is not apparent from geometric morphometrics methods alone.

Conclusion: We conclude that assessments of how age affects pelvic morphology benefit from the inclusion of linear measurements. While geometric morphometrics can be useful for visualizing shape differences, linear measurements are preferred for testing null hypotheses between age groups. Our results call into question the use of age-biased skeletal collections to characterize the range of human pelvic variation that has been used to inform obstetric practices and interpret hominin fossils.

Keywords: age variation, medical imaging, pelvic cavity

S-149

A brief review of virtual methodologies and their importance for evolutionary anatomy and biological anthropology

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In biological anthropology, paleoanthropology and evolutionary anatomy, virtual techniques have become increasingly important in the last years, and they are seen as an excellent alternative to classic methods mainly because of two reasons: 1) they reduce the risk of damaging osteological collections and original fossils, 2) they allow the virtual access and manipulation of fossils and skeletal remains by researchers that cannot afford a trip to visit the institutions where this material is hosted. Recent technological advances have made possible the production of 3D digital data and 3D models that allow not only physical but also virtual interaction with the objects. In anthropology, these methodological advances are known as "Virtual Anthropology", and they allow the researchers to extract information from the real world, to model this information in a computer and to produce physical outputs for manipulation, comprehension, and effective communication. Here I briefly present an overview of this digital technology to produce and reproduce 3D anatomical models for research, teaching, museum exhibitions and virtual conservation. I review different surface scanning equipment and post-processing techniques that are useful for scanning museum collections. This section is followed by an overview of 3D geometric morphometric methods for rigorous morphological quantification, with special emphasis in open-source software and other free resources. I finally discuss the above-described workflow and its potential applications for evolutionary and clinical anatomy and for research and communication in different institutions.

Keywords: virtual anthropology; geometric morphometrics; open-source

Symposium
Integration of anatomy and innovation into healthcare

S-150

Integration of ankle anatomy and innovation into healthcare

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The ankle is one of the more complex biomechanical areas. Different requirements of movement of the foot are reflected by the articular morphology of the joint. Here, knowledge of the applied anatomy of the joint is of maximum importance for the patient's welfare. Especially looking at the different ligaments, neurovascular structures and the ankle joint itself, there are areas, where an intimate interaction between anatomists and clinicians provide better insights into optimal treatment procedures: To stabilize this joint complex is the purpose of the ankle syndesmosis and the lateral and medial collateral ligaments. To facilitate their reconstruction in ankle trauma, knowledge of the exact dimensions of those ligaments and their osseous attachments is imperative. During surgical approaches, the surgeon also must keep in mind the neurovascular structures of the region. Especially the course of subcutaneous nerves is of interest considering the aspect of postoperative complications. Danger zones and safe zones therefore minimizes the risk of nerve damage. Apart from structures surrounding the joint, the ankle joint itself is the link between the foot and the leg. Apart from the various ligaments, muscular stabilization in some positions of the joint is weak, leading to a high incidence of osteochondral lesions to the talar dome. Their minimally invasive treatment is important for the quality of life of the patients. In arthroscopic procedures, the possible access to the talar dome is important for the success of the surgical intervention. Thus, techniques to increase the access must be evaluated for their effectiveness.

Keywords: ankle, joint biomechanics, topographic anatomy, patient welfare,

S-151

Integration of hand anatomy and innovation into healthcare

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S-152

Integrating anatomy with Innovation: advancing the blueprint and knowledge of the lower limb, especially neurovascular structures from the pelvis to the foot improving healthcare

Brion Benninger

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The Anatomical Record Symposium

Evolution of a discipline: the changing face of anatomy

S-153

The evolving ethics of anatomy: dissecting an unethical past in order to prepare for a future of ethical anatomical practice

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Objective: Anatomical practice has arguably one of the most ethically challenging histories in the medical sciences. Among the oldest scientific disciplines in medicine, dissection of the human body for scientific purposes occurred as early as the third century Before the Common Era. Throughout the history of anatomical practice, human dissection has occurred in ways that cross the line from progressing medical science to violating the sanctity of the human body. The dissection of the human body creates ethical dilemmas which stem from the need for anatomical science to gain medical knowledge in juxtaposition with prevailing religious and moral views surrounding anatomy as a threat to the sanctity of the human body.

Methods: This lecture examines the unethical history of human dissection throughout the ages and explores the rationale behind the unethical practices. In addition, this lecture explores imperative modern day ethical standards in anatomy including, the ethical handling of human bodies, respecting human life, and ensuring informed consent for dissection of bodies that are donated. Finally, this lecture explores the question of which ethical prism we should use when dealing with anatomy collections or works of the past.

Results: Learning both the history of unethical practices in anatomy and the rationale behind them is imperative so that the discipline can prepare for an ethical, diverse, and inclusive future.

Conclusion: This lecture provides a foundation for understanding the evolution of ethics in anatomical practice and is a valuable resource for students and anatomists alike.

Keywords: ethics, history, human dissection

S-154

Books, bones and bodies: the relevance of the history of anatomy in Nazi Germany for medical education today

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Objective: The history of anatomy is both: one of beneficial knowledge gain, as well as one of ethical transgressions. The history of anatomy in Nazi Germany highlights the consequences to humanity when the destructive potentials immanent to all science and medicine are enabled by an anti-democratic, totalitarian regime. Anatomy presents an example of ethical transgressions by scientists and health care professionals that were amplified in the criminal political climate of the Nazi regime. This can happen anywhere, as science is never apolitical.

Methods: This presentation gives a short account of anatomy in Nazi Germany, which is followed by an outline of the tangible and intangible legacies from this history, to then discuss implications for anatomy education today.

Results: While Jewish and politically dissident anatomists were forced out of their positions and country by the Nazi regime, the majority of the remaining anatomists joined the Nazi party and used bodies of Nazi victims for education and research. Physical anthropologists among German anatomists provided the scientific biological basis for Nazi policies. Some anatomists even performed deadly human experiments.

Conclusion: Patterns and legacies that emerge from this history can be traced into the present and concern research ethics in general and anatomical body procurement specifically. They shed light on current practices and controversies in the anatomical sciences, including anthropology, and can inform anatomy education in a concept of anatomy as the first "clinical discipline" that includes a full appreciation of the shared humanity of medical practitioners and patients.

Keywords: anatomical legacy collections, ethical transgressions, history of anatomy, national socialism, racism

S-155

Ethical dilemmas in skeletal collection utilization: implications of the black lives matter movement on the anatomical and anthropological sciences

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Objective: The Black Lives Matter Movement represents a decisive turning point in social discussions of race and discrim-

ination. This worldwide initiative to confront racial inequality has permeated various cultural arenas, including the sciences. The recent proliferation of protests centered around US skeletal collections' acquisition and handling of African/African American human remains exemplifies this shift.

Methods: This presentation traces the historical scientific framework influencing and promoting the display of human skeletal remains in US museums and the often illegal and unethical means employed to acquire such remains. We will also explore how many US states legalized the collection of unclaimed bodies for harvesting by anatomical programs, which disproportionately targeted the poor; immigrants; and in-migrants marginalized by their race, class, mental health, and perceived criminality.

Results: Given the absence of consent of many of the individuals currently housed in such museum skeletal collections, we propose implementation of a repatriation and reburial process influenced by the Native American Graves Protection and Repatriation Act and the work of Dr. Michael Blakey. Dr. Blakey employed a clientage model of public engagement to reburial projects that positioned the descendant community as the moral authority in deciding if and how research was conducted. This approach confronts the objectifying tendencies of the scientific community by requiring scientists to both listen to and follow the wishes of the descendant community as their clients.

Conclusion: Such democratization of scientific knowledge prevents human skeletal material from becoming redefined as merely a scientific object and preserves the personhood of these individuals in both life and death.

Keywords: skeletal remains, marginalized, museum collections, clientage model, descendant community

S-156

Queer anatomy: how anatomy has played a role in the sociopolitical treatment of the LGBTQIA+ community

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Objective: Since its establishment as one of the major authorities on the human body, the field of Anatomy has had a reciprocating relationship with the social and political climate of various eras. In this presentation, I aim to demonstrate, through historical examples, how Anatomy has affected the social (legal, political, etc.) organization within human culture and how the identities of scientists completing this work affected our organization of anatomical knowledge.

Methods: This review of anatomical and queer history is complete through the review of historical texts, historical analyses, and analyses from numerous fields. Current best practices concerning inclusive education are also considered.

Results: The reciprocal connection between Anatomy and societal organization is a key component of scientific exploration and pedagogy that anatomists and anatomical practitioners should consider within our practices. I argue that anatomists, clinicians, and educators have an ethical duty to address the connections of this history, both in our research and our classrooms.

Conclusion: The field of anatomy has only just begun to explore the ethical considerations of our current and past work. Much work remains to be done to achieve an ethically sound and inclusive organization of anatomical knowledge that can be used and informed by anatomical pedagogy.

Keywords: history, LGBTQIA+, anatomy, queer history

S-157

Using gender and sex inclusive anatomical language to support transgender and nonbinary identities

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Objective: Healthcare professionals are increasingly likely to care for transgender and nonbinary patients and the use of appropriate and inclusive language is important for affirming their identities. Use of sex and gender inclusive language can be fostered at any point during professional training through modeling and in the formal curriculum, particularly during anatomical education.

Methods: This presentation will describe two perspectives to demonstrate why using inclusive language is essential to support diverse gender and sexual identities: 1) a transgender woman's experience with nongendered language, and 2) an anatomy educator's approach to a formal primer on sex and gender.

Results: Providers who used anatomically-appropriate language that discussed organs and structures independent of sex assigned at birth and avoided binary generalizations was affirming and respectful to the patient during her journey through gender affirmation. The primer introduces and differentiates sex and gender and encourages a movement beyond the prescriptive binary. To demonstrate the nonbinary nature of sex, several chromosomal, genetic, and hormonal variations that complicate the binary sex assigned at birth are described. Types of inclusive language, including person-first and anatomy-based, are discussed to demonstrate how one can refer to anatomic structure independent on binary sex classifications or gender.

Conclusion: A primer exposes students to language and concepts inclusive of diverse sexual and gender identities and encourages them to continue its use into professional practice. Use of inclusive language when discussing sex and gender is associated with positive mental health outcomes for transgender and nonbinary persons and affirms their identities across medical, social, and psychological domains.

Keywords: anatomical language, inclusive language, transgender, nonbinary

S-158

Decolonisation of anatomy curricula

Gabrielle M. Finn

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Objective: Decolonisation has become somewhat of a buzzword. There is now pushback against decolonisation, instead calls are for agency for learners and under-represented groups. In this presentation, we consider both the challenges and opportunities to diversify the anatomy curriculum.

Methods: Decolonizing anatomy education curricula will entail addressing the ingrained cultures within the disciplines, such that produces a number of challenges including: underrepresentation of certain bodies, difficulty talking about difference, and the hidden curriculum in anatomy education

Results: In order to aid educators in achieving inclusive anatomy curricula, a toolkit and considerations are presented, alongside both do's, don'ts and case examples. We highlight the black-or-white dichotomy, and the absence of brown in between.

Conclusion: We start the conversation about if we should, or what it means to begin the process of decolonizing the curriculum within anatomy education.

Keywords: EDI, decolonisation, race

Platform Presentations

(O-001 — O-108)

O-001

Thalamus morphology in healthy and disease patients: MRI retrospective study

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Objective: Thalamus, are a pair of large ovoid organs that form most of the lateral walls of the third ventricle of the brain. T While the thalamus is classically known for its roles as a sensory relay in visual, auditory, somatosensory, and gustatory systems, it also has significant roles in motor activity, emotion, memory, arousal, and other sensorimotor association functions, this study aim to measure and compare the size of thalamus and interthalamic adhesion using magnetic resonance imaging (MRI) between normal, Alzheimer's and multiple sclerosis Arab patients. Moreover, to assess the gender differences and right- left differences of the thalamus and interthalamic adhesion in all three groups

Methods: This prospective study used brain magnetic resonance images (MRI) to measure the anteroposterior, transverse and vertical length measurement of the thalamic and interthalamic adhesion. The MRI scans were obtained from 150 (75 males and 75 females) healthy participants, 100 (52 males and 48 females) Alzheimer's patients, and 100 (56 males and 44 females) multiple sclerosis patients.

Results: The thalamus and interthalamic adhesion size were significantly reduced in both Alzheimer's and multiple sclerosis patients compared to healthy controls. There was no correlation between gender or right-left sides and the dimensions of the thalamus and interthalamic adhesion within the same disease group.

Conclusion: The study showed a correlation between some neurodegenerative disorder and the thalamus and interthalamic adhesion size. The gender and the right-left sides do not affect the thalamus and interthalamic adhesion size within the same neurodegenerative disorder group.

Keywords: thalamus, morphology, magnetic resonance image, multiple sclerosis, Alzheimer's disease

O-002

Morphology of the temporomandibular joint in skeletal class II and III malocclusion

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Objective: To compare the morphology of the temporomandibular joint (TMJ) in skeletal class II malocclusions (CIIM) and class III malocclusions (CIIIM) using cone beam computed tomography (CBCT).

Methods: A total of 76 mandibular condyles, obtained from 38 CBCT images were analyzed and measured retrospectively. The following measures of TMJ were evaluated: condyle shape in sagittal and coronal planes; horizontal condylar angle (HCA); condylar length; condylar cortical thickness; condylar trabecular bone mineral density; inclination and length of the mandibular fossa. Descriptive statistics were applied to all measurements. Differences between CIIM and CIIIM groups were statistically analyzed by independent t-tests. This study was approved by the Research and Ethics Committee of the School of Dentistry of Andres Bello University.

Results: In CIIIM group, the most common condylar shape was convex (43.75%) followed by round (41.65%), while in the CIIM group the most common condylar shape was convex (40,01%) followed by flat (38.45%). The CIIIM group showed larger values for HCA ($p<0.05$) and condylar length in the sagittal plane ($p<0.005$). The CIIM group showed higher trabecular bone mineral density of the right condyle and inclination of the left mandibular fossa compared to the CIIIM group ($p<0.005$). Differences in condylar cortical thickness, length of the mandibular fossa were not significantly different between CIIM and CIIIM ($p>0.05$).

Conclusion: There are differences in the TMJ morphology between CIIM and CIIIM. These results might be useful for diagnosis and treatment planning of different skeletal patterns.

Keywords: anatomy, CBCT, TMJ, skeletal malocclusion pattern. mandibular condyles

O-003

Frequency of ponticulus posticus in cone beam computed tomography

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Objective: Ponticulus Posticus (PP) is an anomalous ossification in the atlas associated with clinical discomfort. The aim of this study was to determine the frequency of PP using cone beam computed tomography (CBCT).

Methods: A descriptive observational study was performed, where 722 CBCT images from the database of the Oral and Maxillofacial Imaging Service of the School of Dentistry of Andres Bello University, Viña del Mar, Chile, were analyzed. The Cederberg and Stubbs classification was used to describe the corresponding degree of ossification. Statistical analysis was performed to establish the relationship between age and gender, applying the Chi-square test. This study was approved by the Research and Ethics Committee of the School of Dentistry of Andres Bello University.

Results: The overall prevalence of PP was 48.07%, most commonly in its bilateral form (61.96%). Regarding laterality and degree of ossification, in both sides predominated degree 1 ossification (right: 63.01%, left: 59%), followed by degree 2 (right: 17.87%, left: 17.72%). There was a slight predominance of PP in males (52.37%) compared to females (45.73%), but this was not statistically significant (p>0.05). Respect to PP frequency by age group, PP was observed in 50.75% CBCTs of individuals over the age of 41 years, in 47.31% of individuals under the age of 20 years and in 43.66% of individuals between 21–40 years, but these differences were not statistically significant (p>0.05)

Conclusion: The presence of PP is common within the population and is not associated with age groups or with gender.

Keywords: ponticulus posticus, anatomy, cone beam computed tomography

O-004

Radiographic evaluation of the morphometric and morphological characteristics of the external occipital protuberance

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Objective: External occipital protuberance (EOP) is a bony protrusion that can occur in different morphologically and morphometrically types located on the posterior surface of the occipital squama. This study aimed to investigate the morphometric and morphological characteristics of the EOP on lateral cephalometric radiographs.

Methods: Lateral cephalometric radiographs of 300 individuals aged over 18 years were evaluated. Protuberances were regarded as EOP if it was longer than 5 mm, and protuberance was regarded as enlarged external occipital protuberance (EEOP) if it was longer than 10 mm. Occipital spurs were also classified into three morphological types according to their shapes; flat, crest, and spine types.

Results: Occipital spurs were determined in 103 of 300 patients (34%). There were significant differences found between males and females regarding spur length (p=0.039). The prevalence of EEOPs among the determined occipital spurs was 29.12% and the frequency was found at 10% in the evaluated data. Flat-type spurs (37.8%; 39/103) were the most common spur type when all subjects who had occipital spurs were evaluated. Crest-type spurs (45.80%;22/48) were the most common in males whereas flat-type spurs (52.70%; 29/55) were most common in females.

Conclusion: The spur length and morphological spur types were found to vary according to sex in adult individuals. Detailed information about the morphometric and morphological characteristics of the EOP could guide the clinicians for safely surgical interventions in the posterior skull region.

Keywords: external occipital protuberance, morphology, occipital spur, radiograph

O-005

Physiological intracranial calcifications in children: a computed tomography-based single-center study

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Objective: The physiological intracranial calcifications (PICs) are benign and related to aging. It's essential to know the detectable age of PICs on imaging. We aimed to study the frequency of PICs in Omani children using computed tomography (CT).

Methods: The brain CT scans of patients (age range, 0–15 years) from January 2017 to December 2020 were assessed for the presence of PICs. All brain CT examinations were performed using a 64–slice multidetector CT scanner. The presence of calcifications was identified using 3 mm thick axial images, and coronal and sagittal reformats. The study received ethical approval from the Medical Research Ethics Committee, Sultan Qaboos University.

Results: A total of 460 patients were examined. Mean age was 6.54±4.94 years. The frequency of PIC in boys and girls was 35.1% and 35.4%, respectively. PICs were most common in choroid plexus with 35.21% (age range: 0.4–15 years; median, 12 years), followed by the pineal gland in 21.08% (age range: 0.5–15 years; median, 12 years) and the habenular nucleus in

13.04% of subjects (2.9–15 years; median, 12 years). PICs were less common in falx cerebri with 5.86% (age range: 2.8–15 years; median, 13 years) and tentorium cerebelli in 3.04% (age range: 7–15 years; median, 14 years) of subjects.

Conclusion: The study provides the reference values for PICs in the Omani pediatric population. PICs increased significantly with increasing age. The choroid plexus is the most frequent site of calcification. Choroid plexus and pineal gland calcifications may be present at less than 1 year of age.

Keywords: brain, calcification, computed tomography, dura, pineal gland

O-006

Coexistence of bifid median nerve and persistent median artery: three case reports

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Objective: Magnetic resonance imaging for the diagnosis of musculoskeletal diseases can reveal different anatomical variants. A rare variant is the presence of a persistent median artery with the bifid median nerve. We aimed to visualize these anatomical variants and emphasize their clinical aspect.

Methods: Informed consent was obtained from the patients, and ethics committee approval is not required as it is a retrospective case study. Magnetic resonance imaging of the right wrist of a 25-year-old female patient, the right wrist of a 29-year-old male patient, and the left wrist of a 57-year-old female patient taken at the Selçuk University Faculty of Medicine hospital were examined.

Results: In these patients, ganglion cyst, lipoma, and tenosynovitis were detected in different localizations, respectively. The bifid median nerve and persistent median artery were found incidentally, which did not cause carpal tunnel syndrome symptoms.

Conclusion: Pathological conditions in the persistent median artery and the bifid median nerve could be considered an anatomical risk factor for carpal tunnel syndrome. In the presence of a persistent median artery, surgeons must be aware of the possibility of additional median nerve anomalies. In hand trauma cases or carpal tunnel release patients, these anatomical variations should be considered. Radiological imaging methods such as color Doppler ultrasonography or magnetic resonance imaging are important for diagnosis.

Keywords: anatomical variation, bifid median nerve, magnetic resonance imaging, persistent median artery

O-007

Intramuscular nerve distribution of the splenius capitis muscle with the modified Sihler's staining technique

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Objective: We aimed to describe the optimal places for intramuscular applications like botulinum toxin (BT) used in the treatment of common diseases such as cervical dystonia by determining the intramuscular nerve distribution of the splenius capitis muscle (SC). We targeted to describe the nerve innervation zones (IZ) of the muscles and the injection sites according to the bone landmarks that can be applied to the patient.

Methods: In our study, 14 neck muscles of 7 cadavers fixed with 10% formalin were used. Posterior edge of the mastoid process superiorly and the tip of the spinous process of the first thoracic vertebra inferiorly were selected for the length of the muscle. Motor entry points (MEP) were measured on the muscles. The modified Sihler's staining technique (MST) was applied after the muscles were dissected. The distribution of stained nerve fibers between transparent muscle fibers was examined. IZ were determined at 10% intervals.

Results: The lengths of SC were respectively 116.6±2.76 mm according to the selected landmarks. It was determined that SC had 3 MEP in 28.6% cases, 2 MEP in 35.7% cases and 1 MEP in 35.7% cases. IZ of the SC was intense at the level of 10–30% of the muscle length in the medial part and 50–70% and 80–100% in the lateral part of the muscle.

Conclusion: The MST has been successfully applied to the SC and IZ were determined. In cervical dystonia, the BT injection may give more effective results if it's applied to these muscles' IZ. It is important to know the MEP of the muscles to prevent muscle paralysis in surgical interventions.

Keywords: botulinum toxin, innervation zone, modified Sihler's staining technique, splenius capitis muscle

O-008

Facial canal morphometry: a technical report

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Objective: The facial canal lies in the petrous part of the temporal bone and contains the facial nerve (CN VII) as it travels through the canal to become extracranial. The facial canal is

divided into three segments, namely the labyrinthine, tympanic and mastoid segments, each traveling in a different plane and of varying importance. Interest is placed on the tympanic segment as it lies in close proximity to the middle and inner ear structures. It is for this reason that the facial canal and nerve is of concern to otologists during electrode placement for a cochlear implant, as it is so closely related to the cochlea and any damage to the nerve may result in untreatable paralysis. Not many studies have been conducted on a cadaveric population, with most being carried out on CT images of the cochlea and facial nerve. Thus, there is no standard or clear methodology that one can follow in order to visualize the facial canal and nerve. We propose a detailed dissection technique to span this gap in research.

Methods: With the use of drilling tools and medical cutters, the facial canal was exposed in the temporal bone of cadaveric skulls (Ethical clearance: 545/2021). Once exposed, morphometric analyses and relationships of the facial canal can then be conducted.

Results: This technique was successful.

Conclusion: Knowledge of the facial canal may assist otosurgeons to safely dissect the region without injuring vital structures within this area.

Keywords: facial nerve, labyrinthine segment, genu, mastoid segment, tympanic segment

O-009

Tympanic annulus: clinical implications for endoscopic ear surgery

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Objective: Critical structures in the middle ear are at risk during endoscopic ear surgery. Blind dissection may occur due to restricted working angles through narrow external auditory canal. Bony tympanic annulus (TA) is the main landmark and the main limitation for this blind work. In this study we aimed to evaluate the middle ear structures in relation to the TA.

Methods: Right-sided temporal bone computed tomography images of 117 patients without ear pathology were studied. Endoscopic transcanal dissections were performed in bilateral ears of 16 fresh frozen cadavers. Middle ear structures such as chordal eminence, facial nerve (FN), incudostapedial (IS) joint, incudomalleolar (IM) joint, jugular bulb (JB) and pyramidal eminence were studied. FN course is categorized in relation to the TA plane. In Type A, FN is medial to the TA plane, in Type B, FN is reaching to the level of TA plane and in Type C, FN crosses lateral to the TA plane during its course.

Results: Radiologic measurements revealed mean (standard deviation) nearest distance between chordal eminence, IS joint, IM joint, FN second genu, JB and TA as 0.94(0.60), 3.53 (0.43), 2.27 (0.44), 4.06 (0.51), 4.8 (2.3) mm, respectively. Nearest points were mapped at the TA. There were 28 (23.9%) Type A, 25 (21.4%) Type B, 64 (54.7%) Type C FN courses. Transcanal dissection yielded mean (standard deviation) distance between IS joint, FN tympanic segment, FN second genu, pyramidal eminence, JB and TA as 3.13 (0.64), 4.39 (0.70), 4.35 (0.51), 3.53 (0.79), 4.35 (2.0) mm, respectively.

Conclusion: Endoscopic ear surgeons should consider certain regions of TA as a landmark to predict the structures at risk during the surgery.

Keywords: middle ear anatomy, facial nerve, endoscopic ear surgery, clinical anatomy

O-010

Anatomical connections among the depressor supercilii, levator labii superioris alaeque nasi, and inferior fibers of orbicularis oculi: implications for variation in human facial expressions

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Objective: The aim of this study was to determine how the depressor supercilii (DS) connects to the levator labii superioris alaeque nasi (LLSAN) and inferior fibers of the orbicularis oculi (OOc INF) in the human midface.

Methods: The DS was examined in 44 specimens of embalmed adult Korean cadavers. We found that the DS connected to the LLSAN or the OOc INF by muscle fibers or thin aponeuroses in 33 (75.0%) of the 44 specimens. This study was approved by the Institutional Review Board of the Catholic Kwandong University (IRB No. CKU-21-01-0101).

Results: The DS was connected to both the LLSAN and OOc INF by muscle fibers or aponeuroses and had no connection to either in 5 (11.4%) and 11 (25.0%) specimens, respectively. The DS was connected to the LLSAN by the muscle fibers and thin aponeuroses in 6 (13.6%) and 4 (9.1%) specimens, respectively. The DS was connected to the OOc INF by the muscle fibers and thin aponeuroses in 5 (11.4%) and 23 (52.3%) spec-

imens, respectively. Our findings regarding the anatomical connections of the glabellar region DS to the midface LLSAN and OOc INF provide insights on the dynamic balance between the brow depressors such as the DS and brow-elevating muscle and contribute to understanding the anatomical origins of individual variation in facial expressions.

Conclusion: These results can also improve the safety, predictability, and aesthetics of treatments for the glabellar region with botulinum toxin type A and can be helpful when performing electromyography.

Keywords: depressor supercilii, levator labii superioris alaeque nasi, orbicularis oculi

O-011

Crossing fibers of the depressor septi nasi and orbicularis oris attaching to the medial crura of major alar cartilage: medial crura depressor

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Objective: The present study aimed to determine prevalence and attaching patterns of the depressor septi nasi muscle (DSN) and orbicularis oris muscle (OOr) to the footplate of medial crus (fMC) of major alar cartilage, focusing on their crossing fibers using microdissection, histology, and micro-computed tomography.

Methods: The DSN and OOr attaching to the fMCs of the major alar cartilage were investigated in 76 specimens from 38 embalmed Korean adult cadavers. This study was approved by the Institutional Review Board of the Catholic Kwandong University (IRB No. CKU-21-01-0303).

Results: Muscles attaching to the fMC were the DSN, OOr, or both. When the DSN was present unilaterally or was absent, some fibers of the OOr ascended to attach to the fMC, instead of the DSN in 20.6% of the specimens. Crossing fibers of the DSN or OOr attaching to the fMC were found in 82.4%. Bilateral and unilateral crossing fibers were found in 32.4% and 50.0%, respectively, and no crossing fibers were found in 17.6%. The DSN and OOr attaching to the fMC could be categorized into the six types, according to presence of the DSN and crossing patterns of the DSN and OOr. Anatomical findings of the DSN and OOr attaching to the fMC were confirmed in histologic and micro-CT images.

Conclusion: These findings will be useful information for rhinoplasty of the nasal tip and suggest a mechanism of dynamic pulling forces of the muscles attaching to the fMCs.

Keywords: depressor septi nasi muscle, footplate of medial crus, orbicularis oris muscle

O-012

Ophthalmic artery arising from the middle meningeal artery in South African patients

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Objective: To describe rare anatomical variation in the origin of the ophthalmic artery from the middle meningeal artery. This variant origin is usually associated with variation in the course of the ophthalmic artery through the superior orbital fissure. The ophthalmic artery and its branches supply blood to the eyeball and its contents. This information is essential for treating clinical conditions such as central retinal artery occlusion or retinoblastoma chemoembolization and ophthalmic artery aneurysm.

Case Reports: We report on two cases of ophthalmic artery arising from the middle meningeal artery in one adult (33-years-old Indian female) and one pediatric (2-years-old African male) South African patient examined by digital subtraction angiography. The patients were diagnosed with arteriovenous malformations and bilateral retinoblastoma, respectively.

Conclusion: There were rare instances of an ophthalmic artery arising from the middle meningeal artery. The ophthalmic artery plays a vital role in vision generation. Therefore, its anatomy is of clinical interest to neurosurgeons, ophthalmologists, and interventional radiologists. Knowledge of its variations is important for planning neurosurgical and neurointerventional procedures and interpreting exceptional angiographic images. The Biomedical Research Ethics Committee of the University of KwaZulu-Natal approved the study (Ethical No: BE 148/19).

Keywords: anatomic variation, external carotid artery, middle meningeal artery, ophthalmic artery

O-013

A marine collagen-based biomimetic hydrogel recapitulates cancer stem cell niche and enhances progression and chemoresistance in human ovarian cancer

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Objective: To improve the understanding of the progression and treatment of cancer for the development of more accurate and physiologically relevant in vitro tumor models that serve as important tools in cancer research.

Methods: Hydrogels for 3D cell culture were prepared as previously described by our group. To measure the cell proliferation and chemotherapeutic sensitivity, the WST-1 colorimetric assay was performed and colony-forming assay was performed to compare colony growth. Wound-healing assay was performed by making scratch wounds when cells reached confluency and scratch closure was monitored. Hydrogel invasion assay was performed and the depth of cell invasion was observed by cell fluorescence using a confocal laser scanning microscope. Western blot was performed for the detection of apoptotic proteins and key EMT and stemness markers were observed by RT-PCR. Flow cytometry was performed for the detection of cancer stem cell (CSC) population and CSC isolation.

Results: 3D ovarian cancer (OC) exhibited biochemical and physiological features, including (1) enhanced cell proliferation, migration and invasion, colony formation, and chemoresistance; (2) suppressed apoptosis with altered expression levels of apoptosis-regulating molecules; (3) upregulated expression of crucial multidrug resistance-related genes; (4) accentuated expression of key molecules associated with malignant progression, such as epithelial–mesenchymal transition transcription factors, Notch, and pluripotency biomarkers; and (5) robust enrichment of ovarian CSCs.

Conclusion: An effective 3D in vitro culture method was developed and optimized for growing multicellular OC spheres derived from different OC cell lines. And we demonstrated its usefulness in the isolation and enrichment of ovarian CSCs.

Keywords: cancer stem cell, ovarian cancer, 3D cell culture, spheroid, chemoresistance

O-014

In vivo preclinical evaluation of bioprinted human cartilage construct

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Objective: Chondrospheres fabricated from chondrocytes or human cartilage cells have been recently successfully used as novel tissue-based therapeutic modality for cartilage defects treatment. However, chondrospheres non-adhered immediately to the surface of cartilage defect could be detached. We hypothesize that bioprinting of tissue engineered cartilage construct using porcine viscous collagen as a bioink and support for chondrospheres will enable biofabrication of rapidly and better integrated tissue engineered construct suitable for implantation.

Methods: Human chondrocytes have been isolated from human cartilage. Tissue spheroids have been fabricated using ultra-low attachment spheroid microplates (Corning, USA). The diameters of tissue spheroids have been estimated as well as their biomechanical properties ("Microsquisher", CellScale, Canada). Bioprinting was performed using porcine viscous collagen hydrogel, chondrospheres fabricated from human chondrocytes and original 3D bioprinter "Fabion" (3D Bioprinting Solutions, Russia). Bioprinted constructs have been implanted subcutaneously into nude mice. One month after implantation the isolated bioprinted construct has been evaluated by morphological, immunohistochemical and biomechanical methods.

Results: It has been demonstrated that cartilage tissue-engineered constructs bioprinted from porcine collagen hydrogel and chondrospheres after heterotopic subcutaneous implantation into nude mice maintain its viability, shape and biomechanical, morphological and histochemical properties typical for cartilage.

Conclusion: Taken together our data strongly suggest that bioprinted human cartilage tissue engineered construct is viable and it maintains its shape and biomechanical, morphological and immunohistochemical histotypical phenotypic properties after implantation in vivo. Implantation of bioprinted human cartilage tissue-engineered construct into nude mice is a valuable pre-clinical evaluation method.

Keywords: bioink, bioprinting, cartilage, chondrospheres, collagen

O-015

Regenerative potential of chondrospheres fabricated from human perichondrium

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Objective: Cultivation of chondrocytes in vitro as chondrospheres or 3D tissue spheroids allows maintaining their chondrogenic phenotype. We hypothesized that chondroblasts

derived from human perichondrium could serve as a new more superior cell source for tissue spheroids-based cartilage regeneration. The regenerative potential of tissue spheroids fabricated from chondroblasts derived from human rib's perichondrium has been investigated in vitro.

Methods: Human chondrocytes have been isolated from human cartilage and human chondroblasts have been isolated from human rib's perichondrium. Tissue spheroids have been fabricated using ultra-low attachment spheroid microplates (Corning, USA). The diameter of tissue spheroids have been estimated as well as their biomechanical properties ("Microsquisher", CellScale, Toronto, Canada). Regenerative potential of tissue spheroids have been investigated by study of tissue spheroids fusion kinetics, tissue spheroids spreading kinetics and, finally, by morphological study of in vitro regeneration of microdefect in the organ culture of isolated piece of human cartilage.

Results: It has been demonstrated that 3D tissue spheroids fabricated from perichondrial cells grow faster and synthesize more extracellular matrix. Also, they fuse, spread and regenerate standard microdefect in cartilage organ culture more efficiently than chondrospheres fabricated from cartilage chondrocytes.

Conclusion: Taken together our data strongly suggest that chondrospheres fabricated from chondroblasts isolated from human rib's periochondrium have superior regenerative potential estimated in vitro as compared to chondrospheres fabricated from differentiated chondrocytes isolated from human cartilage.

Keywords: cartilage, chondrospheres, perichondrium, regenerative potential

O-016

Anatomy of the suspensory ligament of the penis: does size matters?

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Objective: It is widely known that there is a common concern amongst men regarding penis size. Today, there are many ways to acquire a lengthened penis. However, the most popular surgical procedure- the release of the suspensory ligament- despite providing satisfactory results, entails a certain degree of unpredictability and risk. The aim of this study is to successfully predict individual penile length gain after sectioning of the suspensory ligament utilizing simple anatomo-clinical variables and, thus, offering better decision-making tools to surgeons and improving patient satisfaction rates.

Methods: An experimental cross-sectional study was made using 16 penises from fresh adult cadavers and the following data was collected: age at time of death, ethnicity, body habitus, height, penile length before ligamentolysis (L1) and suspensory ligament proper width (W). After the sectioning of the aforementioned ligament, pubic symphysis depth and penile length after the procedure were measured (L2). To investigate the interaction between these variables, multiple correlation coefficients and a generalized linear model were used. This experimental procedure was performed in accordance with the Declaration of Helsinki.

Results: An increase in penile length was achieved in all samples. Statistical analysis of collected data indicated the following: L1, height, W, and body habitus influence L2.

Conclusion: It is possible to pre-operatively predict, for each individual case, final penile length achieved after surgical division of the suspensory ligament by analyzing simple and easily accessible anatomo-clinical variables.

Keywords: organ size, penis, regional anatomy, urogenital surgical procedures

O-017

Abductor pollicis brevis in fetuses: classification, measurements, and surgical implications

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Objective: In newborns with thumb anomalies such as syndactyly and radial polydactyly, the abductor pollicis brevis (APB) may have a course outside its normal pattern. However, a fetal study on anatomical features of APB was not encountered in the literature. In this context, this study aimed to examine the origin, insertion and morphometric features of APB in human fetuses.

Methods: Fifty-four sides of 27 fetuses (mean age: 24±4.16 weeks, sex: 11 male, and 16 female) in the laboratory of Gaziantep University Faculty of Medicine, Department of Anatomy were dissected. The origin and insertion of APB were noted. The area, length and width of APB were measured with a digital image analysis program.

Results: According to the literature review, 7 types were defined for APB according to origin and 4 types according to insertion. In

this study, APB most commonly started from the tubercle of the scaphoid bone plus the flexor retinaculum (44 sides), and ended at the lateral side of the first metacarpophalangeal joint (40 sides). The mean width, length and area of APB were found as 3.53±1.40 mm, 9.16±2.71 mm, and 30.72±20.10 mm^2, respectively.

Conclusion: It is very important for clinicians in reconstructive interventions to muscles of the thumb to know the anatomy and variations of APB. Our classification performed for the first time in the literature may guide future studies, especially focused on thumb anomalies such as polydactyly and syndactyly in newborns.

Keywords: fetus, dissection, thenar region, abductor pollicis brevis

O-018

Anatomical characteristics of the hip flexion abduction external rotation (FABER) position using magnetic resonance imaging

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Objective: The flexion abduction external rotation (FABER) test, also known as Patrick's test, is a useful hip provocation test. However, it remains unclear what is being anatomically assessed, especially in hip soft tissues. This study investigated the in-vivo joint capsule characteristics in the FABER position, including its articular cavity area and relation to the fat pad surrounded by the joint capsule and pericapsular muscles (rectus femoris, gluteus minimus, and iliopsoas), using magnetic resonance (MR) imaging.

Methods: Thirteen hips from 13 healthy volunteers were analyzed. The MR images were obtained, with the participant hips at 15° extension, 45° flexion, and in the FABER position, and statistically compared the articular cavity size and fat pad in the inter-pericapsular muscle space among three positions. All procedures were performed with the understanding and participant consent.

Results: The articular cavity area was greatest in the FABER position, followed by in the hip flexion and then extension, and these differences were significant (FABER vs. flexion, p=0.0015; FABER vs. extension, p=0.0015). Moreover, the area of the fat pad in the inter-pericapsular muscle space in the FABER position was significantly larger than those in the hip flexion and, as a tendency, larger than those in hip extension (FABER vs. flexion, p=0.0058; FABER vs. extension, p=0.046).

Conclusion: In the FABER position, the joint capsule loosened, and the fat pad in the inter-pericapsular muscle space occupied a larger region compared with those in other hip positions as a result of the sufficient postural change of the joint capsule and pericapsular muscles.

Keywords: FABER test, joint capsule, pericapsular muscles

O-019

A novel approach for quantitative imaging of the seated anatomy of the buttocks using ultrasound

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Objective: Prolonged wheelchair use following spinal cord injury is commonly associated with the development of pressure ulcers. This creates the need to better understand the anatomy of the buttocks. The aim was to assess the reliability of using ultrasound (US) to study buttocks soft tissue in the seated position and to measure differences in soft tissue between loaded and unloaded conditions.

Methods: The right gluteal region of able-bodied participants (18–50 years old) was scanned with US (8–10 MHz linear probe, GE LOQIQ 6) in loaded- and unloaded-seated positions on two days. In the loaded-seated position, the soft tissue below the peak of the ischial tuberosity was scanned with subjects seated upright on a custom chair that included a gel pad embedded in the seat cushion and Plexiglas. The tissue in the unloaded-seated position was scanned with subjects lying in a lateral decubitus position in hip (105°) and knee flexion (90°). Total tissue, skin+adipose and muscle+tendon was measured. Intraclass correlations (ICC) were used to measure test-retest reliability. Paired t-test was used to compare soft tissue compression of muscle+tendon vs skin+adipose with significance at $p<0.05$.

Results: Eleven males (BMI: 24±4 kg/m^2) and 13 females (BMI: 23±4 kg/m^2) were studied. Reliability was excellent between days (ICC=0.941–0.981) in all regions/conditions except for seated-loaded muscle+tendon (ICC= 0.884). However, males had excellent reliability for muscle+tendon (ICC= 0.919). The muscle+tendon was compressed more (71.0±13.2%) compared to skin+adipose (40.9±21.8%, $p<0.001$).

Conclusion: Overall, soft tissue of the buttocks in a seated position was highly reliable with muscle+tendon tissue experiencing greater reductions during loading than skin+adipose.

MSU IRB approved study.

Keywords: ultrasound imaging, gluteal region anatomy, pressure ulcers, spinal cord injuries, seated anatomy, able-bodied participants

O-020

Evaluation of the anatomical structures with physical examination and magnetic resonance imaging in ischiofemoral impingement syndrome: preliminary report

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Objective: Ischiofemoral impingement syndrome (IFI) is a syndrome characterized by ipsilateral hip pain in the patient as a result of compression of the quadratus femoris muscle by narrowing of the ischiofemoral space (IFS). The aim of this study is to define magnetic resonance imaging (MRI) findings in patients with IFI, to question physical examination tests and to investigate their relationship with imaging methods.

Methods: Our study is a case control study; Approval was obtained from the Selçuk University Faculty of Medicine Local Ethics Committee with the decision numbered 2022/115. MRI images of 24 hips of 17 patients who had presented with the complaint of hip/groin pain in the case group were analyzed retrospectively. In addition, the files of patients that have been diagnosed with IFS were evaluated for hip/groin pain complaints, severity of pain, clinical findings and physical examination tests. IFS, quadratus femoris space (QFS), hamstring tendon area were measured on MRI, and quadratus femoris muscle edema was graded. In the control group; Bilateral images of 18 patients without IFI who underwent MRI were analyzed.

Results: The IFS and QFS of the patient group were found to be significantly lower than the control group ($p<0.001$).

Conclusion: Clinicians and radiologists should be aware of IFI, since differential diagnosis of hip/groin pain is difficult, especially in atypical cases. Physical examination should be performed for the correct diagnosis and treatment of the disease, and MRI should be performed for IFS and QFS narrowing, edema, and other features that may help in clinical diagnosis.

Keywords: ischiofemoral impingement, hip pain, quadratus femoris muscle, MRI

O-021

Morphological and morphometric study of the latissimus dorsi tendon for its transfers in rotator cuff tears

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Objective: Latissimus dorsi (LD) transfer surgery is one of the various surgical techniques to treat rotator cuff tears. The width, thickness, length, and attaching pattern of the LD tendon are crucial when performing the transfer. The aim of this study was to investigate morphological patterns of the tendon of the LD attached to the humerus and morphometric features of the tendon of LD.

Methods: Sixteen LD of eight embalmed Korean adult cadavers were dissected. Dissection was focused on the insertions of the LD, teres major (TM), and pectoralis major to the humerus. All cadavers had been legally donated to Daegu Catholic University School of Medicine. The present study was conducted in accordance with the Declaration of Helsinki.

Results: The inserting patterns of the LD with the TM were classified into three categories according to the combined shapes. Fully combined pattern was found in 37.5%, partially combined pattern was found in 37.5%, and fully separated pattern was found in 25.0%. The mean width, length, and thickness of the LD tendon at its attachment to the humerus were 56.5 mm, 58.2 mm, and 6.7 mm, respectively.

Conclusion: These anatomical findings can allow surgeons to predict the combined patterns of the LD with the TM and the accurate ranges of width, length, and thickness of LD tendon. It also facilitates safe harvesting of the LD tendon during LD transfer surgery.

Keywords: latissimus dorsi, teres major, transfer surgery, rotator cuff tears

O-022

Evaluation of trachea and bronchi with 3-dimensional reconstruction method in Covid-19 patients

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Objective: This study aims to evaluate changes in the trachea and bronchus of Covid-19 patients by using 3-dimensional reconstruction images obtained from chest CT scans.

Methods: There were 150 Covid-19 patients and 150 individuals in the control group in our study. The CT images of the control group and Covid-19 patients were transferred to Mimics software, and 3-dimensional reconstruction of the trachea and bronchus was performed. Covid-19 patients were grouped as absent (grade 0), mild (grade 1), moderate (grade 2), and severe (grade 3) based on the total lung severity score in each gender. Ethics committee approval was obtained for our study.

Results: The sectional area and diameter of the right upper lobar bronchus decreased as the grade increased. The circumference of right upper lobar bronchus and the sectional area and circumference of left lower lobar bronchus were found to be narrower in grade 1–2–3 Covid-19 patients compared to the control group. The diameter of the left lower lobar bronchus was found to be significantly narrow in grade 2–3 Covid-19 patients. Sectional area, circumference, and diameter of middle lobar bronchus were found to be narrower in grade 3 Covid-19 patients. Sectional area, circumference, anteroposterior diameter, and transverse diameter at the first level of the trachea were found to be narrower in female Covid-19 patients compared to the control group.

Conclusion: In our literature review, no study was found that evaluated the trachea and bronchus of Covid-19 patients with the 3-dimensional reconstruction method. Therefore, we think that our study will contribute to the literature.

Keywords: Covid-19, trachea, bronchus, 3-dimensional reconstruction, computed tomography

O-023

Sex-dependent morphometric analysis of sternum on computed tomography images

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Objective: The sternum is a flat bone that forms the middle of the anterior wall of the thoracic cage. Morphometric characteristics of the sternum are important in both clinical and anthropological aspects. This study aimed to examine sex-dependent morphometric features of the sternum in the Anatolian population on computed tomography (CT) images.

Methods: CT images of 140 subjects (76 males and 64 females) aged between 20 and 88 years were divided into 5 subgroups according to age and sex. Manubrium length, corpus length, xiphoid length, manubrium width, corpus width, and angle of Louis were measured on the CT images. The xiphoid process was classified according to its shape and degree of ossification. Obtained data were statistically analyzed according to sex.

Results: All morphometric parameters of the sternum were larger in males as compared to females ($p<0.05$). Significant sexual dimorphism was found for all sternal morphometric parameters in certain age groups ($p<0.05$). The length of the corpus sterni was found to be sexually dimorphic in all age groups except for ≥60 years.

Conclusion: In the Anatolian population, morphometric characteristics of the sternum displayed significant sexual dimorphism in certain age groups. Obtained morphometric measurements of the sternum in this population could serve as a database for discriminating between males and females in certain age groups.

Keywords: computerized tomography, morphometry, sexual dimorphism, sternum

O-024

Comparison of the cystocoledocal angle in patients with choledocholithiasis and only cholelithiasis

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Objective: This study aims to evaluate the relation between the cystocholedochal angle (SCA) and choledocholithiasis.

Methods: The data of 3.350 patients were reviewed retrospectively and a total of 628 patients who met the criteria were included in the study. The patients included in the study were divided into three groups as patients with choledocholithiasis (Group I), patients with only cholelithiasis (Group II), and patients without gallstones as control group (Group III). Measurements of SCA, cystic, bile and common hepatic ducts were made on Magnetic Resonance cholangiopancreatography (MRCP) images. Laboratory findings and demographic characteristics of the patients were also recorded.

Results: Of the patients included in the study 64.2% were female, 35.8% were male, and their age ranged from 18–93 (mean 53.37±18.87 years). While the mean SCA values of all patient groups were 35.44°±10.44°, the mean length of cystic, bile and common hepatic ducts were 28.91±9.30 mm, 40.28±12.91 mm, 27.09±9.68 mm respectively. All measurements were higher in Group I in comparison to other groups, whereas all measurements of Group II were higher than those of Group III ($p<0.001$). Statistical analysis suggests that a SCA of 33.5° and above is an important criterion for diagnosis of choledocholithiasis.

Conclusion: Increase of SCA raises the likelihood of choledocholithiasis, as it facilitates the passage of stones from gallbladder into the bile ducts. This is the first study to compare SCA in patients with choledocholithiasis and those with only cholelithiasis. Therefore, we think that this study is important and will be a guide for clinical evaluation.

Keywords: choledocholithiasis, cystocholedochal angle, extrahepatic bile ducts, gallbladder, MRCP.

O-025

Differences in the anatomical structure of the uterus between fertile and infertile individuals

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Objective: Infertility affects a significant portion of the reproductive population. The prevalence of congenital uterine anomalies is 3–4%. The most common type is the septate uterus. There is not enough data about whether these anomalies are the cause of infertility. In our study, we compared the morphometric parameters of the uterus of fertile and infertile individuals. Based on the data obtained, we wanted to determine which parameters should be evaluated for fertility prediction. We also aimed to investigate the effect of septum on fertility.

Methods: In our study, the uterus of 55 infertile and 80 fertile individuals between the ages of 20–45 were analyzed retrospectively using magnetic resonance images. Ethical approval (approval number 2019/396) was given by the Local Ethics Committee of the Selçuk University Faculty of Medicine. Group I included women with congenital uterine anomalies. Group II included infertile individuals with tubal and male factors. group III included fertile individuals. Uterine, corpus, cervical, uterine cavity lengths, anteroposterior and transverse diameter, fundal thickness, distance between tubal ostia were measured. The data of uterine variables were evaluated statistically according to age and groups.

Results: The mean age for groups I, II and III were 29.88±6.69; 29.21±4.59 ve 27.45±5.43 respectively. There was no statistically significant difference between the groups in terms of transverse diameters ($p>0.05$). Statistically significant differences were found between groups for other variables ($p<0.05$).

Conclusion: We observed that uterine measurements evaluated in our study are important for fertility. Evaluating these parameters before septum resection will be useful in predicting the contribution of this operation to fertility.

Keywords: infertility, uterus, morphometry, septum

O-026

Evaluation of coronary artery variations and anomalies with coronary computerized tomographic angiography

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Objective: The aim of our study is to evaluate coronary artery variations and anomalies in coronary computed tomographic angiography (CTA) examinations performed in our hospital.

Methods: After the approval of the ethics committee, coronary CTA examinations studied in the years 2020–2022 were evaluated retrospectively. Coronary CTA examinations with adequate imaging quality were included in our study. Images with respiratory artifacts were excluded from the study. Coronary artery variations and anomalies were identified and categorized, and their frequency was calculated.

Results: In total, 29 patients out of 158 patients were excluded from the study because of their images' quality. The mean age of the remaining 129 patients was 55.76±12.75 years (mean±standard deviation). Among these patients, 72 patients were male (55.8%) and 57 patients were female (44.2%). The right main coronary artery was dominant in 115 patients (89.1%), the left main coronary artery was dominant in 13 patients (10.1%), and both coronary systems were dominant in 1 patient (0.8%). No variation or anomaly was observed in 89 (69%) of these patients. There were variations and anomalies in 40 (31%) patients. The most common variation and anomalies were ramus intermedius 19 (14.7%), myocardial bridging 17 (13.2%) respectively, and the others were right coronary artery originating from left coronary sinus anomaly 2 (1.6%), left circumflex artery originating from the right coronary artery was detected in 1 (0.8%) and absence of the left main coronary artery in 1 (0.8%).

Conclusion: The most common coronary artery variations and anomalies in our study were ramus intermedius and myocardial bridging.

Keywords: coronary artery, coronary artery variations, coronary artery anomalies, coronary CTA

O-027

Prenatal diagnosis of giant cardiac tumor with fetal echocardiography: two cases

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Objective: Cardiac tumors of antenatal life are rare but they may be fatal before or after birth depending on location,size of mass,presence of arrhythmias.The most seen intracardiac tumors are the rhabdomyomas usually seen as early sign of tuberous sclerosis.

Case 1: A 35-year-old, G4P2A1, pregnant woman at her 33 th gestational week, referred to us for fetal cardiac examination due to intracardiac multiple hyperechogenic foci. She had epilepsy. Her husband and first child had tuberous sclerosis. There was no consanguinity with her husband. Fetal echo demonstrated huge tumors filling the left ventricular (LV) cavity and obstructing the outflow tract, originating from apical

wall (16×4 mm) and interventricular septum (25×11 mm). Also multiple masses,the largest of which was 8×6 mm, seen on the right ventricular cavity. Because of family history, tumors were considered as rhabdomyomas. After delivery on the 39th week, the boy weighed 3450 gr, evaluated by echo showing similar findings without outflow obstruction. After everolimus pharmacotherapy, tumors regressed progressively.Genetic analysis of family members were negative for TSC1 and TSC2 gene. **Case 2:** A 27-year-old G3P2, on 36th GW, pregnant woman referred to us for fetal echocardiography for intracardiac mass. She had no family history. Fetal echo showed massive bilobular mass that fully filled the LV cavity causing left to right shunt of foramen ovale (20×15 and 16×10 mm on LV and multiple millimetric on RV). After delivery with a planned cesarean section on 38th GW, 3260 gr, girl baby demonstrated with echo showing the same findings. Baby was hemodynamically stable. So everolimus pharmacotherapy started in the first week. Tumors regressed. TSC2 gene mutation found.

Conclusion: Antenatal early detection of intracardiac tumors not only provides tuberous sclerosis diagnosis. It is crucial for delivery time,method,postnatal care and early therapy.

Keywords: cardiac rhabdomyoma, fetal echocardiography, tumor

O-028

Protein homeostasis of lung tissue under the influence of Vipera berus berus and Vipera berus nikolskii poison

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Objective: The lungs are a paired organ that performs a significant number of functions, so it is important to study their molecular tissue changing in toxic processes. The aim was to examine changes of total protein concentration and its qualitative composition in lung tissue under the berus berus and berus nikolskii vipers influence.

Methods: Homogenates of the lungs under the influence of Vipera berus berus and Vipera berus nikolskii were studied, in which the total concentration of protein and qualitative composition of protein molecules were determined. This work was compiled according to the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (1986).

Results: Vipera berus verus poison has almost no effect on the concentration of total protein in the lungs, while Vipera berus nikolskii poison significantly reduces this indexes, compared with the control indexes, which may indicate protein degradation and potential activation of proteolytic process. Under the action of berus berus viper poison the lung tissues contain fractions of 67–35 kDa, 35–10 kDa protein molecules, as well as ≥150 kDa, which were not observed under the Vipera berus nikolskii poison action. In the latter, in addition to the mentioned 67–35 kDa, 35–10 kDa, fractions of ≤10 kDa protein molecules were observed.

Conclusion: Thus, the studied poisons vipers show different effects on the total protein concentration and on its qualitative composition in lung tissue, but the general trend of the both poisons effects – the redistribution of protein molecules in the reducing molecular weight direction.

Keywords: lung, protein, Vipera, poison

O-029

STUB1-mediated proteasomal degradation of m6A methyltransferase METTL3 regulates cancer metastasis

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Objective: m6A is an abundant modification in eukaryotic mRNAs, but its upstream regulatory mechanism remains unclear. We aimed to explore the biological function of RNA m6A in tumor metastasis and identify novel therapeutic strategies for esophageal squamous cell carcinoma (ESCC).

Methods: Genome-wide CRISPR/Cas9 functional screening, combined with experiments in highly invasive and metastatic ESCC subline models, identified METTL3 as a novel cancer metastasis regulator. The biological function of METTL3 was examined through gain/loss-of-function experiments and in vitro/in vivo assays. The downstream targets and upstream regulators of METTL3 were investigated by methylated RNA immunoprecipitation sequencing, luciferase reporter assay, and ChIP. Gene expression and clinical significance were analyzed in tumor tissue microarrays and online databases. Virtual screens, SPR analysis and functional assays based on an FDA-approved drug library were performed to identify compounds targeting METTL3 to suppress cancer metastasis.

Results: METTL3 knockdown inhibited ESCC invasion and metastasis. Mechanistically, METTL3 increased m6A in EGR1 mRNA and enhanced its stability in a YTHDF3-dependent manner, activating EGR1-snail signaling. KAT2A increased the H3K27 acetylation level in the METTL3 promoter region and activated METTL3 transcription. SIRT2 exerted the opposite effects. Immunohistochemical analysis showed that METTL3 expression was upregulated in ESCC tumors and further increased in metastatic tissues and could predict poor prognosis.

Elvitegravir, an FDA-approved drug originally developed to treat HIV infection, suppressed metastasis by directly targeting METTL3 and enhancing its STUB1-mediated proteasomal degradation.

Conclusion: RNA m6A has great biological and clinical significance in cancer metastasis. Targeting METTL3 with elvitegravir has therapeutic potential in esophageal cancer management.

Keywords: m6A modification, METTL3, tumor metastasis, histone H3K27 acetylation, drug repositioning

O-030

Stomach secretes estrogen in response to the blood triglyceride levels

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Objective: Twenty-years ago, we discovered the production of estrogen from parietal cells in the stomach (gastric estrogen); however, the roles of gastric estrogen have not been understood. As gastric estrogen directly enters the liver where estrogen controls energy metabolism, we focused on its secretion mechanism from the view of the energy control.

Methods: We used male and partly ovariectomized female rats. The energy sources of parietal cells were investigated using antibodies against the proteins related to the energy metabolism. The blood triglyceride and estrogen levels of normal or gastrectomized rats were monitored after the oral triglyceride administration. To exclude the effect of gastrointestinal hormones, rats were intravenously injected with triglyceride or isolated gastric mucosa was cultured in the presence or absence of testosterone and fatty acid. Experimental protocols were ethically approved.

Results: Parietal cells predominantly expressed the proteins related to the lipid, but not glucose, consumption. After oral triglyceride administration, blood estrogen levels increased as blood triglyceride levels rose in rats, which disappeared in gastrectomized rats. Estrogen in the stomach tissues also increased as blood triglyceride levels rose. Intravenous injection of triglyceride rapidly increased both blood triglyceride and estrogen levels, and isolated gastric mucosa produced estrogen when both testosterone and fatty acid were present.

Conclusion: Stomach secretes estrogen in response to the blood triglyceride levels. Estrogen is known to lower the blood triglyceride levels. Therefore, we propose a model that "when blood triglyceride levels are high, the secretion of gastric estrogen increases, which lowers blood triglyceride levels and keeps them at the proper level."

Keywords: Wistar rats, stomach, estrogens, triglycerides, lipid metabolism

O-031

99m Tc-labeled keratin gold-nanoparticles in a nephron-like microfluidic chip for photo-thermal therapy applications. An ultramicroscopical point of view

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Objective: Biocompatible gold nanoparticles are of particular interest for photo-thermal therapy of cancer treatment because of their ability to efficiently convert light into heating. Nevertheless, the random accumulation of AuNPs in tissues, mainly determined by their retention time in the bloodstream.this work reports on a new generation of 99mTc-labeled AuNPs and their spatial localization investigated by nuclear imaging techniques on an animal-free model.

Methods: human embryonic kidney (HEK293T) cells incubated with 100 μM99mTc-DTPA-Ker-AuNPs and Ker-AuNPs for 24h were detached and transferred into the Eppendorf tubes for TEM processing. Ultrathin (80–90 nm) sections were collected on 100 mesh copper grids, and the imaging was performed using a transmission electron microscope.

Results: The effective radiolabeling of Ker-AuNPs with 99mTc is achieved by using the chelating agent Diethylenetriaminepentaacetic (DTPA), resulting in the 99mTc-DTPA-Ker-AuNPs nanoconjugate. The 99mTc-DTPA-Ker-AuNPs display a radiochemical purity of 90.7% excellent photothermal properties. In addition, the biocompatibility of the 99mTc-DTPA-Ker-AuNPs with healthy human embryonic kidney (HEK293T) cells is shown.

Conclusion: We have successfully reported the realization and characterization of novel radiolabeled bio-mimetic AuNPs for PPT-based applications. TEM analysis allowed us to understand HEK293T morphology, their interaction with 99mTc-DTPA-Ker-AuNPs, and their uptake mechanisms. These detailed studies establish that DTPA-assisted 99mTc-labeled Ker-AuNPs are excellent candidates for biocompatible and non-invasive radiolabeled nanotherapeutic for PTT-based applications. This opportunity will produce a selective accumulation of AuNPsto a specific tumor area, enabling active tracking, localizing, and PPT-assisted therapy

Keywords: biomimetic gold nanoparticles, electron microscopy, radiolabeling, photo-thermal therapy

O-032

Di-(2-ethylhexyl) phthalate triggers proliferation, migration, stemness, and epithelial-mesenchymal transition in human endometrial and endometriotic epithelial cells via the transforming growth factor-β/Smad signaling pathway

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Objective: To improve the understanding of endometriosis progression and treatment for the development of accurate and physiologically relevant in vitro 3D cell culture models, which could serve as important tools in endometriosis research.

Methods: A CCK-8 cell proliferation assay and nuclear antigen Ki-67 immunofluorescence staining was performed to assess cell proliferation. The levels of phosphorylated Smad-2 (pSmad-2), transforming growth factor-β (TGF-β) receptor 2 and key epithelial-mesenchymal transition (EMT) and stemness protein expressions were assessed using a western blot assay. For the detection of the expression levels of key genes associated with inflammatory and immunological responses, qRT-PCR was performed.

Results: Di-(2-ethylhexyl) phthalate (DEHP) treatment enhanced proliferation, migration, and inflammatory responses, along with EMT and stemness induction in human endometrial and endometriotic cells (EEECs). The selective TGF-βR1/2 inhibitor LY2109761 reversed the DEHP-induced cell proliferation and migration enhancement as well as the increased expression of crucial molecules involved in inflammation, EMT, and stemness, indicating that DEHP-triggered phenomena occur via the TGF-β/Smad signaling pathway.

Conclusion: DEHP plays an important role in the etiology and pathogenesis of endometriosis by enhancing cell proliferation and migration and inducing EMT and stem cell properties via the TGF-β/Smad signaling pathway EEECs using a biomimetic hydrogel-based 3D culture model. Furthermore, our findings suggest that the TGF-β/Smad signaling pathway is a potential therapeutic target for DEHP-induced endometriosis.

Keywords: DEHP, endometriosis, epithelial-mesenchymal transition, stemness, inflammation, transforming growth factor-β

O-033

The effect of growth hormone on 6-OHDA induced HEK-YFP-DAT cell line

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Objective: Parkinson's disease is the second neurodegenerative disease after Alzheimer's disease. 6-OHDA is a preclinical model that is used for Parkinson disease as a neurodegenerative disease to kill and destroy cells. Growth hormone (GH) can act directly on the brain by activating GH receptors on the membrane of neurons of the several brain areas. In embryonic cultures of the cerebral cortex, GH has been shown to stimulate neuronal precursor and glial cells and increase neurogenesis, myelin and synaptogenesis.Our aim is to determine the appropriate dose and time of 6- OHDA to kill cells and study the effect of GH on gene expression levels that play a role in the apoptotic or antiapoptotic pathway.

Methods: To determine the appropriate dose and time for GH, which affects cell viability, and to reveal its protective and therapeutic effect by using it as a pharmacological treatment, GH was applied to HEK-YFP-DAT cell lines at various concentrations and for different times. And, 6-OHDA applied at various concentrations and at different times killed HEK-YFP-DAT cells. We observed that it affected cell proliferation; more than 40% of the cells died within 24 hours with 6-OHDA given at the lowest concentration (50 µM 6-OHDA).

Results: Pharmacological treatment results show that GH has both protective and therapeutic properties against 6-OHDA in HEK-YFP-DAT cells treated with 6-OHDA and H2O2.It was observed that GH inhibited 6-OHDA-induced apoptotic genes and increased the expression of 6-OHDA-inhibited antiapoptotic gene.

Conclusion: We observed that GH inhibited 6-OHDA-induced purposes in Parkinson's diseases.

Keywords: Parkinson, growth hormone, neuroprotective effect

O-034

Preventive effects of bone marrow-derived mesenchymal stem cell transplantation in a D-galactose-induced brain aging in rats

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Objective: Aging is a complex process accompanied by numerous morphological, functional, and metabolic impairments in the brain, and a critical risk factor involved in the increasing incidence of neurodegenerative diseases. Few studies have evaluated the efficacy of different sources of mesenchymal stem cells (MSCs) in ameliorating the early morphological and functional alterations in the aging brain. This study, for the first time, evaluated the potential efficacy of intravenous injection of bone marrow-derived mesenchymal stem cells (BMMSCs) in a D-galactose-induced rat model of brain aging.

Methods: BMMSCs (1×106) were intravenously injected into brain aging model rats once every two weeks for 8 weeks. All experimental procedures involving animals were approved by Institutional Review Board of Princess Nourah bint Abdulrahman University, KSA [IRB# 18-0165].

Results: The transplanted cells survived and migrated to the brain, and differentiated into astrocytes and neurons, including choline acetyltransferase neurons. BMMSC transplantation improved locomotor activity and cognitive functions, restored cholinergic system function, protected atrophic cholinergic neurons in the basal forebrain, induced antioxidative effects and restored neurotrophic factors, and modulated hippocampal synaptic plasticity by upregulating PSD95 and Egr1 expression.

Conclusion: Our findings demonstrated the efficacy of BMMSC injection in an aging rat model and suggest that these cells may be developed into an effective cell therapy for the aging brain.

Keywords: bone marrow-mesenchymal stem cells, D-galactose, rat, brain

O-035

Cannabidiol ameliorates lithium chloride pilocarpine-induced seizure, consequent hippocampal damage in acute, latent and chronic phases of epilepsy in animal model

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Objective: This study evaluated the effects of cannabidiol on memory, learning, spatial navigation, and cognitive behavior in lithium chloride pilocarpine-induced epilepsy, assessed the effects of cannabidiol on neuronal morphology and the levels of excitatory and inhibitory neurotransmitter in the hippocampus of epileptic Wistar rats.

Methods: Ethical approval for the study was obtained from the Health Research and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile Ife. One hundred and twenty adult male Wistar rats (150–180 g) were assigned into three groups representing acute, latent and chronic phases of epilepsy. Each group was further subdivided into five subgroups A-E of eight rats each. Subgroups A were the control and received corresponding volumes of vehicle for the entire period of the corresponding phases of epileptogenesis. Epilepsy was induced in subgroups B, C, D and E by intraperitoneal administration of lithium chloride administration (127 mg/kg, i.p) 24 hours before pilocarpine (30 mg/kg, i.p). Seizures were allowed to last for 60 minutes and then terminated by diazepam (10 mg/kg, i.m). Subgroups C and D received 5 mg/kg and 10 mg/kg of cannabidiol respectively orally daily for the entire period of the corresponding phases of epileptogenesis while subgroups E received 10 mg/kg of sodium valproate. Behavioral study was conducted on days 3, 15 and 41 post induction of epileptogenesis respectively. At the end of behavioral studies, the rats were sacrificed and their hippocampi were processed for histological and immunohistochemical assessment. Assay for glutamate and gamma amino butyric acid (GABA) levels were carried out in the hippocampal homogenate using standard procedures. Data were analyzed using ANOVA followed by Newman-Keuls test for multiple comparisons.

Results: Photomicrograph of Cornu Ammonis 1 (CA1) across all phases of epilepsy showed loss of pyramidal neurons and dispersed granule cells, expressions of GFAP in subgroups B. The expressions were remediated by cannabidiol. There was significant increase (F= 59.91, p= 0.009) (F= 299.2, p= 0.0004) (F= 137.4, p= 0.002) in the number of degenerating neurons in the hippocampal CA1 region in Subgroups B [(24.0±0.04 μm^2), (32.0±0.06 μm^2), (39±0.25 μm^2)] when compared with Subgroups A [(5.0±0.02 μm^2), (5.0±0.02 μm^2), (5.0±0.02 μm^2)] across the three phases of epileptogenesis. These increases were significantly reversed by cannabidiol but not sodium valproate across the three phases. The time spent by the animals to identify the baited arms in the chronic phase were significantly higher (F= 5.84, p= 0.023) in subgroups B (80.0±0.13 sec), (30.0±0.14 sec) compared with subgroups A (60.0±0.12 sec), (20.0±0.45 sec). This was significantly reversed by the cannabidiol (66.0±0.32 sec) and (22.0±0.43 sec), (62.0±0.22 sec) and (23.0±0.25 sec) and sodium valproate (63.0±0.24 sec), (19±0.45 sec) an evidence that cannabidiol improved memory, learning, special navigation and cognitive behavior. There was significant elevation (F= 5.49, p= 0.0063) (F= 6.44, p= 0.0032) in hippocampal glutamate level in subgroups B (latent - (27.20±8.50 nmol/L)), (chronic - (21.30± 3.73 nmol/L)) when compared with subgroups A [latent - (7.95± 1.15 nmol/L)],

[chronic - (5.81±2.00 nmol/L)]. This elevation in glutamate was significantly reversed by cannabidiol and sodium valproate. There was significant elevation (F=4.97, p=0.0181) (F=4.59, p=0.023) in hippocampal GABA level in subgroups B [latent - (9.82±2.97 ng/ml)], [chronic - (7.40±2.30 ng/ml)] when compared with subgroups A [latent - (1.85±0.61 ng/ml)], [chronic - (2.11±0.88 ng/ml)].

Conclusion: The study concluded that cannabidiol ameliorated chemically induced epilepsy in Wistar rats.

Keywords: Astrocytes, cannabidiol, epilepsy, hippocampus, pyramidal neurons

O-036

Evaluation of two point discrimination sensation in the hand

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Objective: Early diagnosis of nerve damage in the hand increases the likelihood of recovery. Two-point discrimination test (TPD) is used to detect nerve damage. To know its normal values is important; therefore, in this study, we aimed to evaluate the normal values of TPD in each hand's palmar side, whether there is a difference between the right/left hand, and handedness.

Methods: Ethical approval was obtained from the Clinical Ethics Committee of Gaziantep University, Faculty of Medicine (2021/345). A total of 200 healthy volunteers, 100 men-100 women, participated in this study. Measurements were made with an electronic caliper of 0.01 mm accuracy in both hands. SPSS 22 was used in statistical analyses.

Results: Mean age was 30.18 (±8.94) years, BMI= 25.29 (±4.84) kg/m2, right-handedness 183 (91.5%) and left-handedness 17 (8.5%). In the comparison of each hand, the lowest TPD values were found in the distal phalanges of the fingers (<4.05 mm) the highest values were in the palm region. TPD values were lower in 11 regions in the left hand. TPD values in 11 regions of the left hand were lower in right-handers, and in 2 regions of the left hand in left-handers. In four regions of females' right hand values were lower. There was no gender difference in the left hand.

Conclusion: The lowest distal phalanges region was the most sensitive location in the hand. Second finger's distal phalanx was the most sensitive region in both hands.

Keywords: two-point discrimination test, normal values of two-point discrimination in the hand, nerve damage

O-037

Anatomical formation of the sural nerve: descriptive study on a sample of South African cadavers

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Objective: Operative procedures and injuries to the lateral aspect of the foot and ankle place the sural nerve (SN) and its branches at risk. The SN originates from branches of the sciatic nerve, and often accompanies the small saphenous vein as it supplies sensory innervation to the dorsum of the foot. This study aimed to investigate the origin of the SN and its relation to the inferior tip of the lateral malleolus.

Methods: The SN was dissected and exposed in 50 formalin-fixed adult cadavers in the Department of Anatomy, University of Pretoria. Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee. The cadaveric material for research was covered by the National Health Act, 61 of 2003, which followed the ethical guidelines outlined in the 1964 Declaration of Helsinki and all subsequent revisions. The formation and length of the SN together with its distance from the inferior tip of the lateral malleolus, were measured.

Results: The mean length of the SN was 103.25 mm, and its mean distance of 26.94 mm, from the inferior tip of the lateral malleolus. A high correlation of 0.77 was found between the sex of the cadaver and the distance from the lateral malleolus.

Conclusion: This study provided four types of SN formation, with type 1 being the most common. An incision made 50 mm below the inferior tip of the lateral malleolus was regarded as a possible safe zone for nerve harvesting.

Keywords: lateral malleolus, nerve graft, sural nerve

O-038

Anatomical investigation of the connection between the accessory nerve and the posterior root of the first cervical nerve using cadaveric dissections

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Objective: The specific function of the accessory nerve (CN XI) is not well-known, as the anatomy described in the literature is inconsistent with variation in the anastomotic connections with other nerves. This study aimed to investigate the CN XI and its possible connections to the posterior root of the first cervical nerve (C1).

Methods: The brain specimens were removed using a specialized technique that ensured that all structures were preserved and accessed. All specimens were dissected bilaterally at the

University of Pretoria's Department of Anatomy, after ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee, and the cadaveric material for this research was covered by the National Health Act, 61 of 2003.

Results: The CN XI was identified in all the cadavers examined in the vertebral canal's cervical part (C1 to C5). In nine (90%) specimens, the posterior root of the C1 spinal nerve was present. The connections were classified into four types using the classification described by Orhan and colleagues (2009). The posterior root of the C1 spinal nerve connecting to the CN XI and ending at the point of anastomosis was seen in four cadavers (40%). This connection type was found more in males than in females. Based on the results from the present study, there is great variability of interconnections with the CN XI and posterior root of C1 in the spinal cord.

Conclusion: These anatomical findings can explain why function loss may vary when the CN XI is injured in different patients.

Keywords: accessory nerve, first cervical spinal nerve, sternocleidomastoid, trapezius

O-039

Origin and cervicothoracic connections of the cardiac nerves in human fetuses

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Objective: The aim was to deepen the knowledge of the human fetal extrinsic cardiac nervous system by the systematization of the origin and formation of the cardiac nerves, branches, and ganglia and its sympathetic-parasympathetic connections.

Methods: A detailed submacroscopic dissection of the cervical and thoracic region was performed in fifty sides from twenty-five human fetuses. No ethical approval was required

Results: Cardiac accessory ganglia that laid on a cardiac nerve or in the conjunction of two or more (up to four) nerves before entering the mediastinal cardiac plexus were observed in 10 sides. Sympathetic cardiac nerves were individually variable and inconstant, except the superior cardiac nerve. In contrast, the parasympathetic cardiac branches appeared grossly to be more constant and invariable, although the individual cardiac branches varied in number and position of origins. Each sympathetic nerve or parasympathetic branch can be single or multiple (up to six) and each of these individual nerves can be originated from the sympathetic trunk or the vagus nerve by one, two or three roots. Sympathetic nerves arose from cervical-thoracic ganglia or the interganglionic segment of the sympathetic trunk. There were connections outside the cardiac plexus, some cardiac nerves were linked to other cardiac nerves, and some others were linked to non-cardiac nerves. Common cardiac nerve trunks were more frequently observed on the right side (76%) than the left side (16%).

Conclusion: The origin, frequency and connections of cardiac nerves/branches are highly variable. Detailed knowledge of the normal neuroanatomy of the heart could be useful during cardiac neuromodulation.

Keywords: autonomic nervous system, cardiac branch, cardiac nerve, sympathetic ganglia, vagus nerve

O-040

Evaluation of the alteration of morphometry in foramina ovale and spinosum: the contribution of the foramen Vesalius

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Objective: The emissary foramen Vesalius (FV) is located in the medial or anteromedial part of the foramen ovale (FO). The foramen spinosum (FS) is situated at the FO posterior part. This study provides data regarding FV location (unilateral or bilateral), FV, FO, and FS morphometry and assesses the relationship of sex, age, in-between foramina distances, and the FV presence or absence and location with the FO and FS morphometry.

Methods: 74 Greek adult dry skulls deriving from the Departments' body donation program were selected. Pearson's χ^2 test was used to compare ratios. Student's t-test was used to compare quantitative variables pairwise. A multiple linear regression analysis was conducted to investigate independently associated variables with the FO and FS morphometry.

Results: FV was identified in 37 (50%) skulls, in 19 skulls unilaterally (51.4%), and in 18 skulls bilaterally (48.6%). No laterality or sex-related difference was identified. The FV mean anteroposterior, laterolateral, and surface area (APD, LLD, and SA) was 2.79±0.83 mm, 1.78±0.53 mm, and 2.64±1.19 mm^2. The FO mean APD, LLD, and SA were 7.64±1.10 mm, 4.66±1.18 mm, and 27.04±10.39 mm^2. The FS mean APD, LLD, and SA were 2.90±0.48 mm, 2.40±0.52 mm, and 5.12±1.82 mm^2. An increase in the total (FO and FS) SA was significantly associated with the FV presence.

Conclusion: FO, FS, and FV morphometry showed no side differences. The (FO and FS) total SA is increased by the FV presence.

Keywords: foramen ovale, foramen vesalius, foramen spinosum, morphometry, skulls

O-041

Anatomical variations of foramen of the diaphragma sellae and neighboring structures: a cadaveric study

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Objective: The aim of our study was to examine the variations and types of foramen of diaphragma sellae and its relationship with nearby surgical landmarks on cadavers.

Methods: Twenty adult (9 male and 11 female) formalin-fixed cadaveric heads were used to analyze the anatomical relationships around the supradiaphragmatic region of sella turcica. Lengths and distances of nearby surgical landmarks around the suprasellar region were measured by digital microcaliper. The independent samples and paired samples tests (SPSS version 25) were used to analyze the comparison between genders and body sides via diameters, distances, lengths and types.

Results: The types of optic chiasm and foramen of diaphragma sellae (OC–FDS) were detected as follows 1a (11.1%), 1b (11.1%), 1c (44.4%), 3 (22.2%) in males and 1a (18.2%), 1b (9.1%), 1c (45.5%), 2 (9.1%), 3 (9.1%) in females (χ^2=3.6141, p=0.729). The diameter of the optic nerve on the right side was greater than that on the left side (p=0.004). The distance between tuberculum sellae and dorsum sellae was higher in male than in females, and the difference was statistically significant (p=0.017). The distance between optic chiasm and dorsum sellae was higher in males than females (p=0.009). The width of the right cribriform plate was higher in females than in males (p=0.047).

Conclusion: Comprehensive anatomical knowledge of the variability of FDS, nearby anatomical structures and gender differences should be taken into account to reduce the complications during surgery.

Keywords: diaphragma sellae, foramen of diaphragma sellae, optic chiasm, cribriform plate, sphenoid bone ramus intermedius

O-042

Innovative fetal imaging, human morphology educator, researcher & humanitarian-Dr Marjorie Ann England: pioneering gender shift in medical anatomy

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O-043

Integrating virtual-reality enriched active learning into pre-clinical gross anatomy education

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Objective: In the School of Biomedical Sciences, HKU, we utilize Virtual-Reality technology for creating an active learning environment in gross anatomy classes. Coupling with a task-oriented-practical approach, we aimed to better integrate basic and clinical sciences, promoting problem-solving and knowledge application instead of rote memorisation. Overcoming the challenges caused by Covid-19 pandemic, we were able to design and build the VR anatomy lab. We have also created VR-enriched tasks (VRETs) for gross anatomy education. Our goal is to introduce VR into large classes of over 300 students and integrate it seamlessly into gross anatomy dissection. HKU/HREC ref: EA210204

Methods: Based on the results from preliminary study, we made improvements on VRETs, pedagogical design and practical logistics. Subsequently, VR technology was officially adopted as a technological learning tool in the MBBS curriculum. Students were invited to complete a 7-point Likert scale validated questionnaire assessing technology-enhanced active learning. Students were also randomly invited to participate in semi-structured interviews.

Results: The large-scale deployment of VRETs in the formal curriculum was found to be effective in helping students grasp complex anatomical concepts, and improving students' learning experience, particularly in piquing curiosity, increasing motivation, providing extra support and enhancing deep understanding.

Conclusion: VRETs were well-received by MBBS students as part of their formal curriculum. The results also implicated a steep learning curve for first-time VR users, and the learning experience improved with VR proficiency. Further quantitative study is currently underway to compare the effectiveness of VRETs with different learning modalities commonly used in gross anatomy education.

Keywords: virtual reality, VR, education, dissection, active-learning, technology-enhanced

O-044

3D–printing: a viable substitute for commercially purchased anatomical models

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Objective: This presentation is supposed to illustrate some of the capabilities of currently available 3-D printing technology and how it can be used in anatomy education. Questions that arise are for instance if 3D printed anatomical models are detailed enough to use for education and the question of cost – is this a cheaper alternative to print your own models? How hard is it to start 3D printing, can we even do this? Lastly, where do the models we print come from?

Methods: We will review a variety of 3D printers that we have used for 3D printing anatomical models at our institution. We will discuss materials used to print, the cost of the 3D printers and the expenses of the material needed to print models. Importantly, we will give a first-hand view of "the good, the bad and the ugly" about 3D-printing – mistakes made, and knowledge gained.

Results: In comparing 3D printers from cheap (<$300) to expensive (>$3,000) we found that cost is not necessarily a guarantee for working well or poorly. A main factor is the material (filament) used and the set-up of the machine for printing (temperatures, supports, infill).

Conclusion: Current technology is affordable and user friendly enough that even a novice user can learn to 3D print their own anatomical models with relative ease. Even a "cheap" 3D printer for a few hundred $US or Euros can create good models that, if purchased from a vendor, would quickly exceed the costs for acquisition of the printer and materials.

Keywords: 3D-printing, anatomy models, anatomy education

O-045

Creating a global community during Covid-19 pandemic: bringing anatomical sciences educators together

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Objective: Anatomical sciences education in medical curriculum is often linked with team-based cadaveric dissection in labs, virtual microscopy, hands-on ultrasound imaging and clinical skills. This traditional teaching came to an abrupt halt globally due to the Covid-19 pandemic and created unparalleled challenges shifting a substantial part of anatomy curricula into a remote and exchange of ideas. Covid-19 enforced lockdowns made it challenging for in person scientific gatherings. The Anatomical Sciences Scholarly Interest Group at OUWB took advantage of the new virtual academic world to establish a Global Community of Anatomical Science Educators (GCASE). In this abstract we describe how GCASE has maximized the Zoom™ platform to further the scholarly activities in anatomy education.

Methods: The members of the GCASE were an international collective (n=25) from five continents. Regular meetings were held where members networked and discussed possible collaborations, shared ideas on innovative teaching tools and presented at national and international platforms.

Results: GCASE is a collaborative group of passionate international educators dedicated to pursuing scholarship of excellence in teaching and facilitating educational and scientific exchange at an international level. Achievements of GCASE till date include editing a special journal issue focusing on anatomical sciences in the Journal of Academic Development and Education, presentations at national and international conferences through collaboration.

Conclusion: Through regular virtual meetings, GCASE members resolved several challenges encountered globally during the pandemic. The insight gained through this collaboration served to refurbish the traditional tenets of teaching and assessment and has opened the door for robust international communication and scholarship.

Keywords: anatomy education, collaboration, global community, scholarship, virtual

O-046

As a learning tool social media in anatomy education from the students' perspective

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Objective: The development of technology creates changes in all areas. The increasing use of the internet and social media has caused many changes from the social needs of the students to the learning methods of them. Technology also brings about changes in anatomy education. In this study, we aimed to contribute to the framing of the ideal anatomy education method by investigating the effects of social media in anatomy education.

Methods: A total of 722 medical and dental students from 8 different universities participated in our study. A questionnaire form was sent to the participants, based on previous similar studies. The questionnaire consists of 4 parts: demographic information, multiple choice questions, 5-point Likert-type proposals, and open-ended questions. Our study was approved by the ESOGU non-invasive clinical research ethics committee (Decree no: 62).

Results: 70.9% of the participants stated that they follow social media pages that produce anatomic contents. According to the students, the most reliable web sources were Wikipedia (38.4%) and YouTube (37.1%). 96.7% of the participants stated that they would prefer to follow the social media account

managed by an academician/anatomy specialist. In the open-ended questions, the students stated that there are many advantages of learning from social media and that the pages that produce anatomy content should be increased quantitatively and qualitatively.

Conclusion: The development of technology seriously affects teaching methods. Students are eager to learn from social media and seek reliable sources.These needs of students should be taken into consideration and these gaps in the learning process should be filled by anatomy instructors.

Keywords: anatomy education, social media, digital era, education tools, medical education

O-047

Let students tell us what resources they used in their online anatomy education!

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Objective: In this study, it was aimed to identify additional resources that are effective in facilitating learning and used to reinforce the online anatomy lessons due to the Covid-19 pandemic.

Methods: After the approval of the ethics committee, a survey form prepared with the Google Survey application was applied to the medical faculty students (currently the 2nd and 3rd semesters) who received anatomy courses at Istanbul Yeni Yüzyıl University in 2019–2020 and 2020–2021 academic years.

Results: A total of 182 students, 63.7% female and 36.3% male, participated in the study. In addition to the online course materials, 54.4% of the students stated that they benefited from anatomy atlases, 46.2% from anatomy videos on Youtube channels and 26.9% from 3D anatomy programs. It was determined that the students using the 3D anatomy program mostly (64.15%) used Acland's Video Atlas of Human Anatomy. 49.51% of those who use social media platforms to study anatomy reported that they use Instagram. It was observed that 13.2% of the participants benefited from E-Sobotta and 12.6% from Atlas of Human Anatomy digital anatomy atlases.

Conclusion: We think that the results obtained in the study will contribute to anatomy education by including the resources that facilitate anatomy learning in the online education process into routine education programs.

Keywords: online anatomy education, anatomy resources, 3D anatomy atlases, social media platforms in anatomy, digital anatomy atlases

O-048

Three-dimensional visualization and quantification of the whole enteric nervous system in mouse and human using tissue clearing

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Objective: Recent studies on state-of-the-art tissue clearing methods enable visualization of the GI tract by increasing tissue transparency and enhancing the antigen-antibody reaction. The scope of the present study was to establish a combinatorial approach for the visualization and quantification of the gastrointestinal tract by establishing a 3D imaging method for the whole GI tract that yields more information and insight about the ENS than a traditional 2D tissue section imaging.

Methods: Our group has set up a method encompassing tissue clearing, immunohistochemistry, confocal microscopy, light-sheet fluorescence microscopy, and quantitative analysis of full-thickness bowel for 3D imaging at high resolutions of the digestive organs in mice and humans. Three-dimensional image reconstruction and statistical methods were used to describe the ENS network quantitatively and provide novel insights into ENS architecture.

Results: The multiscale structural decomposition of mouse and human ENS was clearly visualized in 3D. Our group investigated the cholinergic ENS structure through the whole GI tract, which quantified the number of cell bodies and cell bodies per ganglion in myenteric and submucosal plexus in mice. To identify the network of the myenteric plexus in mice, we measured the number of ganglia and bridges without cell bodies connecting the ganglion. Quantitative data for myenteric plexus and submucosal plexus showed relatively different aspects.

Conclusion: Our study presents the visualization of the ENS in the reconstruction of the three-dimensional cytoarchitecture of the mouse tissue quantitatively analyzed, preserving the tissue structure and providing accurate data with tissue clearing.

Keywords: tissue clearing, enteric nervous system, myenteric plexus, submucosal plexus, three-dimensional structure

O-049

Evaluation of dendrite morphology in Wistar and genetic absence epileptic (GAERS) rats

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Objective: The aim of the study is to examine the morphological features of dendrites and dendritic spines of pyramidal neurons in somatosensory cortex and hippocampus of Wistar and GAERS (Genetic Absence Epilepsy Rat from Strasbourg) rats.

Methods: GAERS (n=5) and Wistar (n=5) rats were sacrificed by transcardial perfusion method. Brain tissues were stained using the FD Rapid GolgiStain Kit. Coronal sections of 200 µm thickness were obtained with cryostat. Pyramidal neurons in deep layers of the somatosensory cortex and CA1 region of the hippocampus were examined using a light microscope and Neurolucida 360 software. Branching and length of apical dendrite and basal dendrites, and types and densities of dendritic spines were analyzed.

Results: Statistically the total number of dendrite nodes (p=0.0053, p=0.0047), the total number of dendrite segments (dendritic arborization) (p=0.0036, p=0.0036), the total number of dendrite terminations (p=0.0033, p=0.0029), the total dendrite length (µm) (p=0.0002, p=0.0007) and the dendritic spine density (1/µm) (p=0.0168, p=0.0120) of the somatosensory cortex and the hippocampus were significantly higher in GAERS rats, respectively. When dendritic spine types were evaluated separately, stubby type dendritic spines in the hippocampus were found to be significantly higher in GAERS rats compared to Wistar rats (p=0.0204).

Conclusion: It was concluded that intense synaptic activation seen in postsynaptic cells in the somatosensory cortex and hippocampus in GAERS causes changes in the dendrite morphology of pyramidal neurons. Grant declaration: This study was supported by Marmara University Scientific Research Projects Commission (TYL-2021-10244).

Keywords: absence epilepsy, GAERS, dendrite, dendritic spine

O-050

Ameliorative effect of 'Zingiber offinale and Allium sativum' on the hippocampus of streptozotocin induced diabetes mellitus in adult male wistar rat models

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Objective: Diabetes mellitus is an endocrine disease that leads to functional and structural changes in the brain. It often leads to a number of complications, including cognitive decline and depression. The aim is to study the effects of Zingiber officinale and Allium sativum on the hippocampus of streptozotocin induced diabetes mellitus in adult male wistar rats.

Methods: 36 rats were allocated into nine (9) groups: control group (NC), diabetic control (DC), standard drug, diabetes+ ethanol Ginger and Garlic 400 mg/kg, diabetes + aqueous Ginger and garlic 400 mg/kg, diabetic + Ginger 300 mg/kg, diabetic + garlic 300 mg/kg, and Ethanol Ginger + Garlic 400 mg/kg and aqueous Ginger+ Garlic 400 mg/kg were given orally for 14 days, following diabetes mellitus induction of multiple dose of STZ (70 kg/kg body weight) intraperitoneally. For spatial memory and learning, neurobehavioural assay and histological stain of the hippocampi was done.

Results: The hippocampus of the normal control group showed the granular cell layer (GL) and normal pyramidal cells (PC). Diabetic control showed a section of granule cell layer of the dentate gyrus, there was presence of vacuolation and pale nuclei. The group treated with Metformin showed mild distortion of the granular cell layer, darkening of the cells and presence of pale nuclei. Treatment with extracts showed its effect in restoration of neuronal cells with distinctive characteristic cell layers in ethanolic extracts of Z. offinale and A. sativum mix over the aqueous extract mixture.

Conclusion: This study has shown a relationship between the two extracts and how significant they can be to the hippocampus of a diabetic adult wistar rat.

Keywords: diabetes mellitus, hippocampus, zingiber officinale, allium sativum, streptozotocin

O-051

Dorsal and ventral hippocampus changes in a novel TDP-43 overexpression rat model by viral-mediated gene transfer method

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Objective: Although effects of TarDNA-binding protein-43 (TDP-43) on motor neurons are known, vulnerability of the hippocampus is inexplicit. We aimed to investigate cognitive and hippocampal morphological alterations in rats overexpressing TDP-43.

Methods: Sprague-Dawley male rats (n=5, each group) were transduced via viral vectors (AAV9-pCMV-TDP43-GFP, 6.4x1012 gc/ml) while controls received saline through their tail vein, at PND 30. Two weeks later, elevated plus maze (EPM), novel object recognition (NOR), 8-armed radial maze test (RAM) were used to measure anxiety, attention, and spatial memory performances of animals, respectively. Animals were sacrificed by intracardiac perfusion under anesthesia. Density of neurons in Nissl-stained sections (lateral 3.90–4.32) were counted in the dorsal and ventral dentate gyrus and CA1–3 regions of the hippocampus. All of the procedures were approved by the Institutional Animal Usage Committee of ESOGÜ (Protocol: 154/841).

Results: Statistical analysis of behavioral tests revealed no difference between groups in the EPM, but the control group received significantly higher scores in NOR and needed more time to consume all the food rewards in RAM ($p<0.05$). The number of Nissl (+) cells per unit area in the total hippocampus and dorsal dentate gyrus decreased significantly ($p<0.05$) in the experimental group compared to controls.

Conclusion: Our data suggest that overexpression of native TDP–43 gene might have region specific effects in the hippocampus and cause reduction in the granule cells of dorsal dentate gyrus. This novel and relatively low-cost animal model can be used to investigate morphological alterations in various animal models of neurodegenerative diseases (TÜBİTAK Grant # 1919B012004851).

Keywords: AAV, TDP–43, CMV, dorsal-ventral hippocampus

O-052

The role of platelet-rich plasma (PRP) on motoric functions after peripheral nerve injury

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Objective: Peripheral nerve injury is one of the causes of disability in the world. Riset Kesehatan Dasar (Riskesdas) stated that in 2018 there were 67,9% of the population of all accidents that occurred in Indonesia experienced leg trauma, while walking is one of the most important motoric functions for daily activities. Platelet-rich plasma (PRP) is an autologous product with higher concentration of platelets. PRP is currently considered to have benefits as a complementary therapy for nerve regeneration. There are various growth factors, cytokines, and microparticles in PRP. This study aimed to determine and analyze the role of PRP on sciatic rat models through motoric function examinations.

Methods: The research study used 18 male Wistar rats which were divided into three groups. Each group was treated with sham surgery (control), sciatic nerve injury only (P1), and sciatic nerve injury with PRP therapy (P3). Furthermore, motoric function examinations were carried out once a week for 42 days using Sciatic Functional Index (SFI) and Foot Fault Test (FFT).

Results: Based on the results, there were insignificant differences between P1 and P3 groups ($p>0.05$; one-way ANOVA) on the 14th day with SFI and FFT examinations. It indicated improvement in motor function began to occur on day 14 in group P3, a week faster compared to without PRP treatment (P2). Complete healing of all groups appeared on day 28 ($p>0.05$; one-way ANOVA).

Conclusion: In conclusion, PRP therapy can accelerate peripheral nerve regeneration as indicated by an increase in motoric functions after sciatic nerve injury especially on day 14.

Keywords: peripheral nerve injury, sciatic nerve injury, platelet-rich plasma, motoric function

O-053

The dose dependent effects of linalool on the cerebellar morphology of diabetic rats

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Objective: We investigated the morphological alterations in the cerebellum of diabetic rats and tested the potential effects of Linalool, commonly used monoterpene alcohol in medicinal plants due to anti-inflammatory and antioxidant properties.

Methods: Sprague Dawley male rats (n=30) were divided into; control, diabetes (Streptozocin, 50 mg/kg, IV), treatment (75 mg/kg, and 150 mg/kg doses, IP, 14 days.) groups. Induction of diabetes was confirmed with high blood glucose level. After intracardiac perfusion, 80 µm-thick serial sections from the vermis, paravermis, hemisphere regions of the cerebellum were stained with toluidine blue. The volume proportions (Vv) of the molecular (ML) and granular layer (GL) were estimated by point counting method and number of Purkinje cells per unit length of Purkinje cell layer (PCL) was compared with statistical methods. All procedures were approved by the Institutional Animal Usage Committee of ESOGU (Protocol number: 883/2022).

Results: The mean Vv of vermal ML and GL in diabetic and high dosage Linalool treatment group were significantly greater than control group, respectively (1.59±0.18, 1.52±0.13>1.27±0.04). One-way ANOVA results of the Purkinje cell density did not display a significant difference between control and treatment groups.

Conclusion: Different cerebellar subregions have distinct functional heterogeneity and connectivity. Besides, we observe that the vermis is more vulnerable to changes than the paravermis and hemisphere regions following induction of hyperglycemia and diabetic neuropathy in animals. Comparable morphological parameters in the low dosage Linalool treatment and control groups suggest that this molecule might be useful to prevent neuron damage of diabetic animals

Keywords: cerebellum, diabetes, linalool, rat, peripheral neuropathy

O-054

Developing maternal socio-demographic and anthropometric protocol: determining birth size and delivery outcomes at the Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Nigeria

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Objective: The study aims to determine the influence of maternal socio-demographic and anthropometric parameters on birth size and delivery outcomes at AE-FUTHA

Methods: The study involved a cross section of pregnant mothers and their newborn babies. A total of 400 pregnant mothers that were certified by an obstetrician as being healthy in the antenatal ward of AE-FUTHA, Nigeria from 1st May 2020 to 1st June 2021, were involved. Informed consent was voluntarily signed by each participant. Ethical approval was obtained from the Ethics and Research committees of AE-FUTHA. The study adopted direct standard anthropometric measurements, obstetric protocol and a questionnaire approach. Maternal and neonatal anthropometric features, socio-demographic factors and delivery outcomes were considered in this study, using guidelines of Institute of Medicine.

Results: There was a significant difference between the birth length of male and female neonates ($p<0.05$). The mode of delivery of male neonates was strongly associated with maternal degree of pain during labor. Furthermore, there is an association between Apgar score at 5 minutes of birth for male neonates and maternal parity ($p<0.05$). The logistic regression shows that the mode of delivery of male neonates depends on the maternal degree of pain during labor.

Conclusion: The study established that maternal socio-demography and anthropometry are determinants of delivery outcomes. It also suggested that gynecologists and nurses should place great emphasis on weight control measures during antenatal visits to reduce birth complications, especially through spontaneous vaginal delivery.

Keywords: anthropometries, birth size, neonates, painful labor, vagina

O-055

A comparison of results using three mathematical models for multifactorial adult age-at-death estimation in a South African population

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Objective: Achieving both acceptable accuracy and precision when calculating adult age-at-death estimations from the skeleton remains challenging. As a result, mathematical methods used to produce age-at-death estimations have become increasingly complex. This study compared results from a mathematically complex method - Bayesian analysis - with a phase-based averaging method and linear regression analysis to analyze whether more complex methods produced better results.

Methods: Data were collected from 330 skeletons housed in the Raymond A Dart Collection of Human Skeletons and the Pretoria Bone Collection. An additional 30 skeletons were analyzed as a hold-out validation sample to test the mathematical methods developed. The three mathematical models were evaluated for bias, inaccuracy and precision.

Results: The averaging method performed particularly well, achieving small mean intervals of between 8 and 11 years while simultaneously maintaining accuracies between 75 and 85%. The regression analysis method also achieved small mean intervals of between 8 and 11 years, but accuracy obtained was between 19 and 43%. Finally, the Bayesian method achieved mean intervals of between 18 and 21 years, but only produced accuracies of between 19 to 31%.

Conclusion: Thus, the regression analysis method as well as the averaging method consistently outperformed the Bayesian analysis method when assessing both accuracy and precision. This indicates that the additional computational power and mathematical complexity required for Bayesian analysis did not produce corresponding improvements in the age-at-death esti-

mates. An ethics waiver (W-CJ-140604-1) applies to this study as per the National Health Act No 61 of 2003 of South Africa.

Keywords: adult age-at-death estimation, Bayesian analysis, forensic anthropology, regression analysis

O-056

Proportional evaluation of measurements related to height and body parts: assessment of the presence of golden ratio

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Objective: In this study, we aimed to examine the ratios between body mass index and body parts in adults. We also investigated the possible relationship between these ratios and the golden ratio.

Methods: A total of 97 subjects in the age range of 18–45 were included in the study. In the Frankfort plane, height, navel to head distance, navel to foot distance, and distance between two arms were measured. The body weights of the individuals were measured with a digital scale. These measurements were evaluated for compliance with the golden ratio.

Results: The ratio of height to navel to foot distance was found to be 1.66. The ratio of the navel to foot distance to the navel to head distance was 1.49. There were not statistically significant differences between males and females regarding body height to navel to foot distance (males: 1.68 vs females: 1.66 $p>0.05$). In females, the ratio of the navel to head distance to the navel to foot was 1.51. In males (n=38), the ratio of height to navel to foot distance was found to be 1.68.

Conclusion: We have found that ratios between the height and upper and lower body parts in regard to navel are relatively close to golden ratio. Although these ratios show slight deviation from the number of 1.618, potential variations in methodology and defining landmarks might have contributed to this deviation. Therefore ratios between the height and body parts deserve to be evaluated in further clinical studies using different measurement methods and landmarks.

Keywords: golden ratio, 1.618, anthropometry, body parts, body mass index

O-057

Assessing growth changes in the human palate across different stages of dental eruption

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Objective: The immature palate functions in suckling and swallowing, while in adulthood the palate transitions to participate in mastication and sound production. These alterations in function are accompanied by morphological changes to the palate which may be due to dental eruption. The aim of this study was thus to analyze whether the eruption of teeth influenced morphological growth changes of the human palate in pediatric and sub-adult individuals

Methods: Ethical clearance was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (W-CBP-210401-01). Crania from 72 individuals were sourced from the Raymond A. Dart Collection of Human Skeletons, University of the Witwatersrand. Three age groups which correspond with the eruption of the deciduous (birth–5 years), mixed (6–12 years) and permanent dentition (13–20 years) respectively were used. Fourteen osteological landmarks were digitized across the oral surface of the palate. Landmark data using geometric morphometrics were converted into linear distances and assessed relative to the state of the dentition. Data analysis focused on alterations in size and shape.

Results: The palate in the permanent dentition group was significantly wider and longer when compared to that in the mixed and deciduous dentition groups Elevation of the palatal dome in the permanent dentition group was significantly greater when compared to the mixed dentition group.

Conclusion: Progressive changes in the morphology of the palate were observed as dental development and eruption progressed, providing insights into the nature of the early functional environment of the palate.

Keywords: dental eruption, immature palate, palatal dimensions, palatal shape

O-058

Quantitative differentiation of thoracolumbar transitional vertebrae: possible associations with other anomalies in the vertebral column

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Objective: Thoracolumbar transitional vertebrae (TLTV) result from overlapping somites and retain features from the thoracic and lumbar regions. Based on the current literature, a need to further investigate TLTV with regards to repeatable differentiation, classification and clinical significance had been identified.

Methods: This project aimed to identify vertebral anomalies and to determine whether TLTV can be quantitatively differentiated from thoracic and lumbar vertebrae at the thoracolumbar junction. Skeletal remains from Pretoria and the Western Cape of South Africa (n=287) in addition to CT scans (n=175) from Windhoek in Namibia were evaluated in this study. This was achieved by measuring the superior zygapophyseal facet angle. This study also aimed to evaluate whether associations exist among congenital malformations of the spine.

Results: The results show that the prevalence of TLTV ranges between 7.5% (Windhoek), 30% (Western Cape) and 33.2% (Pretoria) in the reference samples. The results clearly demonstrate that thoracic, lumbar and TLTV falls into separate confidence intervals in skeletal remains T12 is 189±9.5 (CI: 188–190), 110.6±7.88 (CI: 109.0–111.6) for L1, and 137±24.11 (CI: 133.5–140.5) for TLTV. The mean confidence interval in CT-scans for T12 is 182.8±10.4 (CI: 181.6–183.9), 112.3±7.27 (CI: 111.5–113) for L1, and 136±23.18 (CI: 125–147) for TLTV.

Conclusion: The results strongly infer that quantitative morphometry from the superior articular facets of vertebrae can differentiate between T12, L1 and TLTV using radio-images or skeletal remains.

Keywords: congenital defects, transitional vertebra, vertebral column

O-059

Revisiting the muscles and nerves of anterior compartment of the arm: preliminary results of a cadaver study

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Objective: Differences in cell migration during embryological development of the arm can result in variations of multiple structures. The aim of this study was to evaluate variations of structures in the arm and relations between them for possible explanations of entrapments as well as further information about related regions for a better approach during surgical procedures.

Methods: This study was conducted in the Department of Anatomy, Bahçeşehir University Faculty of Medicine. Anterior compartments of arms were dissected bilaterally and variations were detected in 1 cadaver out of 6 cadavers (3 females, 3 males). All parameters were measured using a digital caliper (Shan 150 mm, China). The study was conducted in accordance with the declaration of Helsinki.

Results: Two accessory heads (superior, inferior) observed in the right arm of 1 female cadaver (%8.3) arose from the medial side of the short head of biceps brachii (BB), inserted into medial intermuscular septum of arm. Superior accessory head (length: 153.9 mm transverse diameter: 12.2 mm) had muscle fibers from both the short head of BB and coracobrachialis muscle (CB). Inferior accessory head (length: 106.47 mm; transverse diameter: 9.83 mm) had fibers from just BB. musculocutaneous nerve (MCN) did not penetrate CB but rather provided a muscular branch, and gave a communicating branch to median nerve (MN). MN and brachial artery coursed under extra heads.

Conclusion: An extra head of BB variation with such origin and insertion is not very common in the literature. Present study suggests that such variations defined here may be related to entrapments of MN and brachial artery. Furthermore, it is critical to understand these variations prior to surgical interventions.

Keywords: accessory head of biceps brachii, entrapments, extra head, median nerve variations, musculocutaneous nerve variations

O-060

Width of the orbicularis oculi fibers extending to the upper lip with the lateral and inferior lengths of the orbicularis oculi at the level of the lateral canthus: application to botulinum neurotoxin type A injection for crow's feet

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Objective: The aim of this study was to clarify width of extending fibers of the orbicularis oculi muscle (OOc) to the upper lip and the lateral and inferior lengths of the OOc at the level of the lateral canthus. The obtained data will be helpful to distinguish the muscles underlying the wrinkles around the lateral canthus for a safer and efficient BoNT-A treatment for crow's feet.

Methods: The OOcs were investigated in 40 hemifaces from Korean cadavers. This study was approved by the Institutional Review Board of the Catholic Kwandong University (IRB no. CKU-21-01-0603).

Results: Some lateral fibers of the OOc (OOc lat) extending to the upper lip were identified at the level of the lateral canthus in 77.5% of the specimens, whereas some inferolateral fibers of the OOc extending to the upper lip were found near the level of the lower margin of the OOc in 22.5%. The mean and maximum widths of the OOc lat extending to the upper lip at the level of the lateral canthus were 6.9 mm±3.3 and 14.3 mm, respectively. Mean lateral length and mean inferior length of the OOc at the level of the lateral canthus were 33.9±4.4 mm and 30.5±3.7 mm, respectively.

Conclusion: The present study analyzed the lateral and inferior lengths of the OOc and its extending fibers to the upper lip, thus clinicians can predict the areas and borders of the OOc and its extending fibers to the upper lip underlying the wrinkles around the lateral canthus.

Keywords: lateral canthus, orbicularis oculi muscle, width, upper lip

O-061

Localization of the mandibular lingula using panoramic radiographs

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Objective: To determine the anatomical location and to identify changes over time of the lingula through panoramic radiographs (PR) in patients aged 5 to 12 years.

Methods: In this cross-sectional study, 407 PR were analyzed from the database of the Oral and Maxillofacial Imaging Service of the Faculty of Dentistry of the Andrés Bello University, Viña del Mar, Chile. Data analysis was performed using descriptive statistics and the Student's t-test was performed to determine statistical differences, considering $p<0.5$. This study was approved by the Research and Ethics Committee of the School of Dentistry of Andres Bello University

Results: The position of the lingula with respect to the occlusal plane becomes cephalic as the patient grows (1.7 mm/5 years and 4.2 mm/12 years). Its distance from the anterior border of the mandibular ramus ranges from 14.3 mm (6 years) to 15.2 mm (10 years). There are no significant differences in relation to the eruption stages, except for the location of the lingula with respect to the occlusal plane ($p<0.01$).

Conclusion: The changes in the anatomical position of the lingula are directly related to the age and eruption process of each tooth.

Keywords: panoramic radiography, inferior alveolar nerve, mandibular lingula

O-062

Topographic anatomy of the tibial nerve and posterior tibial artery in the tarsal tunnel

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Objective: We aimed to examine the topographic relationship between the neurovascular structures and tarsal tunnel (TT) in adult cadavers.

Methods: This study was performed on 10 adult cadavers (5M; 5F) fixed with 10% formalin. We measured the distance of bifurcation points of tibial nerve (TN) and posterior tibial artery (PTA) to the malleolar-calcaneal axis (MCA) and horizontal axis (HA) and classified these bifurcation points in relation to MCA. We also investigated the positional relationship between PTA and TN at the bifurcation point of PTA. Ethics committee approval was not obtained as the cadavers donated their bodies for scientific research.

Results: The bifurcation points of both TN and PTA were classified into 5 main types. We detected the most common patterns regarding bifurcation points of TN and PTA were Type I (n=16, 80%) and Type III (n=12, 60%), respectively. We observed that bifurcation of TN was proximal to HA and outside TT in two cases bilaterally. We found that TN passes on the left side in front of the PTA inside TT in only one case. In 12 cases, the bifurcation point of PTA was medial to the lateral plantar nerve.

Conclusion: Proximal bifurcation of TN is thought to promote tarsal tunnel syndrome by causing narrowing at the entrance of TT. It is important in TT surgery to mind that the bifurcation point of PTA is medial to the lateral plantar nerve in most cases.

Keywords: anatomic variation, posterior tibial artery, tarsal tunnel, tibial nerve

O-063

Case cadaveric series on the sural nerve formation variants and the aberrant sensory innervation of the lateral surface of the foot

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Objective: The sural nerve (SN) is a sensory cutaneous nerve, that originates from a combination of either the sural communicating branch and medial sural cutaneous nerve (MSCN), or the lateral sural cutaneous nerve (LSCN). SN terminates as the lateral dorsal cutaneous nerve in the lateral ankle. The study explores the diversity in SN formation and the variant sensory innervation of the lateral surface of the foot.

Methods: Fifty unpaired formalin embalmed cadaveric lower limbs derived from the Anatomy Department of AUTh body donation program were dissected at the popliteal fossa and posterior leg compartment. The sciatic nerve and its division were

identified, as well as the MSCN and LSCN. The dissection proceeded to the SN's entire length and the sensory innervation of the lateral surface of the foot was recorded.

Results: The level of the SN complex formation was located in the middle third of the posterior tibial surface in 23 cases (46%), in the lower third in 20 cases (40%), and in the upper third in 7 (14%). In 11 cases (22%) no SN was found. Huelke type II variant course and termination was identified in 39 cases (78%), type I in 10 cases (20%), and type III in a single case (2%).

Conclusion: The knowledge of the SN variants has a high diagnostic value in nerve conduction studies, as well as in biopsies of the peripheral nervous system and neuromuscular diseases. In addition, the knowledge of the SN variants may explain unsuccessful cases of the SN block during surgical procedures.

Keywords: lateral sural cutaneous nerve, medial sural cutaneous nerve, sensory innervation, sural nerve, variant

O-064

Topographical anatomy of the superficial temporal artery

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Objective: The purpose of this study was to establish a detailed study focusing on a gross anatomy of the STA, the course and the branches of the STA and its relations with the branches of the facial nerve especially around the zygomatic arch, certain anatomical and surgical landmarks to preserve STA and its branches and the facial nerve and its branches in daily neurosurgical practice and also to use the STA during revascularization surgery.

Methods: It is a cadaveric study that 16 cadaver heads were used bilaterally (a total of 32 STAs, that were silicon/latex injected arteries, were dissected by using the microdissection technique in Ankara University School of Medicine, Department Anatomy).

Results: The average values of the parameters were measured as, a1: 25.39 mm, a2: 29.84 mm, a3: 23.83 mm, a4: 15.56 mm, b1: 20.95 mm, b2: 13.01 mm, b3: 4.85 mm. c1: 39.29 mm, c2: 20.26 mm, d1: 97.63, d2: 96.45 mm, e: 9.83 mm, f1: 11.01 mm, f2: 25.62 mm, f3: 16.78 mm, g1: 27.21 mm, g2: 14.44, g3: 1.23 mm.

Conclusion: The results of this anatomical study demonstrate that to know the anatomy of the STA and its branches and its relationships with other structures such as STV, the frontal branch of the facial nerve is of critical importance for a successful and a non-complicated surgery.

Keywords: anatomy, cadaver, anatomic study, superficial temporal artery, zygomatico-orbital artery

O-065

Contralateral transorbital endoscopic approach to petrous apex: a feasibility cadaver study

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Objective: Petrous apex of the temporal bone is an anatomically challenging area to access. Traditionally the subtemporal open approach is the norm. Nowadays in suitable cases minimal invasive ventral approaches are the preferred approaches. The aim of this anatomic study is to compare and combine contralateral transorbital endoscopic approach with endonasal endoscopic approach to get full access to the petrous apex and to describe technical notes of this approach. As far as we know this is the first study defining and evaluating contralateral petrous apex approach.

Methods: Two human cadaver heads (4 sides) were dissected. Pre-dissection CT scans of each specimen were done to plan the approach. Endoscopic dissection through purely endonasal endoscopic route and a combined with contralateral transorbital route were done. No ethical approval was required.

Results: The two minimally invasive approaches (endonasal endoscopic and contralateral transorbital) to petrous apex let us have different visualization to the petrous apex. Contralateral transorbital approach to the petrous apex makes it possible to visualize ICA better and can give a direct access to the petrous apex. Contralateral transorbital routes mostly allow visualization and manipulation of superior portions of the petrous apex. A combined approach makes it possible to reach and remove petrous apex fully without a need for a curved drill.

Conclusion: Surgical approach to petrous apex is challenging. Combined approach with endonasal and contralateral transorbital route provides full control to the petrous apex. This combined approach may be especially useful if there is no access to curved endoscopic instruments and drills.

Keywords: endoscopic endonasal, endoscopic transorbital, petrous apex, skull base surgery

O-066

Beyond the tip of the iceberg: a meta-analysis on the anatomy of the clitoris

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Objective: Historically, the clitoris has often been tarnished with a shroud of shame and has been demeaned as not clinically relevant. As such, empirical data regarding the anatomy of clitoral structures is lacking. Therefore, the aims of this study are to collate data on the anatomy of the clitoris, in addition to highlighting the lack of representation within the literature.

Methods: A systematic review and meta-analysis was performed on Ovid Medline and Embase. Descriptions and measurements of clitoral structures were extracted from cadaveric, patient and medical imaging studies, in addition to 32 anatomical textbooks. A meta-analysis was performed to calculate the average measurement and range of clitoral structures, and a statistical analysis was performed to compare these measurements from different study modalities.

Results: Within the anatomical textbooks, the word 'penis' was mentioned 2.6 times more than the word 'clitoris' and discrepancies in anatomical descriptions were elucidated. Nine textbooks reported the distance between the external urethral meatus and the clitoris (20.00–30.00 mm) and only two reported the combined length of the glans and body (20.00 mm; 30.00–40.00 mm). Data was extracted from 31 relevant studies. The average length and range of the glans (8.60 mm; 0.5–35 mm), body (28.14 mm; 13.00 mm–59.00 mm), crura (48.43 mm; 25.00 mm–90.00 mm), bulb of the vestibule (54.00 mm; 13.00 mm–70.00 mm), prepuce (23.84 mm; 5.00 mm–40.00 mm) and frenulum (9.5 mm; 5.00 mm–12.00 mm) was calculated. No statistical difference was found between the different imaging modalities utilized.

Conclusion: The clitoris is an underrepresented structure in medical textbooks. The normal variations in clitoral measurements should be disseminated to healthcare professionals and the public.

Keywords: clitoris, female, female anatomy, genitals

O-067

A microsurgical study of the anatomy and anatomical variations of the median nerve: a cadaveric study

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Objective: Variations in the morphological anatomy of the median nerve such as formation, distribution, and communication have been very well documented. All these variations should be taken into account when practicing any surgical approach for the treatment of injuries affecting the median nerve, furthermore, are of the utmost importance for the interpretation of the clinical presentation.

Methods: The objective of this investigation was to determine the anatomical variations in the formation of the median nerve in cadavers at the Forensic Pathology department in Central Clinical Hospital of the Academy of Sciences of the Russian Federation, between January 2022 – April 2022. A descriptive, cross-sectional and prospective information source study was conducted on 42 anatomical bodies (corpses) and 84 brachial plexuses.

Results: After analyzing the results obtained in the investigation, we concluded that the median nerve presented a variation in its formation in 22.6% of investigated cases. These variations occur more in males (81.8%) than in females (18.2%). The anatomical variation was unilateral in 7.1% and bilateral in 19% of all anatomical bodies examined.

Conclusion: The median nerve presented a great number of variations in its formation in roughly 23% of anatomical bodies with male being the predominant gender. Furthermore, the most frequent region of formation was the axillary region (92.9%). For clinicians it is important to remember these variations during surgical procedures in this area and during brachial plexus block.

Keywords: anatomical variations, median nerve, corpses, brachial plexus, peripheral nerve

O-068

Clinically relevant morphometric analysis of pterygopalatine fossa and its volumetric relationship with adjacent paranasal sinuses: a CT-based study

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Objective: Researchers studied each anatomical content of the pterygopalatine fossa (PPF) separately in the literature due to its rich neurovascular structure and proximity to essential cavities. Our study examined morphometric measurements of all anatomical structures of PPF together in terms of surgical approaches in the same individuals and evaluated their relations with each other. Also, it investigated nasal and sphenoidal sinus (SS) septal deviations and their effects on PPF and surrounding paranasal sinuses volumes.

Methods: This study analyzed CT images of 260 patients (130 male and 130 female, age range 18–79). The local ethics committee approved it by resolution 2021/3268.

Results: All volume and most morphometric measurements were significantly higher in men than in women. Foramen rotundum (FR) diameter and the angle between FR and pterygomaxillary fissure were significantly higher in individuals without nasal septal deviation (p=0.001; p=0.000). Sphenopalatine foramen diameter was significantly higher in individuals without nasal and SS septal deviations (p=0.020; p=0.042). Only the maxillary sinus (MS) volume was considerably higher in the 18–34 age group (p=0.045). The volume of SS on the side with both nasal and SS septal deviation was significantly smaller.

Conclusion: Our study found no correlation between PPF and paranasal sinuses volumes, whereas there was a strong positive correlation between the SS and the MS volumes. Since PPF concerns many clinical branches such as dentistry, otolaryngology, and neurosurgery, we hope that our study can provide reference data for multidisciplinary surgical approaches applied in diagnosis and treatment.

Keywords: pterygopalatine fossa, paranasal sinuses, volume, septal deviation types

O-069

Chronic neck pain and its association with the angle of the cervical curve

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Objective: Neck pain is a common health problem among the working population of South Asian Countries including Sri Lanka. The objective of this study was to investigate the relationship between the angle of the cervical curve and the presence of chronic neck pain.

Methods: A case control study was conducted among 363 patients (76.9% female, 23.1% male) who had neck pain of more than 3 months and 349 individuals (58.5% female, 41.5% male) with no neck pain, aged 20–69 years. The ethical approval was obtained from the Ethics Review Committee (ERC) of the Faculty of Medical Sciences, University of Sri Jayewardenepura. The angle of the cervical curve was measured in lateral cervical χ-rays using AutoCAD 2007 and cross checked by a Consultant Radiologist, blinded to the clinical history. The angle of the cervical curve was classified as 30°–45° - normal, <30°–hypolordosis and >45°–hyperlordosis.

Results: The majority of the patients with chronic neck pain had hypolordosis (44.9%, n=163) or hyperlordosis (49%, n=178) categorized as the atypical angle of the cervical curve. The majority of the individuals with no neck pain (80.8%, n=282) had the normal angle of the cervical curve. Chi square test showed a statistically significant association between neck pain and the angle of cervical curve (p=0.001). Patients with an atypical angle have a 3.3 times risk of neck pain than individuals with a normal angle of the cervical curve.

Conclusion: Atypical angle of the cervical curve contributes to chronic neck pain.

Keywords: neck pain, angle of cervical curve, hypolordosis, hyperlordosis

O-070

Evaluation of the piriformis muscle anatomy by magnetic resonance imaging

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Objective: Variation studies of the piriformis muscle, which are generally classified according to the course and adjacency of the sciatic nerve, are few. It was aimed to evaluate the morphology diversity of piriformis muscle, which has significant functional and clinical effects, by magnetic resonance imaging.

Methods: This study was approved by the Selçuk University Faculty of Medicine Non-Invasive Clinical Research Ethics Committee (2022/266). A total of 484 patients who underwent sacroiliac joint magnetic resonance imaging between April 2021 and April 2022 were included in the study. The images were examined in the coronal oblique and axial planes.

Results: Bipartite piriformis muscle was found in 16 patients, five on the right, one on the left, and ten on both sides. Its agenesis in three patients, two on the right and one on the left, as well as significant asymmetry between the sides in 12 patients, and bilateral hypoplasia in one patient.

Conclusion: Due to its proximity to the surrounding neurovascular structures, piriformis muscle changes may have clinical consequences. Awareness of the piriformis muscle types is essential while evaluating different structures with a comprehensive incidence study of variation. Considering such variations aids clinicians in investigating low back and hip pain and surgeons operating on the gluteal region in evaluating potential prediagnoses and avoiding complications.

Keywords: agenesis, magnetic resonance imaging, piriformis muscle, variation

O-071

Evaluation of the alignment of the intersesamoidal ridge's axis through 3D-printing models and digital method

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Objective: To evaluate the angle between the axis of the intersesamoidal ridge of the first metatarsal and the axis of the first metatarsal, studies were previously performed on dry bones. However, since dry bones can not accurately reflect the first metatarsophalangeal angle, it is not easy to establish its relationship with Hallux Valgus (HV). A 3D-Printed model may be important in accurately detecting the ridge axis in individuals with HV and health.

Methods: According to our power analysis, 51 retrospectives computed tomographies of 25 individuals with HV and 26 healthy individuals were collected. The first metatarsal was modeled via 3D slicer software and exported in STL format. The angle between the axis of the intersesamoidal ridge and the axis of the first metatarsal was measured digitally via Ansys software. At the same time, the 3D-Print of the relevant model was taken and it was measured manually with a transparent protractor.

Results: In the study, since the variables were normally distributed, dependent groups were measured with the t-test. As a result of the analysis, it was observed that there was no significant difference between digital and manual measurements ($p>0.05$). One case from the HV group was unsuitable for ridge measurement.

Conclusion: In this study, we provide a protocol for detecting the ridge axis with an accurate, easy, and inexpensive method. 3D Models can be useful in the preoperative planning phase in HV surgery.

Keywords: 3D-printing models, digital method, the axis of the intersesamoidal ridge

O-072

Morphometric evaluation and classification of the superior orbital fissure on 3D MDCT images

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Objective: The anatomy of the superior orbital fissure is very important because of the spaces it connects, the regions it is adjacent to, and the structures it contains. We aimed to study the width, length and types of the structure, their change according to gender, body sides and age. The fissure shape has many variations that aren't easy to systematize. Therefore, it was aimed to classify them with various reference points determined for the first time, identify their types and determine their incidence.

Methods: An objective and comprehensive classification was used on three-dimensional images using multidetector computed tomography. Ethical approval (approval number: 2020/01) was given by the Local Ethics Committee of the Selçuk University Faculty of Medicine. We retrospectively evaluated the orbit and paranasal sinus computerized tomography images of 200 individuals (age range: 3 months-90 years; 106 female, 94 male).

Results: There was no statistical difference in the length of the fissure according to gender on both sides, and in width only on the left ($p>0.05$). On the right side, it was statistically significantly wider in female ($p<0.05$). While the fissure types were grouped based on observation in the literature, they were defined more comprehensively according to different shape features by giving a certain reference lines by us for the first time and evaluated over seven types. The most common shape for both sides was racket-shaped type (right: 24.5%, left: 26%), while the least common was narrow type (right: 1%, left: 2%).

Conclusion: Thus, the shape variations of structure have gained a systematic typing criterion for the first time with the definitions in our study.

Keywords: morphology, morphometry, multidetector computed tomography, superior orbital fissure, variation

O-073

Investigation of the presence of discoid meniscus and its effect on anatomic structures in the knee joint by magnetic resonance images: a retrospective study

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Objective: We aimed to investigate the effect of the presence of discoid meniscus (DM) on the anatomical structures of the knee joint.

Methods: The knee magnetic resonance (MR) images of 144 (97 female, 47 male) individuals with DM and 159 (94 female, 65 male) individuals with normal meniscus were evaluated.

Results: DM was mostly seen on the left side (n=64). This was followed in decreasing order by the right side and bilateral. The incidence of DM was higher in individuals aged 36 years and older than in 18 years and younger ($p=0.003$). Incomplete type DM was seen most frequently in both genders. Meniscopathy

was most common (n=21) in the medial meniscus of people with DM. Unilateral lateral meniscopathy was more common in individuals with bilateral DM. And also in individuals with normal meniscus, meniscopathy was also most common (n=31) medially. Unilateral medial meniscopathy was the most common in those with normal meniscus. When the affected ligaments were examined, tearing and degeneration were most common (n=21) in the ligamentum cruciatum anterius (LCA) in individuals with DM. On the other hand in the presence of DM, chondropathy (n=42) on adjacent joint surfaces was reported. It was determined that ligament damage was mostly (n=43) in LCA in normal menisci. In addition, the presence of chondropathy was observed on the bone surfaces adjacent to the joint (n=64) in normal menisci.

Conclusion: Almost all of the DM was located in the lateral meniscus. This was mostly accompanied by meniscopathy and LCA injury.

Keywords: discoid meniscus, knee joint, magnetic resonance

O-074

The development of a core musculoskeletal anatomy syllabus for physical therapy education

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Objective: Musculoskeletal anatomy is fundamental to physical therapy education. Despite the development of detailed anatomy syllabuses for medical and other health professional students, none are available for training physical therapists. The aim of this project was to produce a core musculoskeletal anatomy syllabus specific to physical therapy students, utilizing a modified Delphi approach.

Methods: The Delphi panel consisted of 53 anatomists and clinicians involved in physical therapy education from a wide range of countries. The panel rated a total of 2193 anatomical items encompassing the vertebral column and limbs, based on whether they were considered core knowledge for a competent physical therapy student. Using specific criteria, each item was then classified as core, recommended, not recommended or not core. Ethical approval was granted by the Australian National University Human Research Ethics Committee.

Results: Of the 2193 items, 1700 (77.5%) were rated as core or recommended. For the musculoskeletal concept items, 70% (233/332) were categorized as core/recommended. Approximately 80% of items in the other three categories were considered core/recommended – vertebral column (355/440); pectoral girdle and upper limb (513/657); pelvic girdle and lower limb (599/764).

Conclusion: This study presents a detailed musculoskeletal anatomy syllabus which may be used within a physical therapy curriculum. A key difference compared to published musculoskeletal anatomy syllabuses for medical students was that a greater number of items were considered core/recommended (approximately 80% vs 50%). These findings will now be presented for consideration and deliberation in accordance with the International Federation of Associations of Anatomists modified Delphi approach.

Keywords: Delphi study, education, gross anatomy, musculoskeletal system, syllabus

O-075

Neuroanatomy in the medical curriculum: a South African perspective

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Objective: Medical schools have implemented strategies in response to neurophobia to counteract the negative perception and to improve neuroscience experiences for undergraduate medical students. In this study we explored the attitudes, perceptions, and preferred learning approaches of undergraduate- and postgraduate medical students toward the teaching, facilitation, learning and assessment of neuroanatomy, as well as their perceptions on its relevance in the South African medical curriculum.

Methods: Ethical clearance was obtained for this study. A total of 299 undergraduate and five postgraduate students from the University of Pretoria participated in this study. We used a multimethod approach in which the undergraduate students completed an anonymous quantitative questionnaire, while the postgraduate students participated in a qualitative focus- group discussion.

Results: Undergraduate medical students preferred lecture notes to study from above any other type of literature and mainly used laptop computers as preferred electronic devices in preparation for their assessments. The most favorite topic was cranial nerves, and the least favorite was histology of the nervous system. Postgraduate students shared their undergraduate neuroanatomy experiences and provided constructive feedback and suggestions to undergraduate students and lecturing staff.

Conclusion: Ineffective teaching methods and limited contact time remain factors that contribute to neurophobia in South Africa. Students perceive neuroanatomy as an interesting and important subject in their medical degree, however, changes are needed to modernize neuroanatomy and make it more accessible and student friendly. The challenge then remains, how do we, as lecturers, modernize neuroanatomy in the medical curriculum to make it contemporary and clinically applicable?

Keywords: neuroanatomy curriculum, neurophobia, postgraduate medical students, undergraduate medical students

O-076

A postgraduate perspective of radiology into the anatomy curriculum

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Objective: Due to the current situation regarding the uncertainty of available cadavers and the advancement of medical imaging, radiology has provided a means to sustain postgraduate research in the discipline of clinical anatomy. This study aimed to determine the depth of current anatomical knowledge and its application in research using radiological imaging.

Methods: A questionnaire was completed by a group of postgraduate participants (n=16) at different levels of postgraduate studies. Participants evaluated their experience with basic knowledge of radiology, confidence prior to commencement of their current radiological based research projects, and possible solutions that would aid in building their radiological skill-set. Furthermore, self-reflective pieces regarding the use of radiological material was also assessed. (Ethical clearance number: BREC/00004342/2022).

Results: A total of 87.5% had prior knowledge in basic radiology with the majority having received a lecture (31.3%) or self-rated knowledge (31.3%). Participants felt they did not possess the necessary skill-set to complete a radiological based project without the assistance of a clinician or radiologist (100%). A total of 12.5% rated their confidence as very good in being able to identify radiological structures. Participants felt that integrating more complex radiology content at an undergraduate level would aid in building their radiological skill-set (68.8%). Qualitative analysis on the self-reflective pieces identified three different themes.

Conclusion: A lack of knowledge and skill regarding radiological examination of different types of medical imaging exists. It is therefore crucial that the implementation of a complete radiology-based module at an undergraduate level be considered.

Keywords: postgraduate, qualitative, radiological imaging

O-077

A Southern African perspective on the ethical use of digital images in anatomical teaching

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Objective: The Covid-19 pandemic resulted in the reduction of face-to-face teaching and escalated the move to online anatomy instruction, using digitized cadaveric resources. However, concern has arisen regarding informed consent by body donors for the use of their remains, which may not have been considered at the time of their death, for use in digital resources for teaching and research. This study therefore assessed the awareness of southern African anatomists to the provenance and ethical use of human material for digital resources used in their teaching.

Methods: Ethical clearance was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (M200866). The study consisted of a cross-sectional, self-administered, anonymous questionnaire conducted on a research data system, REDCap, which was administered to southern African anatomists.

Results: Of the 46 southern African anatomists who responded to the survey, less than 40% confirmed that they knew the provenance of the human material used in their teaching resources. Of these respondents, 20% indicated that it was acceptable to use unclaimed remains for digital images, while 37% were against it. Some respondents were not concerned with using unclaimed remains if it was legal (as is the case in South Africa), although this is not recommended by the International Federation of Associations of Anatomists (IFAA, 2012).

Conclusion: It is recommended that clear guiding principles be established for the best ethical practice in producing and using digital images from human remains.

Keywords: anatomical education, consent, digital technology, ethics, provenance

O-078

Factors that influence decomposition timeline estimation in Anambra state, Nigeria

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Objective: There is no literature on factors that affect decomposition timeline estimation in Nigeria. Therefore, the purpose of this study was to investigate the factors that play vital roles in the estimation of decomposition timeline of carcasses on soil surface in Anambra state, Nigeria.

Methods: The ethical approval (079PHY3321) was obtained from the ethical committee of the Faculty of Basic Medical Sciences, University of Calabar, Nigeria. Two Sus scrofa domestica (male and female) were used for this study because

of strict animal protection index laws on animal rights in Nigeria. Pearson correlation was employed to determine the relationship between decomposition, and six factors of decomposition such as atmospheric temperature, humidity, rainfall, soil temperature, soil pH, and duration of decomposition. Prediction models for time since death and decomposition were derived by regression analyses.

Results: Findings from the study showed that the factors that statistically ($p<.05$) influenced the decomposition process includes atmospheric temperature, humidity, precipitation, and soil salinity. The prediction model for time since death is very reliable because it can explain 9711.839 variables of all possible factors of decomposition but cannot explain 88.161 variables. The prediction model for decomposition is also reliable because it can explain 2438.799 variations in the variables of all possible factors of decomposition but cannot explain 70.334 variations in the variables.

Conclusion: The six factors identified in this study should be considered when predicting time since death and rate of decomposition. The prediction model for time since death and rate of decomposition has a high goodness of fit.

Keywords: criminal investigation, decomposition timeline estimation, factors of decomposition timeline, forensic taphonomy, post-mortem interval

O-079

An evaluation of the reliability of current stature estimation equations for contemporary White South Africans

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Objective: In 2008, Dayal and colleagues introduced regression equations for the estimation of total skeletal height (TSH) of white South Africans using skeletal measurements from the Raymond A. Dart Collection of Human Skeletons. The validity of these equations, however, has been questioned.

Methods: Ethical approval (M2111174) was obtained from the Human Research Ethics Committee – Medical of the University of the Witwatersrand to use the magnetic resonance imaging scanograms of 74 white South African adults to assess the reliability of the Dayal and colleagues (2008) equations. The physiological length of the femur (FEPL) and the tibia (TPL) were measured from these scanograms and input into the appropriate equations to obtain total skeletal height (TSHD). Living stature (LS) estimates were then calculated using the soft tissue conversion equations of Cloete (2017) and Loubser (2022) for females (ELSC) and males (ELSL), respectively. These were compared to the measured total skeletal heights (TSHMeas), measured directly from the scanograms, and the measured LS (LSMeas) of the participants using paired t-tests, mean differences (MD), and mean absolute differences (MAD).

Results: No significant differences were observed between TSHMeas and TSHD in males, and TSHD using TPL in females. However, all estimated LS using the FEPL were significantly different from LSMeas. These significant differences and large MD and MAD indicate that the equations by Dayal et al. (2008) are no longer valid.

Conclusion: New regression equations were calculated to estimate LS of white South Africans and are characterized by strong positive correlations and low SEE.

Keywords: forensic anthropology, living stature estimation, MRI scanogram, soft tissue correction factor

O-080

Morphological evaluation and clinical significance of the supracondylar process and supratrochlear foramen: an anatomic and radiological study

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Objective: In our literature review, we did not encounter any study examining the supracondylar process (SP) and the supratrochlear foramen (STF) with a three-dimensional (3D) reconstruction method. The present study aimed to evaluate SP and STF morphologically by employing the 3D reconstruction method and emphasizing their clinical significance.

Methods: The research was carried out on dried human humeri. A total of 81 humeri were obtained from the Departments of Anatomy of Gazi University Faculty of Medicine and Lokman Hekim University Faculty of Medicine. The morphometric measurements of SP and STF were made with a digital vernier caliper. The computed tomography (CT) images acquired for radiological evaluation were analyzed with the 3D reconstruction method. Ethics committee approval was obtained for our study.

Results: The narrower distal medullary canal widths of humeri with STF were found to be statistically significant. No statistically significant difference was found between the transverse diameters (TD), vertical diameters (VD), the distance of the medial edge to the medial epicondyle (ME), and the distance of

the lateral edge to the lateral epicondyle (LE) of the supratrochlear foramen of the right and left humeri.

Conclusion: The supracondylar process is often evaluated by mistake as a pathological condition of the bone, not as a normal anatomical variation. Knowing different shapes and dimensions, e.g., the TD and VD distance in which STF emerges, can assist in avoiding the misinterpretation of radiographs. STF may play a key role in the preoperative planning of intramedullary nailing of the humerus.

Keywords: 3D reconstruction, medullary canal, supracondylar process, supratrochlear foramen

O-081

Aplasia cutis congenita associated with coarctation of aorta in a newborn: is this a coincidence or variant of Adams-Oliver syndrome?

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Objective: Aplasia cutis congenita (ACC) is included in a group of heterogeneous disorders all characterized by focal absence of the skin. Proposed etiologies for ACC include intrauterine infections, vascular malformations, amniotic defects, and exposure to teratogens. ACC could be seen as single or multiple defects. It is often associated with a variety of abnormalities, such as omphalocele, the absence of distal limbs, and craniofacial deformities. The coexistence of ACC and cardiovascular anomaly is not common. In this paper, we described a newborn case of ACC of the scalp associated with coarctation of aorta.

Case: A male newborn was born at 38 weeks of gestation with a body weight of 3170 g. At birth, the patient had a defect of the scalp sited in the midline of the vertex. He was admitted to the neonatal intensive care unit for further research and treatment of ACC. In this paper, we described a newborn case of ACC of the scalp associated with coarctation of aorta. It has been decided for the patient to undergo surgery due to aortic coarctation. He underwent left thoracotomy; extended end-to-end anastomosis, coarctation repair, and ductal division were performed.

Conclusion: Congenital anomalies are frequently be accompanied to heart defects. Coarctation of the aorta is a disease that can be missed in the neonatal period and can be diagnosed incidentally in advanced ages. In order to avoid this situation, despite the absence of any abnormalities in the physical examination, echocardiography should be performed to detect associated heart anomalies. Timely diagnosis of the serious heart defects would be life-saving in these newborns.

Keywords: aplasia cutis congenita, congenital heart disease, coarctation of aorta, newborn

O-082

An anatomical variation: absence coeliac trunk

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Objective: Total ratio of absent coeliac trunk (CT); in dissections (0.11%), surgeries (0.35%), radiologic (0.12%) and combined procedures (0.64%) is 0.19% hitherto. In our dissections, one of them demonstrated the absence of CT as a clinical outcome which makes our study the fourth cadaver study of anatomical dissection that has been published hitherto.

Case: Absence of CT was observed in a 79-year-old male cadaver during dissections were made in the New York Albert Einstein College of Medicine Department of Anatomy Dissection Laboratory. During the same dissection while the branches of CT arose independently from abdominal aorta, Superior Mesenteric Artery (SMA) and Inferior Mesenteric Artery (IMA) showed varying levels of arise between L1–L3 vertebral levels. Aortic bifurcation (AB) was seen in the L3–L4 intervertebral disc space. AB, left renal artery (LtRA), vertebral level's origin are selected as reference points and their anatomical variations and their longitudinal, transverse and linear distance with SMA and IMA were analyzed with their significant possible outcomes of surgical interventions and researches. This study was completed after obtaining all necessary permissions from New York Albert Einstein College of Medicine.

Conclusion: Our study about absence of CT and its variations will be used as a reference in abdominal operations (liver transplantation etc.) or invasive arterial procedures that are applicable, laparoscopic surgery and radiological procedures in the abdomen. It is an extensive study that could be utilized by researchers, surgeons and who would like to improve their clinical competence and this research has been a role model for our future works.

Keywords: abdominal aorta, anatomical variation, cadaver study, coeliac trunk

O-083

Immune-mediated arthritis: is there any way for experimental modeling of its premorbid conditions and detection of compensatory mechanisms in the joint during the preclinical phase?

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Objective: We studied joint morphology using hip joints of Wistar rats in norm and after antigenic stimulation. The last one

was modeled through the transuterine intrafetal interscapular subcutaneous injection of antigen (0.05 ml of human normal immunoglobulin) for the rat fetus on the 18th day of its antenatal life under general anesthesia and sterile conditions via laparotomy for the pregnant female (M. A. Voloshyn's method (1981). The study was approved by the local ethics committee.

Methods: Joints were fixed, decalcified and dehydrated. Paraffin-embedded tissue specimens were stained with hematoxylin and eosin, Alcian blue, peanut agglutinin (PNA-HRP) and Mallory's trichrome staining. The hip joint components were analyzed using light microscopy (×100) and statistical methods.

Results: We found an increased quantity of hyaluronan, macrophages, mast cells, lymphocytes and vessels and a decreased amount of sulphated glycosaminoglycans in the marginal synovium, together with the premature appearance of strong expression of receptors for peanut agglutinin in the marginal cartilage of antigen-suppressed rats in the early postnatal period.

Conclusion: Such phenomena in the marginal synovium could create preconditions for an excessive penetration of the joint capsule into the articular cartilage. The premature appearance of an increased amount of galactose residues might indicate the premature intensive glycosylation of "chondroprotective substances" such as fibronectin, laminin etc. and could be considered a compensatory mechanism to create the „innate defensive wall" against immunocompetent cells. We would suggest this method for further in-depth study of the conditions which could precede the development of the immune-mediated inflammatory diseases (IMID) of the joint.

Keywords: immune-mediated arthritis, joint, Wistar rats

O-084

A different exosome secretion modality occurs in patient-derived colorectal cancer spheroids and in their mouse xenograft

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Objective: Colorectal Cancer (CRC) is the third most commonly diagnosed cancer in males and the second in females globally. One strategy to reduce mortality in CRC is development of personalized therapies to treat patients in the more advanced stages of the disease. The development of up-to-date in vitro and in vivo preclinical models, expressing the patient-specific cancer lineage and genetic diversity is urgently needed. Three-dimensional models of cancer are emerging: patient-derived tumor organoids (PDTOs) and Multicellular Tumor Spheroids (MTS), as well as the role of exosomes as specific biomarkers in CRC prediction and screening. We studied the exosome secretion pattern by TEM and SEM in patient-derived MTS and in mouse xenografts, to find possible differences between "in vivo" and "ex vivo" models.

Methods: MTS (authorization no. CE5ISS 09/282 of the ethics committee on human experimentation of the Istituto Superiore di Sanità) originated from CRC of a 63 year old man who was then transplanted in an immunodeficient mouse. Both MTS and xenograft were prepared and analyzed by electron microscopy. Morphology, exosome and multivesicular body size were compared and statistically analyzed.

Results: In MTS exosome secretion increases proportionately to spheroid complexity, and is less intense than in xenograft. Size of exosome and multivesicular bodies is the same (about 70 nm and 240 nm) in both spheroid and xenograft.

Conclusion: MTS are a useful 3D preclinical model and reproduce several aspects of tumor biology. MTS-derived xenografts represent a further improved model of cancer behavior and show sustained exosome production/secretion, possibly due to the influence of the in vivo tumor microenvironment.

Keywords: colorectal cancer, exosome, spheroid, transmission electron microscopy, scanning electron microscopy

O-085

Evaluation of muscle spindle density and distribution of certain mimic muscles: preliminary results of a cadaveric study

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Objective: This study aims to provide reference data about the density and distribution of muscle spindles (MS) in certain mimic muscles on human cadavers.

Methods: Orbicularis oculi, orbicularis oris, zygomaticus major and buccinator muscles were obtained from 16 cadavers on both sides, and they were dissected into pieces according to muscle mass. Routine tissue processing procedures were applied to all samples. Dewaxed serial sections were stained with hematoxylin and eosin (H&E) and Masson's Trichrome staining to determine muscle spindles. They were examined and photographed under a light microscope.

Results: The mean numbers of MS in the buccinator muscle were 2.22 (H&E), 2.37 (Masson's) on the right side and 2.42 (H&E), 2.16 (Masson's) on the left side. The following numbers (0.5 and 1.33) were detected on both sides for orbicularis oculi and orbicularis oris muscles, respectively. The mean numbers of MS were 2.1 (H&E), 1.85 (Masson's) on the right and 0.5 on the left for zygomaticus major. Light microscopic examination of 72 samples revealed that perimysium enclosing fascicles, skeletal muscle fibers, peripherally located nuclei, endomysium, blood vessels, and peripheral nerves were intact. External and internal connective tissue capsules and intrafusal muscle fibers were observed in the muscle spindles inside the perimysium and fascicles.

Conclusion: The differences in density and distribution of muscle spindles were presented in certain mimic muscles. Therefore these differences may provide a basis to explain the mechanisms related to movement disorders of mimic muscles and functional indicators of pathological conditions.

Keywords: muscle spindle, orbicularis oculi, orbicularis oris, zygomaticus major, buccinator

O-086

Microanatomic alterations in the uterus of a polycystic ovary syndrome (PCOS) mouse model and the potential role of carnitines

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Objective: Polycystic ovary syndrome (PCOS) is a multisystemic endocrinopathy associated with female infertility, also characterized by polycystic ovaries. After having established an experimental model of PCOS in mice induced by DHEA and assessed the protective actions of two different L-carnitine formulations (Di Emidio et al., 2020), we here aimed to describe the microanatomy of the uterus.

Methods: Adult CD1 mice were injected or not (control group) with DHEA (DHEA group) for 20 days with two different carnitine formulations: 1) L-carnitine and acetyl-L-carnitine (DHEA+C1 group), and 2) also containing propionyl-L-carnitine (DHEA+C2 group) (Di Emidio et al., 2020). Uterine horns were then collected and subjected to a) Hematoxylin-Eosin and Trichrome Mallory stainings; b) immunohistochemical analysis for MG-AGE, 4-HNE, Tomm20, Col1 and 17 β-HSD4.

Results: In the DHEA group was found hyperplasia of luminal and glandular epithelium, lower stromal density, increased endometrial width, and collagen deposition, compared to controls. Both carnitine formulations reduced hyperplasia and fibrosis, with a more protective effect exerted by DHEA+C2. Compared to the DHEA group, the oral administration of Carnitines ameliorated glycative, antioxidant and energetic activities, with a reduced expression of MG-AGEs, 4-HNE and 17 β-HSD4 and increased immunostaining for the mitochondrial transporter TOMM20 in the endometrial luminal and glandular epithelium of carnitine treated groups.

Conclusion: The data obtained confirmed that PCOS negatively affects uterine morphology; carnitine supplementation may reduce PCOS-induced hyperplasia and fibrosis and restore glycative, antioxidant and energetic activities. These results suggested that a diet supplemented with oral carnitines might exert protective actions on the female reproductive system.

Keywords: mouse, uterus, PCOS, DHEA, light microscopy, histology

O-087

Prenatal choline, uridine monophosphate, and fish oil supplements affect synaptogenesis in 5XFAD animals

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Objective: Alzheimer's disease (AD), in which Aβ accumulation occurs, causes synaptic loss, and impaired functional brain connectivity. Synapses are composed of lipid membranes, and most occur in prenatal and early postnatal periods. In AD, changes in lipid metabolism cause an increase in Aβ accumulation. Choline (Ch), uridine monophosphate (UMP), and fish oil (FO) play important role in the synthesis of membrane lipids, and these supplements enhance memory and learning by increasing specific protein levels and dendritic density in pre-and postsynaptic membranes. It is believed that taking this triple nutritional supplement during the prenatal and lactation period will prevent synapse loss and support synaptogenesis. We aimed to investigate the impact of these nutrients given as membrane precursors during prenatal and lactation periods on synaptogenesis.

Methods: Dams in the experimental group were fed with Ch, UMP, and FO combinations until offspring were weaned. Experiments were done on transgenic and non-transgenic offspring. Hippocampal tissues were obtained from 6- and 9-month-old animals. The effects of congo red staining on amyloid deposition and changes in the expression of PSD-95, neurofilament, and synaptophysin, which are markers of synaptogenesis, were investigated. Additionally, the terminal area and

the length of the synapses of the hippocampus were evaluated in the images obtained by transmission electron microscopy.

Results: We observed changes in the expression of PDS-95, neurofilament, and synaptophysin, as well as terminal area and synapse length in experimental groups.

Conclusion: Our findings will contribute to the development of neuroprotective dietary supplements as a preventive measure. Grant declaration: This study is supported by TUBİTAK (219S307).

Keywords: Alzheimer's disease, synaptogenesis, lipids, choline, UMP, fish oil

O-088

Effect of exosomes derived from Sertoli cells on reconstruction of seminiferous tubule

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Objective: Spermatogenesis is a complex process that produces mature spermatozoa from spermatogonia stem cells,which is liable to genetic, protein, nc-RNA, hormones and growth factors acting though endocrine and paracrine pathways. Previous study suggested that exosomes play an important role in the development of liver, heart, brain and so on. Recently, some research discovered that exosomes promote testicular development through mediate testis microenvironment. However, our previous studies have demonstrated that the seminiferous tubule-like structure was successfully established with KSR, and the sertoli cell derived exosomes extracted from the supernatant of KSR group were succeeded in identification.

Methods: In this study, primary sertoli cells from 10-dpp mice were divided into control group, KSR group, KSR+GW4869 group (GW4869 was an exosome inhibitor) and exosomes group (the optimal concentration of exosomes was determined by concentration gradient) cultured for 7 days to explore the effect of exosomes on the reconstruction of seminiferous tubule-like structure in mice. The formation of seminiferous tubule-like structure and the proliferation of Sertoli cells (SCs) and germ cells (GCs) were observed by immunofluorescence techniques.

Results: Immunofluorescence results showed that compared with KSR group, after GW4869 treatment, seminiferous tubule-like structure was damaged and sertoli cell proliferation was inhibited.

Conclusion: These results suggest that Sertoli cell-derived exosomes are involved in the process of seminiferous tubule-like structure remodeling in mice. After that, the miRNAs contained in exosomes were screened by RNA SEQ, which will provide a foundation for our future studies.

Keywords: testis, exosomes, sperm, sertoli cells

O-089

Education of anatomy of arm and leg using 60 hand gestures

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Objective: The hand gesture method was found effective for educating on the anatomical structures of the heart, blood vessels, brachial and lumbar plexi. This method, referred to as digit anatomy, has the following characteristics. First, this method was more appropriate to express 3-dimensional relationships between anatomical structures than a 2-dimensional method of figures or photos in anatomy textbooks and atlas. Second, based on this 3-dimensional anatomy knowledge, students could be educated more efficiently on CT or MRI anatomy.

Methods: Using digit anatomy, we focused on and expressed the anatomical positional relationships and routes of major structures such as muscles, nerves, and blood vessels in arms and legs, and expressed even muscle actions in some hand gestures for muscles.

Results: In the arm, the rotator cuff, the formation of triangular and quadrangular spaces and the axillary nerve passing through the spaces, the radial nerve running in the upper arm, the formation of the cubital tunnel and the ulnar nerve passing it, the positioning of the forearm muscles, and muscles that flex the fingers were expressed. In the leg, the positional relationship of the thigh muscles, the formation and internal structure of the popliteal fossa, the pes anserinus, the meniscus and cruciate ligaments in the knee joint, the muscle arrangement of the calf, and the plantar muscle layers, were also expressed.

Conclusion: The digit anatomy is expected to be effective not only for students to study the anatomy of arm and leg but also for professors to educate.

Keywords: education, anatomy, hand gestures, arm, leg

O-090

Consolidation carnival: a modified speed-dating approach to reviewing musculoskeletal anatomy in an undergraduate medical curriculum

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Objective: Recent changes in undergraduate medical curricula have resulted in time constraints that are particularly chal-

lenging when students must learn large blocks of content. Musculoskeletal anatomy is one such blocks, and students may resort to rote memorization to cope. In an effort to help students learn both concepts and content, a "consolidation carnival" was developed.

Methods: For a 6-week musculoskeletal course, two consolidation carnivals were scheduled: one on week 3 and the other on week 6, following the completion of the upper and lower limb contents, respectively. These largely self-directed speed-dating-styled review sessions consisted of 6 to 7 students rotating through 7 to 8 clinical cases with corresponding cadaveric specimens every ten minutes.

Results: Ninety-four per cent of the 103 students who participated in this study agreed that the consolidation carnival provided a helpful overview of musculoskeletal anatomy content, including other positive reviews. Student performance on the short, open-ended, case-based musculoskeletal examination showed no significant difference on shoulder, hand, hip, thigh, or leg questions. There was however a statistically significant decrease in the students' scores on a forearm question in 2021 compared to 2019.

Conclusion: This study shows that the consolidation carnival was positively received by students as having value in reviewing the musculoskeletal content and enhancing their problem-solving and critical thinking skills, while promoting peer collaboration.

Keywords: musculoskeletal anatomy, integrated curriculum, review, consolidation, curriculum revision, undergraduate medical education

O-091

Virtual journal club in anatomy: perspectives of postgraduate students

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Objective: The initial Covid-19 pandemic wave required all teaching and research activities to continue online. Attendance of a journal club is compulsory for the postgraduate Honors programme in Anatomy, with outcomes that include scientific writing and critical appraisal skills. The study aimed to design and implement a virtual journal club following an evidence-based approach and investigate students' perceptions of the format during 2020–2021.

Methods: After searching the literature for studies describing online journal clubs and determining what resources students had access to, a hybrid approach was developed. Synchronous meetings were held on Microsoft Teams, with an asynchronous WhatsApp® group used for continuing the discussions. Two cohorts of students were recruited. The 2020 group participated in an open-ended questionnaire, while the 2021 group were interviewed individually. The questionnaire responses and the interview transcripts were analyzed using Braun and Clarke's thematic analysis approach. Ethical and institutional approval were obtained (N20/05/056).

Results: Emerging themes were virtual format and content, and community of practice. Sub-themes included knowledge, time, challenges, positive experience, social interaction, and mentoring. Students were flexible in adapting to an online journal club, which they experienced as enjoyable. They emphasized the content as applicable to their research projects. Some challenges were encountered in the online format, which involved internet connectivity and a lack of body language appreciation.

Conclusion: Students adapt rapidly to the new format and form a virtual community of practice. Hybrid journal clubs with both in-person and online meetings can also be considered as suitable approaches during the ongoing pandemic.

Keywords: Covid-19 pandemic, postgraduate education, virtual journal club, anatomical education

O-092

Short and long-term retention of anatomical variation recognition using extended reality visualization

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Objective: The aim of this study was to use an online extended reality case-based approach as the basis for the introduction of anatomical variations to medical students and assess student perceptions as well as short and long-term retention performance concerning this knowledge.

Methods: The case preparation phase of this project involved gathering MRI data from selected donors at John A. Burns

School of Medicine (JABSOM). Cases consisted of learning objectives, clinical, radiological, and pathologic reports. All case information and 3D models were uploaded to RAD3D, the platform used to access the case presentations. First year medical students from the JABSOM class of 2024 volunteered to participate. All participants (n=67) received an email explaining the purpose of this activity 3 days prior to the laboratory session. The study design consisted of a repeated measures model with subjects serving as their own controls. Pre, post and post-post evaluation results were expressed as means (+ SD) and compared (Mann-Whitney U test, $p<0.01$) using the XLSTAT statistical package. The survey design comprised either bimodal or Likert based (5 scale) based and short answer questions.

Results: All post- and post-post test scores were significantly greater than the pretest scores ($p<0.01$). There was no difference between posttest and post-post test scores. Open-ended survey responses revealed that students perceived case-based learning modules positively, but encountered some technical problems.

Conclusion: Case-based learning modules using extended reality visualization enhanced short and long-term retention of anatomical variation recognition.

Keywords: anatomic variations, extended reality, case based learning, long-time retention

O-093

Exploring the most effective combination of drawing approaches for observation and understanding three-dimensional anatomy

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Critical observation is crucial for appreciating the three-dimensional (3D) form and spatial complexity of anatomical structures. The incorporation of different art-based approaches, including drawing, can be found in the academic literature. The process of observing and drawing anatomical features using any drawing approach is likely to support student learning due to increased time-on-task, attention and focus on the structures under observation. However, recent studies have shown varying success when employing drawing to support students in their learning of anatomy. The authors propose that the elementary essence of 'drawing', has not been investigated or discussed. 'Drawing' is an umbrella term which incorporates a number of drawing approaches that include photorealistic drawing, shading, contour drawing, cross-contour drawing, and gesture drawing. We propose that the application of a specific combination of drawing approaches in anatomy education, can result in alternative pedagogical outcomes. Here we explore why some drawing approaches are inherently more capable of supporting 3D observation and representation of the form of an anatomical structure. In particular, we examine why the combination of cross-contour and gesture drawing approaches employed in the established Haptico-visual observation and drawing (HVOD) method, are most effective for 3D observation and memorisation of the form of anatomical structures. Our definition, and analysis of this drawing approach for anatomical learning will have wide-ranging implications for educators seeking to introduce drawing as an art-based technique into their teaching and will in turn support their students in the critical observation of three-dimensional anatomy. Ethical approval was not required for this work.

Keywords: gross anatomy education, drawing, spatial awareness, 3D observation

O-094

A biomechanical study on the effect of long head of biceps tenotomy on supraspinatus load and humeral head position during shoulder abduction

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Objective: The purpose of this study was to determine the effect of biceps tendon tenotomy on the load of supraspinatus tendon/ muscle complex during abduction of the arm from 0° to 15°.

Methods: Eleven fresh frozen human cadaver shoulders (6 males, 5 females, mean upper extremity weight 2.96±0.56 kg) were included. The specimens were sequentially mounted onto a custom-made fixture attached to a pulley system and load cell. The pulley was used to pull the supraspinatus tendon/muscle complex to abduct the arm to 15°. Abduction angles were recorded with a digital inclinometer. Two conditions were tested: (1) long head biceps tendon (LHBT) intact and in normal anatomical position; (2) LHBT cut within the bicipital

groove. Qualitative visual inspection of humeral head displacement during abduction was also included. Descriptive statistics were calculated. The Shapiro-Wilk test was used to establish normal data distribution, and the paired t-test was used to compare the 2 conditions.

Results: For the intact condition (LHBT intact), the mean load was 45.71±21.04 N. For the biceps tenotomy test, the load measured 41.37±23.43 N. These differences were not significant (p=0.1480). In the tenotomy condition, the humeral head initially displaced inferior, and with initiation of abduction, the humeral head translated superior to its normal position.

Conclusion: The results suggest that the LHBT has no critical role with initial abduction of the arm. Furthermore, the LHBT does not appear to increase loads required for the supraspinatus muscle/tendon complex to perform the same action of abduction.

Keywords: biceps pulley, gleno-humeral joint, shoulder abduction, supraspinatus tendon load, tenodesis, tenotomy

O-095

Branching patterns and variations of the facial artery and clinical importance: a cadaveric study

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Objective: The facial artery (FA) has distinctive variations, which occur during embryologic development. Therefore, this study demonstrated disparities in the origin and termination of FA by clarifying the localization and tributaries in cadavers.

Methods: The study was conducted in Bahçeşehir University Faculty of Medicine, Department of Anatomy. The types, variations, prevalence and distance to nearby surgical landmarks of FA were recorded on both sides. Study was performed on 13 male (68.4%), 6 (31.6%) female cadavers. The FA was evaluated on the right and left sides (36 sides).

Results: Four types of FA were detected according to the termination point and observed types were angular type 73.1% (n=14,right; n=19,left), labial type 5.3% (n=1, right), alar type 5.3% (n=1, right), nasal type % (n=1, right). The following parameters were significant according to gender; the distance between the ala of the nose and the origin of the FA on both sides (p=0.007 right; p=0.018 left), the diameter of FA at the cheilion (p=0.019 left), diameters of the superior and inferior labial arteries at its origin (p=0.031 right; p=0.025 right). It was determined that there was no difference according to gender in terms of the incidence of the types (χ^2=3.132, p=0.536).

Conclusion: As a result, significant differences in gender according to the distance of the FA and its branches from the origin should be taken into account to reduce the complications during surgery in reconstruction and tumor resection and dermal injections for aesthetic surgery.

Keywords: facial artery, branching patterns, variation, types of the facial artery, tributaries of the facial artery

O-096

A novel anatomical description of the terminal peroneal artery and the terminal peroneal window with its important clinical and radiological implications

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Objective: The "Terminal Peroneal Window" is a newly described anatomical course and location of the terminal part of the peroneal artery. This important anatomical location has only been recently identified and reported where the terminal part of the peroneal artery changes its anatomical course and position, by surfacing anteriorly and lateral to lie more anteriorly, mostly halfway between the tibia and fibula directly beneath the interosseous membrane, before it gives off its terminal branches. Accessing the terminal peroneal artery at the "terminal peroneal window" with minimal dissection is a unique surgical option for peroneal artery open bypass revascularization in patients with critical leg ischemia. The aim of this study is to assess whether these new findings are consistent in all people, or whether these reported cases were abnormal anatomical variations.

Methods: A retrospective analysis of all performed computed tomography (CT) angiography scans of the lower limbs at a single tertiary center in 2019. Inclusion criteria was any scan with a patent peroneal artery.

Results: A total of 250 CTA were analyzed. 162 (65%) were males, median age was 68 years (range 12–96). The indications for the CT scans were peripheral vascular disease 111 (44.4%), acute limb ischaemia 38 (15.2%) trauma 53 (21.2%), pseudoaneurysm 11 (4.4%) and other less frequent indications. The anatomical course of the terminal Peroneal artery and the TPW were present in every CT scan. The mean Terminal Peroneal Window size in the right leg was 7.72 mm (range: 2–14 mm) compared to 8.17 mm (range: 3–16 mm) in the left leg.

Conclusion: This study demonstrated that the terminal peroneal artery's anatomical course and the Terminal Peroneal Window as originally described was not an anatomical variant, but the norm. A wider study will be required to assess its clinical implications in similar limb salvage procedures or in other subspecialty fields.

Keywords: limb salvage, peripheral arterial disease, vascular surgery

O-098

Effect of virtual interactive 3-dimensional models on anatomy education: a randomized controlled study

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Objective: The virtual 3-Dimensional technology has a promising future in anatomy education. But there is not enough evidence regarding its effect on the student's knowledge of anatomy. The aim of the study was to measure the effect of the virtual interactive 3-D models on the anatomy education for those following objectives. Comparison of anatomical knowledge of the medical students who used the virtual interactive 3-D models with those who did not use the 3-D models.

Methods: The study was conducted during 2021–22 after the institutional ethical committee approval. The Virtual interactive 3-D Models created from the liver and femur were used in the study. 150 first year medical students enrolled in the study were divided into two equal groups. Both groups were taught liver and femur (30 minutes for each specimen) through a teacher assisted self directed learning method. Group 1 was provided conventional teaching aids including the text book, the specimen and 2-dimensional images while group 2 was provided the 3-D models in addition to conventional teaching aids. The anatomical knowledge of the students was assessed by a test-paper before and after the teaching sessions.

Results: The difference in the post-test score and pre-test score was significantly higher for both the specimens in the group who used the virtual interactive 3-D models ($p<0.05$, unpaired t-test) in comparison to the group who did not use the 3D models.

Conclusion: Use of virtual interactive 3D models as a learning aid can improve the anatomical teachings and medical students' knowledge.

Keywords: anatomical education, medical education, virtual interactive 3D models, virtual reality

O-099

The effectiveness and satisfaction of virtual anatomy laboratory education on medical students: a randomized trial compared to cadaver dissection

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Objective: Technological advances in recent years have produced virtual dissection in medical education. This study aims to investigate whether virtual dissection can provide superior learning efficacy and quality compared to traditional cadaver dissection.

Methods: A crossover randomized controlled trial with 154 first-year medical students in both Human Anatomy and Neuroanatomy courses was conducted with two different groups, namely, the virtual dissection-first group (ie, virtual-cadaver), and cadaver dissection-first group(ie, cadaver-virtual). The virtual dissection was delivered via the head-mounted display, tablet PC, and life-size touch screen. To compare knowledge between virtual and cadaver dissections, quiz 1(Q1) was conducted following the first virtual-only or cadaver-only dissection. A quiz 2(Q2) and a survey were conducted at the end of the final procedure in each training modality.

Results: Regarding the Human Anatomy course, there was no significant difference in the total score of Q1 between virtual and cadaver education. However, regarding the observation subgroup, virtual education showed significantly higher Q1 score compared to cadaver education. Among the digital lab resources, most students felt that tablet PC-based learning was an effective way to study. Neuroanatomy course was focused on tablet PC-based contents only. Virtual anatomy education showed significantly higher Q1 score compared with cadaver education in brain anatomy. Most students reported that 3D virtual platform-based learning enhanced their understanding of the cadaveric anatomy because of multiple selection modes and labeling functions.

Conclusion: This study demonstrates that there is potential for virtual dissection to cadaver dissection in medical education. Virtual dissection education can provide innovative learning experiences augmenting traditional cadaver dissection.

Keywords: anatomy education, virtual dissection, head-mounted display, tablet PC, life-sized touch screen

O-100

Customized 3D printing model in preventing vertebral artery injury for cervical pedicle screw insertion

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Objective: Cervical posterior screw fixation represents a challenge for spine surgeons due to the complex anatomy and the risks of vascular and medullary injury. Major advances in 3D printing have opened up a whole new world of alternatives for these surgeons. The aim of our study is to help preoperative guidance for posterior cervical screw fixation by preserving neurovascular structures with printed models.

Methods: In our study, 3D printing was used to create a guideline for insertion of the lateral mass screw into the C1 and C2 vertebrae. Computed tomography (CT) scans were used to create full-size models of the upper cervical spine and the corresponding screw guides. The 3D-printed guides were used to install the guidewires.

Results: The superior and inferior articular surfaces, the vertebral foramen, and the vertebral artery were all avoided by all of the guidewires used in the current study's models. 3D models aided in identifying fracture sites, pedicle diameters, and VA placements. The measurement range for the optimal point of entry highlights the necessity for patient-specific intervention.

Conclusion: The current study established the efficacy of the guide, a dependable instrument for assisting with the insertion of guidewires for screws in C1 and C2 lateral masses. The patient's early release and lower surgery time are made possible by the three-dimensional models without injury of the neurovascular structures.

Keywords: 3D neuroanatomical model, individualized screw insertion, patient-specific model, vertebral artery

O-101

Creation of 3-dimensional anatomical models using mobile phone applications

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Objective: Technological advancements have been introduced, in many forms, into the educational process. Formal teaching and learning are increasingly complemented by new technologies which fostered the active-learning approach. Using anatomical specimens has been proven to be crucial for understanding and learning by students. Our research aims to digitize this resource so that it's available to students at any time and location.

Methods: Our group used photogrammetry to create 3D anatomical models from plastinated specimens. We only used a smartphone with the Polycam App to capture numerous pictures of the same object from different angles and stitch them together. The Polycam app uses the mobile phone's sensors for image processing and gyroscope to map out where the phone is currently in space. By moving around the model, the app will automatically snap photos in an overlapping manner. The user needs to walk one round around the object. To facilitate self-learning, we used Sketchfab to add labels to important landmarks in the 3D model.

Results: Using non-expensive technologies, we were able to create 3D anatomical models to better our students' learning.

Conclusion: Students are quite pleased with the created 3D models. We expect this to have a positive impact on students' performance and learning experience during our evaluation. 3D images will be helpful for medical and allied health science students to learn anatomy remotely.

Keywords: 3D models, plastinated specimen, mobile application, photogrammetry, digital anatomy

O-102

Individualized 3D printing-assisted C1 and C2 cervical posterior screw fixation using full-scale models

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Objective: Posterior cervical spine fixation has a key role in the treatment of various cervical spine pathologies, especially traumatic, neoplastic, inflammatory and degenerative diseases. 3D printing navigation is increasingly used for cervical screw insertion, especially for cervical pedicle screws, where the free-hand technique is technically challenging and may carry a higher risk of neurovascular injury.

Methods: Using computed tomography (CT) sections of 30 patients, the diameter of the vertebral canal, the diameter of the right transverse foramen, the diameter of the left transverse

foramen, the distance from the midline to the right transverse foramen, the distance from the midline to the left transverse foramen, the height of the pedicles C1 to C6 were measured. After the measurements were completed, the full-size three-dimensional model was printed.

Results: In our study,the diameter of the vertebral canal was 23.59±2.05 mm, the diameter of the right transverse foramen was 5.25±1.01 mm, the diameter of the left transverse foramen was 5.19±0.89 mm, the distance from the midline to the right transverse foramen was 25.24±2.70 mm, the distance from the midline to the left transverse foramen was 25.02±2.71 mm, the height of the pedicles C1 to C6 were 10.62±1.28 mm, respectively.

Conclusion: The posterior approach to the cervical spine provides access to the posterior portions of the cervical spine and is used for a variety of treatments such as laminectomy, laminoplasty, foraminotomy, and posterior cervical instrumentation. With printed 3D models, pedicle screw fixation of C3-C6 vertebrae with small pedicles and close to the vertebral arteries was performed safely.

Keywords: 3D neuroanatomical model, Individualized screw insertion, patient-specific model, screw fixation, vertebral artery

O-103

Biomechanical properties of the tendinous and capsular layers of the rotator cuff complex in a fresh tissue sample

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Objective: The rotator cuff (RC) tendons have been described inserting across the humeral tuberosities as an interdigitated sheet consisting of both tendinous and capsular portions. Orthopedic surgeons thus now consider these two individual layers in their surgical and treatment plans. This study thus aimed to test and compare the elastic modulus and peak load of these layers for the supraspinatus (SS), infraspinatus (IS) and subscapularis (SC).

Methods: Fourteen (n=14) fresh/frozen arms (ethics approval number 384/2018) were reverse dissected at the area of interest and the RC muscles trimmed to 20×20 mm strips and separated into the two macroscopic layers. The strips were loaded to a point of failure using an Instron 1342 (Newtons/N). Accompanying cameras captured images for digital image correlation analyses.

Results: SS, IS, and SC tendinous layers yielded higher mean elastic moduli readings (72.34 MPa, 67.04 MPa, and 59.61 MPa respectively) compared to their capsular counterparts (27.38 MPa, 32.45 MPa, and 41.49 MPa respectively). Similarly, the tendinous layers for SS, IS and SC showed higher average loads to failure (252.74 N, 356.27 N and 385.94 N, respectively) when compared to the capsular counterparts (211.21 N, 168.54 N and 281.74 N, respectively).

Conclusion: Biomechanical variations between the individual layers that make up the RC complex need to be taken into account during surgical repair as repairing them as one singular structure may place the tough but weaker elastic capsular layer under more strain than the stronger tendinous layer. This could result in re-tear complications or reduced postoperative patient satisfaction.

Keywords: biomechanics, fresh tissue, rotator cuff, elastic modulus, peak load

O-104

A guide to facilitate the creation of a femoral tunnel for arthroscopic ligamentum teres reconstruction: a three-dimensional computed tomography study

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Objective: The ideal femoral tunnel passing through the center of the femoral neck targeted to the footprint of the ligamentum teres is established during the ligamentum teres reconstruction surgery with the free-hand technique. We aimed to quantitatively determine the entry site and define the angular orientation of the ideal femoral tunnel with its relevance to the femoral valgus angle and the femoral anteversion angle to facilitate the creation of an ideal femoral tunnel during the ligamentum teres reconstruction surgery.

Methods: A total of 65 randomly selected computed tomography images were obtained to reconstruct three-dimensional femur models. The femur length, femoral valgus angle, femoral anteversion angle, the femoral tunnel anterior angle, and the femoral tunnel superior angle were measured. The

skin- and bony-entry sites of the virtual reamer according to the center of the greater trochanter's superior border were also measured. The study protocol was approved by the Acibadem University Research Ethics Board.

Results: The femoral tunnel angular orientation was strongly correlated with the femoral valgus angle and the femoral anteversion angle. Mathematical formulas were defined by which entry site of the reamer and the anterior and superior angulation of the femoral tunnel could be estimated before the surgery.

Conclusion: The angular orientation of the femoral tunnel using femoral valgus angle and femoral anteversion angle can be easily estimated using mathematical formulas before ligamentum teres reconstruction surgery, and applying it can reduce dependency on the usage of fluoroscopy and the workload on the surgeon during the surgery.

Keywords: ligamentum teres, reconstruction, femoral tunnel, entry site, three dimension

O-105

Endonasal endoscopic route to superior orbital fissure: a feasibility anatomic study

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Objective: Superior orbital fissure (SOF) is a space connecting the middle cranial fossa and orbit. SOF has a close relationship with cavernous sinus, lateral sellar space, pterygopalatine fossa, and middle cranial fossa medially. The aim of the study is to evaluate feasibility of endonasal endoscopic approach to superior orbital fissure and to

Methods: The two cadaver heads (4 sides) were dissected via endonasal endoscopic approach. 4 mm 0- and 30-degree scopes were used for visualization during endonasal dissection and recording were done with an integrated system. No ethical approval was required.

Results: A standard total spheno-ethmoidectomy was done and lamina papyracea was exposed. Bony layers were removed and periorbita, ICA, lateral sellar compartment were exposed transnasally. Muller's muscle is visualized and as described from previous studies it has a close relationship with cavernous sinus. MM's close relationship to maxillary strut was used as a landmark to identify superior orbital fissure. Relationship between foramen rotundum and superior orbital fissure visualized. And with extended lateral dissection exploration of part of middle cranial fossa achieved.

Conclusion: Endonasal endoscopic approach to superior orbital fissure is challenging due to close relationship of important neurovascular structures and still not in use in clinical settings. This feasibility study allows us to reach and manipulate superior orbital fissure in a minimally invasive way. Further study exploring clinical application of this approach is needed.

Keywords: endonasal endoscopic, superior orbital fissure, skull base surgery, orbital surgery

O-106

Morphometric analysis of select cranial ventricular access points in patients with scaphocephaly

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Objective: Due to variable cranial morphologies, ventricular access in patients with craniosynostosis using conventional techniques is often challenging. Whilst ventricular access may not be frequently required in scaphocephalic patients, it is vital that an ideal location of the access points is established for safe ventricular catheterization. This study aimed to document the morphometry of commonly used ventricular access points, i.e. Kocher's and Frazier's points, within a select South African scaphocephalic pediatric population.

Methods: The craniometric dimensions of Kocher's and Frazier's points were measured relative to anatomical and craniometric landmarks on pre-operative computed tomography scans of 24 consecutive patients diagnosed with scaphocephaly between 2014 and 2020. The results were compared against age, sex, population group and the degree of severity [Ethical approval number: BREC/00002084/2020].

Results: Kocher's point was located between 91.6 mm and 140 mm posterior to the nasion, and between 20.5 mm and 34.6 mm lateral to the midline. Statistically significant increases were reported in the mean distance posterior to nasion between patients in the <1 year and older age groups (>1-<9 years) (ANOVA, $p<0.001$); and in the mean distance lateral to the midline (ANOVA, $p=0.004$), between patients in the <1 year and 3-<6-year (post-hoc, $p=0.002$) and 1-<3-year and 3-<6-year (post-hoc, $p=0.030$) age groups, respectively. Frazier's point was located between 60.9 mm and 82.8 mm superior to the inion, and 25.9 mm and 41.4 mm lateral to the midline.

Conclusion: Traditional landmarks used for ventricular access can be unreliable in scaphocephalic patients. This study provides novel morphometric data for neurosurgical consideration regarding ventricular catheterization procedures in scaphocephalic patients.

Keywords: Frazier's point, Kocher's point, scaphocephaly, ventricular access

O-107

Evaluation of preop and postop 6 months findings of surgery and transcatheter ventricular septal defect closure with Doppler echocardiography

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Objective: Ventricular septal defect (VSD) is one of the most common congenital heart diseases. This study aims to compare the effects of surgical and transcatheter closure at VSD on cardiac structure and functions in preoperative and postoperative sixth months.

Methods: In this study, echocardiographic images of 49 patients in the surgical group and 24 patients in the transcatheter group were retrospectively analyzed as a master's thesis study. Left atrium (LA) major axis, minor axis, LA volume and lateral mitral valve (MVDL) diameter, right atrium (RA) major axis, RA minor axis, RA volume and lateral tricuspid valve (TVDL) measurements were made in the apical 4-chamber position. Aortic valve (AV) annulus diameter and pulmonary valve (PV) annulus diameter measurements were made. In addition, ejection fraction (EF) and fractional shortening (FS) parameters were analyzed.

Results: Considering the improvement in cardiac anatomy, geometry and functions the parameters that showed faster recovery were LA major axis (p=0.004), RA minor axis (p=0.014), RA volume (p=0.004), TVDL (p=0.001), AV annulus (p=0.002) in the transcatheter group; EF (p=0.002) and FS (p=0.002) were in the surgical group. In the evaluations made after the operation, the residual shunt was detected as 4.08% in the surgical group whereas it was found to be 33.33% in the transcatheter group.

Conclusion: As a result, the group that recovered faster for the cardiac anatomy and geometry in the 6th month after the operation was the transcatheter group. However, the surgical group was found to be more successful for the improvement in left ventricular functions.

Keywords: Doppler echocardiography, surgical closure, transcatheter closure, ventricular septal defect

O-108

Investigating the accuracy of ultrasound-guided blocks of peripheral branches of trigeminal nerve using methylene blue: an anatomical study

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Objective: Trigeminal neuralgia (TN) is a debilitating facial pain disorder which can be alleviated by injection of the superficial branches of the trigeminal nerve. Ultrasound guidance may improve the accuracy of an injection, limit side effects and improve the efficacy. In this study, we examine the anatomical details of the superficial branches of the trigeminal nerve including supraorbital (SO), infraorbital (IO), and mental (M) nerves relevant to their use in trigeminal neuralgia and assess accuracy of ultrasound-guided injections in a cadaveric model

Methods: A single operator performed ultrasound-guided injections with methylene blue dye on 3 fresh cadaver heads. 6 hemifaces were dissected, SO, IO and M nerves were identified. For each nerve; horizontal distance from midline, skin boundaries, number of branches, and presence and degree of staining were recorded.

Results: The accuracy rate was 100%. A maximum of 4 SO branches (range 2–4) were identified and several sub-branches emerged from the main trunks of the ST and M nerves.

Conclusion: This cadaveric investigation further our knowledge of the peripheral branches of the trigeminal nerve. In the management of TN, using ultrasound guidance for injection has a high degree of accuracy.

Keywords: supraorbital nerve, infraorbital nerve, mental nerve, ultrasound-guided, anatomy

Poster Presentations

(P-01 — P-62)

P-01

Corpus callosum anatomical changes in Alzheimer patients and the effect of acetylcholinesterase inhibitors on corpus callosum morphometry

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Objective: The purpose of the current study is to determine any possible changes in CC size in patients suffering from Alzheimer's disease. The Study also investigated the effect of acetylcholinesterase inhibitors (AChEIs) on the size of CC and its association with improvement in the Alzheimer disease severity scores.

Methods: Midsagittal size of CC were recorded prospectively from 439 routine T1-weighted MRI brain images in normal individuals. The internal skull surface was measured to calculate CC/ internal skull surface ratio. Two groups of patients were studied: 300 (150 male / 150 female) were healthy subjects and 130 (55 males / 75 females) had Alzheimer disease. Out of the 130 Alzheimer disease patients, 70 patients were treated with Donepezil or Rivastigmine or both. The size of the CC was measured based on T1-weighted MRI images after the treatment to investigate any possible improvement in CC size.

Results: The mean surface area of CC in controls was 6.53±1.105 cm^2. There was no significant difference between males and females ($p<0.627$), and CC/ internal skull surface ratio was 4.41±0.77%. Patients with mild or severe Alzheimer disease showed a significant reduction in CC size compared to healthy controls. Treating mild Alzheimer patients with either Donepezil or Rivastigmine exerts a comparable therapeutic effect in improving the CC size. There was more improvement in the size of CC in patients with severe Alzheimer disease by using combined therapy of Donepezil and Rivastigmine than using single medication.

Conclusion: Alzheimer patients have pronounced reduction in CC which is corrected after taking Donepezil and Rivastigmine leading to remarkable improvement in Alzheimer disease severity scores.

Keywords: corpus callosum, Alzheimer, acetylcholinesterase inhibitors (AChEIs), severity

P-02

Proteases in rat`s heart tissues with hyperhomocysteinemia model

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Objective: The main cause of death is cardiovascular disease. One of the risk factors for cardiovascular disease is increasing homocysteine level. The aim was to examine the level and distribution of proteases in the homogenate of the different age rat's hearts with a model of hyperhomocysteinemia.

Methods: The chronic hyperhomocysteinemia model on white rats (1–2, 6–8, 24–26 months) was created by administering 200 mg/kg body weight of D,L-thiolactone homocysteine hydrochloride once daily for 8 weeks. The paper complied with the provisions of the European Convention for the Protection of Vertebrate Animals. The work was carried out in collaboration with researchers from the Taras Shevchenko National University of Kyiv. Homogenates of the heart were studied, in which the total activity of proteinases and their distribution were determined.

Results: The total proteolytic activity in the heart homogenate of rats with HHC at the three ages increased by 1.88, 2 and 2.23 times, respectively. The distribution of proteolytic activity determined that HHC is accompanied by an increase in the share of metal-dependent enzymes in the overall structure of proteolytic activity. Changes in the level of metal-dependent enzymes, in contrast to serine and other proteases, were more pronounced in 24–26 months animals (22% in control compared with 58% in rats with hyperhomocysteinemia).

Conclusion: Thus, an increase in the level of proteases and an increase of metal-dependent enzymes in the homogenate of the all age groups rats heart with hyperhomocysteinemia. Changes in proteolytic activity were more pronounced in animals with hyperhomocysteinemia aged 24–26 months.

Keywords: homocysteine, proteinase, heart, age

P-03

The candidate homeobox genes and their role in local-site inflammation in lip mucosa of children with non-syndromic cleft lip and palate

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Objective: Craniofacial development is a complex process which requires an expression of various genes and factors for proper facial embryogenesis. One such group of genes essential for craniofacial development is the Homeobox genes, and we have focused on the detection of DLX4, HOXB3, and MSX2 along with analyzing their role in promoting local-site inflammation using NF-κB and tissue remodelation of PTX3 in cleft lip and palate (CLP) affected tissue.

Methods: Material was obtained from 15 children (aged 3–8 months) during the lip plastic. Seven controls were obtained from the lip during upper labial frenectomy. Informed consent was obtained from parents, Research Ethics Committee approval no. 5/26.08.2018. DLX4, HOXB3, MSX2 and PTX3 were detected by in situ hybridization simultaneously with the immunohistochemistry for the genes and NF-κB.

Results: We found a residual gene and protein expression of DLX4 in cleft mucosa, whilst no differences in gene expression levels of HOXB3 and MSX2 were noted. A significant increase in protein expression for these genes was noted in cleft mucosa, coupled with a significant increase in NF-κB expression. No differences in PTX3 expression were noted.

Conclusion: Residual expression of DLX4 via upregulation of NF-κB pathway in CLP mucosa participates in the increased cellular proliferation (stimulated also by the high HOXB3 expression) and promotion of pro-inflammatory environment. Persisting appearance of MSX2 and NF-kB in the cleft-affected lip seems to dysregulate the hard tissue formation in CLP. PTX3 gene plays a crucial role in regulation and fine-tuning the persisting inflammation in postnatal cleft-affected lip tissue.

Keywords: cleft, genes, inflammation, immunohistochemistry, in-situ hybridization

P-04

Pro-, anti- and inflammatory cytokines and antimicrobial peptides in the milk of healthy and mastitis-affected cows

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Objective: The bovine mastitis is extremely important due to its economic and environmental impact. There are contrary data on mastitis fast indicators like pro-inflammatory, regulatory and anti-inflammatory cytokines and antimicrobial proteins. The aim of the work was the diagnostic marker evaluation from the different milk cytokines, and defenses in healthy and cows with mastitis.

Methods: Milk was taken from 15 healthy, and Holstein Friesian cows with subclinical and clinical mastitis, kept in a typical agricultural setting in Northern Poland. Milk smears were prepared and stained with IL–10, IL–17A, TGFβ1, IL–8, IL–12, IL–4, NFkβ, IFNγ and β defensin 3 by immunohistochemistry during the week. Results were evaluated semi-quantitatively.

Results: IL–10 showed 90%, but β defensin 3–55% positive cells in the healthy cows with the following decrease during the acute inflammation. IFNγ and IL–8 demonstrated individual variations. IL–12 showed 50% of cells in the healthy group, while indices overlapped for clinical and subclinical cows. The most stable factors with the highest number of positive cells in all the groups were IL–2, IL–4, IL17A, TGFβ1. NFkβ demonstrated a small number of positive cells in milk smears.

Conclusion: The IL–10 and β defensin 3 positive milk cells are the fastest most sensitive markers for the mastitis-affected cows. IRNγ, IL–12 and IL–8 should be removed from the diagnostic prognostic markers due to their individual variations. The stable high number of IL–2, IL–4, IL–17A and TGFβ1 reveals the phenomenon to be researched in future studies. NFkβ is not valid for diagnostic purposes due its small number of positive cells.

Keywords: cytokines, defensins, mastitis, milk, cows

P-05

The modulatory role of curcumin and quercetin on Drosophila GSK-3: a potential therapeutic intervention in Parkinson's disease

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Objective: We explored the mechanistic interactions and potential therapeutic benefits of curcumin and quercetin co-administration with a specific focus on Glycogen synthase kinase 3 GSK-3 activity.

Methods: We hypothesize that excess GSK-3 accumulation in the substantia nigra is driven by oxidative stress and aim to test the effects of these compounds on the localisation and activity of GSK-3 in the well-established model organism Drosophila melanogaster. We probed the dopaminergic neutrons characterisation via Tyrosine Hydroxylase Confocal microscopy, Locomotion and lifespan test were also assayed for

Results: The antioxidant properties of curcumin with quercetin mediated an anti-inflammatory response, ameliorat-

ing oxidative stress in the brain. The co-administration of both compounds as well rescue the Dopaminergic neurons in the brain of the shaggy fly.

Conclusion: The co-administration of curcumin and quercetin were able to reduce the loss of function of the nervous system typical of GSK 3 shaggy strain, by reducing the over expression of GSK 3 beta.

Keywords: GSK 3beta, Parkinson's disease, Shaggy, Drosophila, quercetin

P-06

The presence of overuse syndrome in professional musicians

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Objective: The overuse syndrome is of chronic character, due to repetitive movements and muscular drowsiness. Overuse and false technique, incorrect posture, stress and inadequate rest contribute to injuries that can cause the end of musicians careers. The goal was to determine the existence of overuse symptoms in professional musicians.

Methods: Participants were 50 professional classical musicians of the Serbian National Theater symphonic orchestra in Novi Sad. The study was approved by the Ethics Committee of the University of Novi Sad, Faculty of Medicine, Serbia. Participants completed a standard questionnaire, by which we determined the presence of symptoms of overuse syndrome.

Results: Out of the 50 musicians surveyed, 30 (60%) are male and 20 (40%) female. The majority of respondents were in the fourth decade of their lives. Most respondents 43 (86%) experienced some sort of discomfort during their career, while the back was the most common localization of symptoms 39 (90%). The most common symptom for all musicians was pain. More than half of respondents 27 (54%) sought some kind of help, and only 2 (7%) of respondents who applied for help did not have a change of condition.

Conclusion: Overuse syndrome occurs in most professional musicians 43 (80%) in the fourth decade of life. The primary symptom is pain and the most common localization of the discomforts is back. Musicians who are playing wind instruments have the most problems with neck 5 (62.5%). The effectiveness of therapy is reported in 25 (93%) cases.

Keywords: musicians, overuse syndrome, pain

P-07

I love anatomy so much

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Anatomy seems like a long journey in our medical history. The term 'Anatomy' is derived from the Greek meaning 'to cut up'. Thus, anatomy is a major subject which teaches about the structure of the human body. Most of anatomical terms are Greek and Latin derivations and remain until nowadays. Through several years, anatomy flawlessly combines both art and science. To understand better how anatomy plays a crucial role in our medical history. Thus, recalling the anatomy transformation will help us advance our understanding in anatomical science. In the past centuries, centers of science were found in Egypt, Greece, Roman empire, Islamic golden age, Renaissance period in Europe up to modern Anatomy in the twenty-first century. Until now, anatomy has further dramatically progressed. Hence, we would like to present how we have become obsessed with 'Anatomy' in the aesthetic Japanese Haiku poetry.

I Love Anatomy So Much

In early medical history
Little of human Anatomy is realized
Once shines in Egyptian records
Vessels and heart are depicted
Ebers discovers the heart function
Ancient Greek becomes advanced later
Notation of Hippocrates has found
Aristotle is now the pioneer of systematic dissection
Term 'Anatomy' is declared then
Over years, Galen's concepts emerge
Major knowledge is widespread in Roman empire
Years fly by to Islamic golden age
Such a foresight Neuroanatomy
Of Muhammad Al-Razi
Middle age education ascends later
Until the rise of Renaissance period
Challenges by Andreas Vesalius, 'De Humani Corporis Fabrica'
Here, we're in modern era of Anatomy!

Keywords: anatomy, medical history, haiku poetry

P-08

Human platelet lysate as a functional substitute for fetal bovine serum in the culture of human amniotic fluid derived mesenchymal stem cells (hAF-MSCs)

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Objective: Amniotic fluid-derived mesenchymal stem cells (hAF-MSCs) are promising sources for cell therapy for a variety of diseases. Treatment with MSCs frequently requires an in vitro cell expansion step and is commonly cultured with fetal bovine serum (FBS), however, endotoxin content increases the risk of contamination and the possibility of eliciting a host immunological response. Recently, human platelet lysate (hPL) appears to be a valuable alternative serum-supplement. The study investigated whether hPL could be used instead of FBS without altering MSC properties.

Methods: This study applied the repeated freeze and thaw method to generate hPL, and 10% of hPL showed optimal concentration after evaluation by MTT and alamar blue analysis. To obtain the data, hAF-MSCs were cultured in parallel in culture media supplemented with either 10% hPL or 10% FBS. In the second passage, hAF-MSCs were characterized based on their morphology, proliferation rate, and tri-lineage differentiation potential as described by the ISCT criteria.

Results: The isolated hAF-MSCs exhibited positive expression of CD44, CD73, HLA-ABC, and OCT4 markers, whilst negative for the expression of CD31, CD34, CD45, CD117, HLA-DR, and fibroblast antigenic biomarkers. The MSCs in both conditions could adhere to the culture surface and showed the spindle-shaped morphology. Alamar blue proliferation analysis of paired samples showed a similar pattern of the growth characteristic. The ability to differentiate into osteoblasts, chondrocytes, and adipocytes was observed in both the hAF-MSC populations.

Conclusion: The results indicated that hPL could be an alternative supplement for cell culture by which it could support cell growth without affecting the MSC properties.

Keywords: mesenchymal stem cells, human platelet lysate, proliferation, differentiation, osteoblasts

P-09

Characteristics of the female heads anatomy in several of Rigas' Art Nouveau architectural buildings

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Objective: Female heads and their anatomical details are popular decorative elements of the Art Nouveau architecture. Objectives. The study aims to describe the specificity of the female heads in the decors of Rigas' architectural buildings in the context of regional anatomical features.

Methods: An extensive historical, anatomical literature search was undertaken from several databases, books and architectural sources. The literature search was based on key terms relevant to anatomical details concerning the presentation of them in female heads of Rigas' Art Nouveau architectural buildings. Several methods were used to formulate the anatomical details of female heads in the architectural works, including observation, formalization, analysis, synthesis, analogy and interpretation. No ethical approval was required.

Results: Female heads appeared in different forms and manifestations of ideas, including a series of historical, biblical, mythological characters or symbols of unity between humans and nature. Women's wild and undulating hair served as an icon representative of the Art Nouveau. Several faces were depicted with a winged head, a wide-open mouth, wide staring eyes, broad nostrils, with a romantic, comical, angry, horrifying, neutral look or serious expressions. In the female heads, part of the aspects was used together with some images of contrasting mood or contrary meaning. Ideal classical and symmetrical female faces were common too. None of these heads were in color. "Disturbed" faces and screaming masks were also represented.

Conclusion: Analyzed architectural works had a lot of common or different signs but at the same time every female head was unique in its anatomical details.

Keywords: anatomy, architecture, Art Nouveau, head, women

P-10

Anatomical variants at the origin and distribution of the brachial plexus nerves in three domestic cats (Felis catus, Carnivora)

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Objective: Anatomical variants in the brachial plexus of the cat are few reported, and its knowledge should be considered in veterinary procedures of the thoracic limb. Thus, this study aimed to report the anatomical variants of the brachial plexus nerves presented in three cats.

Methods: Gross dissections were performed in three formalin-fixed specimens (two females and one male) of the Veterinary Anatomy Laboratory of the Universidade de São Paulo (Brasil). The bioethics committee approved this study (CEUAx 3928240820).

Results: All brachial plexus originated from C6-T1. In one specimen, the nerve to the coracobrachialis muscle originates directly from a communicating branch between the cranial and caudal pectoral nerves. In two specimens, C7 sent a branch to the median nerve, which passed medial to the axillary artery forming an ansa axillaris, while in one specimen, the same branch joined to the median nerve medially to the brachial artery. On the dorsum of the manus in two specimens, the lateral branch of the superficial branch of radial nerve sent a communicating branch to the abaxial dorsal proper common digital nerve IV (ulnar nerve). Whereas in another specimen, on the right manus, there was no communication; however, on the left manus, the dorsal common digital nerve IV (ulnar nerve) sent a branch to the dorsal common digital nerve III (radial nerve).

Conclusion: The brachial plexus of the cat may have ansa axillaris as an anatomical variant but formed from C7 and not from the musculocutaneous nerve. The nerves to the manus can have communications among them.

Keywords: feline, nerves, neurology, peripheral nervous system

P-11

Effects of liquid diet feeding on growth of nerve in rat salivary glands during growth period

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Objective: The purpose of this study was to clarify how liquid diet feeding affected growth of nerve in parotid and submandibular glands of growing rats.

Methods: Male Wistar rats were weaned on day 21 after birth and divided into control and experimental groups. Control rats were given a pellet diet and experimental ones were given a liquid diet from 0 to 8 weeks. Animals were euthanized with deep inhalation of isoflurane, and parotid and submandibular glands were frozen in liquid nitrogen. The frozen sections were made and immuno-stained using anti-protein gene product 9.5 (PGP9.5) antibody (general nerve marker), anti-tyrosine hydroxylase (TH) antibody (sympathetic nerve marker), or anti-neuronal nitric oxide synthase (nNOS) antibody (parasympathetic nerve marker). This experimental protocol was approved by the Laboratory Animal Committee of Hokkaido University (Approval no. 14-0108).

Results: In parotid glands, TH-positive reaction was often observed around acini although positive reactions to PGP9.5 and nNOS were scarcely identified at 0 week. In control parotid glands, positive reactions to all antibodies gradually increased over time. In experimental parotid glands, the reaction to anti-TH antibodies was similar to that in the controls at each time point. However, PGP9.5- and nNOS-positive reactions were less than those in the controls. In submandibular glands, positive reactions to all antibodies in experimental groups were similar to those in control groups.

Conclusion: Liquid diet feeding inhibits growth of parasympathetic nerve in parotid glands, although it does not affect growth of autonomic nerves in submandibular glands.

Keywords: growth, liquid diet, nerve, salivary gland

P-12

Gross anatomy of the thoracic limb muscles of crab-eating raccoon (Procyon cancrivorus) and coati (Nasua nasua)

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Objective: The crab-eating raccoon (Procyon cancrivorus) and the coati (Nasua nasua) are two procyonid species (order Carnivora) with abilities for cursorial locomotion. However, Nasua nasua also has fossorial abilities, while Procyon cancrivorus has handling and swimming abilities. Therefore, this study aimed to describe the origin and insertion of the thoracic limb muscles of both species.

Methods: Four Procyon cancrivorus (two females and two males) and one Nasua nasua (male), which died of natural causes in wildlife care centers were used. These specimens were fixed with formalin at the Veterinary Anatomy Laboratory of the Universidad del Tolima (Colombia). Gross dissections on the thoracic limb regions were performed. The bioethics committee of the Universidade de São Paulo approved this study (CEUAx 3928240820).

Results: The supraspinatus and subscapularis muscles had an intermuscular septum cranially, where both muscles originated. The biceps brachii muscle inserted only onto the radial tuberosity; triceps brachii muscle had four heads; a palmaris longus muscle was derived from the flexor digitorum superficialis muscle; interflexorii muscles had a high development; and flexor digitorum profundus muscle had a higher development in Nasua than Procyon. The pronator teres muscle is inserted onto the proximal third of the radius in Procyon, while in Nasua inserted onto the two distal thirds of the radius.

Conclusion: The similarity of the thoracic limb muscles in both species corroborated its phylogenetic closeness. However, the differences of the muscles in Nasua nasua should be mainly adaptations for its fossorial habits, whereas in

Procyon cancrivorus to faster and finer movements due to its handling abilities.

Keywords: carnivore, myology, procyonidae

P-13

Morphological, morphometric and histological evaluation of the iliolumbar veins in a South African population: implications for spinal surgery

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Objective: The iliolumbar veins (ILVs) and their high frequency of variations are crucial to lumbosacral spine surgical interventions. Related damage during surgery may result in significant hemorrhage. Variations of ILVs are population specific but such reports are limited in the South African population. The current study examined the anatomy and variations and the tissue composition of the ILVs in South African cadavers of European descent.

Methods: Following the ethical waiver: W-CBP-210401-01, Eighty-nine adult cadavers were dissected for ILVs. The variations, morphometrics, and topography of ILVs were studied. Nineteen (ten proximal, nine distal) ILVs were processed for Hematoxylin and Eosin, Masson's trichrome and Verhoeff's histological stains to determine the tissue composition.

Results: ILVs were identified in 100% of cases. 45% of ILVs anastomose with each other bilaterally. Right sided ILVs terminated into posterior surfaces of the iliac vessels (p=.001), while left sided terminated into lateral surfaces (p=.001). 61% of the cadavers exhibited classification type 1 of ILVs pattern. 42% of ILVs were at S1 vertebral level with 31% lying between L4 and L5 spinal nerve roots. Left side PILVs had higher elastic fiber composition (p=.030). ILVs elastic to collagen fiber area ratio was 1:9.

Conclusion: ILV variations described in this study present new additional patterns, like bilateral anastomosis and laterality of the terminal drainage and ILV lying between L4 and L5 spinal nerve roots. ILVs have more collagen fibers than elastic fibers, predisposing them to avulsion during surgical retraction. Identification of all ILVs is important to minimize inadvertent hemorrhage and injury to adjacent structures.

Keywords: anatomical variations, iliolumbar vein, lumbosacral trunk, obturator nerve, South Africans of European descent

P-14

Machine learning and discriminant function analysis in the formulation of generic models for sex prediction using patella measurements

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Objective: Sex prediction from bone measurements that display sexual dimorphism is one of the most important aspect of forensic anthropology. Measurements of bones which do not have distinct morphological traits have been subjected to statistical analysis in the generation of population specific standards for sex estimation. Recent studies have highlighted some drawbacks in the use of population specific equations. This study aims to formulate generic models for sex prediction using measurements of the patella of South Africans of Africans using linear discriminant analysis and machine learning algorithms.

Methods: Six parameters were measured on each of a sample of 260 patellae of South Africans obtained from the Dart collection. Stepwise and direct discriminant function analyses were performed for measurements that exhibited significant differences between male and female mean measurement. We also used eight classical machine learning techniques along with feature ranking techniques to identify the best feature combinations for sex estimation. A novel stacking machine learning technique was trained and validated to classify the sex of the subject.

Results: The measurements of the patellae of South Africans are sexually dimorphic and the range of average accuracies obtained for pooled multivariate discriminant function equations is 82–84% while the stacking ML technique provides 91% accuracy which compares well with those presented for previous studies in other parts of the world.

Conclusion: The generic models proposed in this study from measurements of the patella of South Africans are useful for sex estimation with reasonably high average accuracies.

Keywords: anthropology, patella, sex estimation, discriminant function analyses, machine learning

P-15

Fetal-type variant of the posterior cerebral artery and concurrent bilateral cerebral infarction in a Korean male cadaver

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Objective: Fetal type variant of the posterior cerebral artery is a relatively common variant of the circle of Willis, but concurrent cerebral pathologies have not been well reported.

Case: This study was approved by the Institutional Review Board of Jeju National University (JJNU-IRB-2022-009). We describe a case of fetal type variant of the posterior cerebral artery and concurrent bilateral multiple cerebral infarction in the territories of the middle cerebral artery in a 78-year-old Korean male cadaver. Fetal type variant of the posterior cerebral artery was found in the right circle of Willis, arose from the internal carotid artery with larger diameter than the pre-communicating segment from the basilar artery. Histopathological examination revealed that left supramarginal gyrus and right infraparietal lobule showed characteristic cerebral infarctions with chronological changes.

Conclusion: Knowledge on the variation in the posterior cerebral artery combined with clinical features including cerebral infarction plays a pivotal role to anatomists and clinicians

Keywords: cadaver, cerebral infarction, circle of Willis, fetal-type variant

P-16

Sphere formation depends on E-cadherin expression, not on supplementation with serum or growth factors, in colorectal cancer

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Objective: To define the feasible factors for sphere formation in anchorage-independent environment, key characteristics were compared between 2D- and 3D-cultured colorectal cancer cells.

Methods: Human colorectal cancer cell lines, SNU-C5 and 5-FU resistant SNU-C5 (SNU-C5/5-FUR), were cultured as 3D supplemented with fetal bovine serum (FBS) or growth factor (GF) to form spheres as compared with 2D culture. To confirm the characteristics of sphere cells, morphometry, MTT assay, Western blotting, and immunocytochemistry were adopted.

Results: Sphere formation was induced better when supplemented with FBS than GFs, while SNU-C5/5-FUR only formed spheres supplemented with GFs. Sphere-formed cells showed slower cell proliferation than cells from monolayer, which coincided with increased levels of p21 and decreased levels of β-catenin. Markers for cancer stem cell and drug resistance were not significantly changed between 2D and 3D culture conditions. Sphere-forming cells showed significantly increased mature form of E-cadherin when supplemented with FBS.

Conclusion: These results suggested that sphere formation might be related with expression of E-cadherin, but not with cancer stem cell or resistance markers.

Keywords: cancer stem cell, colon cancer, e-cadherin, resistance, sphere

P-17

Anti-cancer effects of fenbendazole on 5-fluorouracil-resistant colorectal cancer cells

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Objective: To evaluate the anti-cancer effects of benzimidazole on resistant cells, various cell death pathways were investigated in 5-fluorouracil (5-FU) resistant colorectal cancer cells.

Methods: SNU-C5 and 5-FU resistant SNU-C5 (SNU-C5/5-FUR) colorectal cancer cells were adopted for cell viability assay, Western blotting, and flow cytometry for cell death and cell cycle analyses to examine the anti-cancer effects of benzimidazole.

Results: The IC50 of fenbendazole on SNU-C5 and SNU-C5/5-FUR cells was 0.50 μM and 4.09 μM, respectively, which was lower than that of albendazole. FACS analysis revealed that fenbendazole significantly induces apoptosis as well as cell cycle arrest at G2/M phase on both colorectal cancer cells. When compared with SNU-C5 cells, SNU-C5/5-FUR cells showed following differences: 1) less autophagy by Atg7 and LC3 inactivation, 2) more ferroptosis by decreased GPX4 and xCT, and increased DAMP, 3) less necroptosis by RIP3 inactivation, 4) feasible augmentation of apoptosis through beclin-1 and DAMP, and 5) less activation of caspase-8 and p53.

Conclusion: These results suggest that p53 might be correlated with 5-FU-resistant colorectal cancer cells and fenbendazole may be a potential alternative or adjuvant treatment in resistant colorectal cancer cells.

Keywords: apoptosis, benzimidazole, colorectal cancer, p53, resistance

P-18

The change of learning style profiles among year-one medical students at The University of Hong Kong

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Objective: Learning style is a holistic learning feature and may change in response to different learning environments. Year-

one medical students at the University of Hong Kong have emerged in an experiential learning environment inclusive of many self-directed, hands-on anatomy and histology practical sessions, which is drastically different from the lecture-dominated and teacher-centered learning environment in secondary school. This study attempted to portray the potential shift of learning styles among year-one medical students in regard to changes in the learning environment.

Methods: Using Kolb's Learning Style Instrument, two surveys were distributed to medical students at the beginning and end of their first year in medical school. The survey results were analyzed via pairwise comparison. In addition, focus group interviews were conducted to determine how the new learning environment impacted students' learning styles.

Results: The imagining and reflecting styles were dominant learning styles among medical students at the beginning of the first year. After one year of emerging with hands-on practical sessions, students' dominant learning styles have shifted to experiencing and imagining styles. Focus group interviews identified that self-directed learning is a significant challenge to first-year medical students. However, anatomy and histology practical sessions provided an encouraging experiential learning environment helping them overcome the challenge. Students' learning strategies were changed accordingly, which contributed to the shift in learning style.

Conclusion: In conclusion, year-one medical students changed their learning strategies to achieve learning goals when facing radical changes in the learning environment. The adjustment of learning strategies eventually contributed to changes in learning style.

Keywords: anatomy, experiential learning environment, learning style

P-19

Relationship between the maxillary sinus and teeth apexes with two different imagenological techniques

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Objective: To compare the relationship between maxillary posterior teeth apexes and the maxillary sinus using orthopantomography (OPG) and cone beam computed tomography (CBCT).

Methods: A total of 383 roots of postero-superior teeth, obtained from 28 pairs of images (OPG and CBCT), were measured, and analyzed. Each root was classified according to its vertical relation with the maxillary sinus in 4 categories (0: apex is not in contact with maxillary sinus; 1: apex is in contact with sinus; 2: apex is projecting laterally to sinus; 3: apex is projecting inside the sinus). The distance between the two structures was also measured.

Results: The relation between the apexes of all postero-superior teeth with the floor of the maxillary sinus reported an overall agreement of 57.8% between OPG and CBCT ($p<0.0001$). This agreement was 75.2%, 56.9%, 52.3% and 66.7% for the first premolar, second premolar, first molar and second molar respectively. The OPG showed 67.8% agreement for category 0, 54.6% for category 1, 16.4% for category 2 and 97.2% for category 3 with respect to CBT. The mean distance was found to be lower in all teeth measured with OPG than those obtained by the CBT. This was statistically significant in the first premolar, second premolar and first molar ($p<0.0041$, $p<0.013$, $p<0.0001$, respectively). Kappa 0.87 and Lin 0.97.

Conclusion: The OPG is not a reliable technique to observe the relationship of postero-superior teeth apexes with the maxillary sinus.

Keywords: Maxillary sinus, cone beam computed tomography, orthopantomography

P-20

A versatile, 3D-printed ultrasound hip model for the practice of joint injections

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Objective: As the use of ultrasound techniques rises, the need for ultrasound trainers in the academic setting has become more apparent. However, the benefit of such training is often outweighed by cost. Our ultrasound trainer utilizes 3D printing techniques to create an inexpensive hip phantom embedded into a biodegradable ballistics gel.

Methods: A hip mold was created from a 3D-scanned anatomy model. A model of a human hip was downloaded from Thingiverse, and edited in Meshmixer software. A Lulzbot, Taz 6 - 3D Printer using Verbatim PLA filament was then used to print the models. The outer hip mold was painted with latex to ease extraction, and the hip replica was suspended into the mold. A 15% Ballistic Gelatin Solution was poured into the mold and let set overnight at 4ºC.

Results: We were able to achieve a good echogenic appearance of the proximal femur with head and neck. Repeated needle sticks were possible with the phantom before needle tracks

became obstructive to the image acquisition. Air bubbles from the gel pouring process are visible in the gel, but cause little obstruction.

Conclusion: In this project we have been able to create a working prototype of a scannable ultrasound phantom of the human hip. Using ballistics gel similar to human tissue, we merged the power of 3D scanning, modeling and printing with ultrasound technology. This has enabled us to create a relatively inexpensive ultrasound phantom for ~$50, in contrast to commercially available alternatives ranging from hundreds to thousands of dollars.

Keywords: 3D printing, ultrasound, phantoms, medical education, task trainer

P-21

Analysis of the anatomical and dimensional variations of the nasopalatine canal by cone beam computed tomography

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Objective: To evaluate and determine the anatomical and dimensional variations of the nasopalatine canal (NPC) according to sex, age and dental status.

Methods: This observational cross-sectional study analyzed a total of 251 CBCT images obtained from the database from the Oral and Maxillofacial Imaging Service of the School of Dentistry of Universidad Andres Bello, Viña del Mar, Chile. Student-t test, chi-square test and ANOVA ($p<0.05$) were performed to evaluate statistical significance according to sex, age and dental status. This study was approved by the Research and Ethics Committee of the School of Dentistry of Andres Bello University.

Results: The NPC showed variability in terms of morphology and dimensions. The most predominant shape of the NPC was cylindrical (65.33%) and the most frequent shape of the curvature of the canal in a sagittal plane was straight inclined (54.98%). The mean length was of 10.92±2.82 mm, being greater in males than females ($p<0.01$). The most frequent anatomical variation in the coronal plane was the single canal type (57.76%). The effect of gender on the distance between the anterior wall of the NPC and the vestibular crest of the maxilla was not significant ($p<0.05$). In addition, a significant difference was detected between the dental status and the dimension of the vestibular table in relation to the CNP ($p<0.01$).

Conclusion: The use of CBCT revealed the importance of 3D imaging in terms of morpho-dimensional parameters. NCP variations should be considered to avoid possible complications during surgical procedures.

Keywords: anatomy, nasopalatine canal, cone beam computed tomography

P-22

Frequency of ponticulus posticus in digital lateral cephalograms

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Objective: The Ponticulus Posticus (PP) is a bride of bone located in the posterior arch of the atlas (C1) and it is related with the development of cervical pain. The aim of this study was to determine the frequency of PP in digital lateral cephalograms from the School of Dentistry of Andrés Bello University in Viña del Mar, Chile

Methods: This study corresponded to a descriptive observational study. Four hundred and fifty digitals lateral cephalograms from the database of the Oral and Maxillofacial Imaging Service of the School of Dentistry of Andres Bello University, Viña del Mar, Chile, were analyzed. The presence of PP was investigated in each cephalogram, and the Cederberg and Stubbs' classification was used to determine the degrees of ossification. The prevalence of PP was reported, and the Chi-squared test was applied to establish an association between the presence of PP with gender and age. This study was approved by the Research and Ethics Committee of the School of Dentistry of Andres Bello University.

Results: In total, 42.4% of all cephalograms exhibit PP, with a higher prevalence between the range of 21–40 years. Regarding the degree of ossification, grade 1 ossification was the most prevalent type (57.5%) followed by grade 2 (25%), grade 4 (9.5%) and grade 3 (8%) No association was found between the presence of PP with age and gender ($p>0.05$)

Conclusion: PP is common within the population, and it is observable at different ages without a predilection for gender.

Keywords: Ponticulus Posticus, Anatomy, digital lateral cephalograms

P-23

Anatomical changes in the stylohyoid chain complex: a radiological anatomy study

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Objective: Anatomical variations of the hyoid apparatus have great importance for radiological examination and surgery of the neck region. The aim of this study was to determine the aberrant hyoid apparatus and the elongated styloid process (the reason for Eagle's syndrome), which are variants of the stylohyoid chain complex.

Methods: We used the data of 406 cases that performed head and neck computer tomography angiography (CTA) at Hacettepe University. Radiological examinations performed between 2014–2022 were analyzed retrospectively. Age ranged from 2 to 95 years (mean of 45 years). The male/female ratio was one. This study was approved by the ethics committee of the Hacettepe University Faculty of Medicine (GO 22/386).

Results: Out of a total of 406 cases, 71 (17%) showed anatomical variants, 49 (12%) of the cases had an elongated styloid process, and 17 (4%) had the aberrant hyoid apparatus. In the present study, all of the aberrant hyoid apparatuses were incompletely ossified.Although both variants can be unilateral or bilateral, most of the aberrant apparatus cases tended to be bilateral. Remarkably %22 (n=5) aberrant apparatuses were observed together with the contralateral elongated styloid process.

Conclusion: In the literature, the Eagle's syndrome and the aberrant hyoid apparatus cases are mostly confused with each other. The anatomical variations of the aberrant hyoid apparatus and the elongated styloid process can be explained embryologically. Their exact incidence is important for forensic radiologists, ear-nose-throat surgeons, and radiologists.

Keywords: hyoid bone, hyoid apparatus, elongated styloid, computer tomography

P-24

Evaluation of the hyoid bone: a radiological anatomy study

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Objective: Shape differences of the hyoid bone are important because of its unique location and closely related structures. The aim of the present study was to evaluate morphological aspects of the hyoid bone using computed tomography angiography (CTA).

Methods: This study was conducted using head and neck CTA of 406 patients aged between 2–95 years (the mean age was 45). Ethics committee approval was received by the Hacettepe University Medical Faculty Ethics Committee (GO 22/386). The diameter of the hyoid body and fusion of the greater/lesser horn with the body were evaluated together with the shape of the hyoid bone. The variations in the shape of the hyoid bone were classified into four types alternatively to the literature.

Results: According to the direction of the greater horn, the classification was defined macroscopically as type 1 (outward), type 2 (inward), type 3 (parallel), and type 4 (asymmetrical). It was determined whether the body width and existence of fusion were related to the classification after they were analyzed separately. The association between the low diameter of the body and the non-fused form was found to be statistically significant. Also, there was a significant difference between the low diameter of the body and the outward type.

Conclusion: Differentiations of the hyoid and clinical conditions related to its morphology are particularly important in forensic medicine, radiology, anthropology, and neck surgery. We believe that understanding the complex developmental structure of the hyoid bone will provide data for surgical interventions and research on the neck region.

Keywords: hyoid bone, greater horn, lesser horn, computer tomography

P-25

Perception of teachers and students about the use of the Hyflex model in anatomy

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Objective: To know the perception of teachers and students about their experience in the use of the Hyflex model for the teaching of anatomy implemented in the task training rooms of the Simulation Hospital of Andrés Bello University, Viña del Mar, Chile.

Methods: This study corresponded to an observational study approved by the Research and Ethics Committee of the School

of Dentistry of Andrés Bello University. During the 2021 academic period, 98 students of the Applied Anatomy subject and its 7 laboratory teachers took part in this study. The participants answered a questionnaire of 10 closed questions with a 5 level Likert scale and 1 open question for additional comments. The quantitative analysis was performed with descriptive statistics and the Mann-White test was used to compare between groups. Statistically significant results were considered with $p<0.05$.

Results: Students and teachers showed a positive assessment of the use of Hyflex, highlighting that it enables them to access online content and activities that complement face-to-face activities, providing students with greater autonomy and organization of their study times. However, the participants had the impression that students do not learn more in the online format compared to face-to-face.

Conclusion: The use of Hyflex makes it possible to diversify the teaching-learning dynamics of the subject, making it fit the current educational needs of heterogeneous students that seek a personalized and autonomous experience that favors equivalent learning. According to the students and teachers, face-to-face attendance is essential to provide an adequate learning experience.

Keywords: Anatomy, Dental education, Distance education, Problem-Based Learning.

P-26

Enhancement of FABP4-expression in septoclasts in FABP5-deficient mice

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Objective: Septoclasts are mononuclear cells and involved in cartilage resorption of the epiphyseal plate. Our previous studies showed that epidermal-type fatty acid-binding protein (E-FABP/FABP5) was expressed exclusively in septoclasts of mouse epiphyseal plate. In this study, we investigated localization of adipocyte-type FABP (A-FABP/FABP4) and peroxisome proliferator-activated receptor (PPAR) Á in septoclasts of FABP5-deficient or PPARÁ agonist (GW1929)-treated mice.

Methods: Frozen sections of the epiphyseal plate were obtained from the proximal tibiae of FABP5-deficient mice, GW1929-treated mice and wild-type C57BL/6 mice. Single or double immunohistochemical staining for FABP4, FABP5, and/or PPARÁ was performed. In this study, maintenance and use of the mice and the experimental plan were approved by the Meikai University Animal Ethics Committee (A2016) and by the Ethics Committee for Animal Experimentation of Yamaguchi University School of Medicine (01–013).

Results: Number of FABP4-immunoreactive septoclasts of FABP5-deficient or GW1929-treated mice was more numerous than those of controls. PPARÁ was localized in the nuclei of FABP4-positive septoclasts of FABP5-deficient or GW1929-treated mice, although no expression of PPARÁ was detected in FABP4-positive septoclasts of control mice.

Conclusion: Present results suggest that the functional role of FABP5 in septoclasts is compensated by enhanced expression of FABP4 and new expression of PPARÁ in septoclasts of FABP5-deficient mice.

Keywords: FABP4, FABP5, epiphyseal plate, mouse

P-27

Observation of palatal shelf elevation developing mouse embryos using live imaging method

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Objective: The mammalian secondary palate is formed through complex developmental processes: growth, elevation, and fusion. Histological analyses reported that the palatal shelf development occurs as a result of multiple and coordinated cellular behaviors such as cell proliferation, changes in cell density, and ECM remodeling. However, especially in palatal shelf elevation, the cell dynamics are still unclear. In this study, to directly observe tissue deformation and cell dynamics during palatal shelf elevation, we established the confocal live imaging method in explant culture.

Methods: We used mouse embryos at embryonic day 13, which occur the palatal shelf elevation, and cross-sectional slices of palatal shelves were microsurgically processed and embedded in a dish with a collagen gel. For the observation, cells were visualized by nuclear staining dye.

Results: Using this live imaging method, we were able to observe the palatal shelf elevation for 360 minutes and trajectory of cell migration. During the observation, the palatal shelf continued to deform, with the lingual side deformation was greater than the buccal side deformation. Moreover, the lingual side cells migrated in one direction, while the buccal side cells migrate radially around a deformation point of palatal elevation.

Conclusion: These results suggested that the tissue deformation on the lingual side contributes to the palatal shelf elevation.All the animal procedures were in accordance with the Guidelines for Care and Use of Laboratory Animals of Meikai

University School of Dentistry, and these experiments were approved by the Meikai University Animal Ethics Committee.

Keywords: live imaging, mouse development, palatal shelf elevation, palatogenesis

P-28

Persistent sciatic vein: a cadaveric case report

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Objective: The objective of this study is to report the presence of a persistent sciatic vein (PSV) in a cadaver from the laboratory of human anatomy of the medical course of the UNIFAGOC. This anatomical variation is an anomaly of embryonic origin, which can be classified into three variations: complete, proximal or superior, or distal or inferior. It may lead to cases of chronic venous failure of the lower limb.

Case: During the routine dissection of the lower extremities of a Brazilian male cadaver, a case of PSV was encountered at the left posterior thigh region. The variant vein was originated from the saphenopopliteal junction (SPJ), ascended laterally and penetrated the fibres of the adductor magnus muscle. The length of the variant vein was 25 cm, and its diameter at the emerging site was 5 mm. It was a complete PSV, whose origin is the popliteal vein, ending in the external iliac vein and across the thigh to the buttock. It follows the sciatic nerve medially.

Conclusion: Physicians must understand the morphological changes in this area to properly diagnose and manage conditions such as deep vein thrombosis.

Statement: No ethical approval was required for this study.

Keywords: anatomical variation, cardiovascular system, anatomy, cadaver

P-29

Histological study on postnatal changes of the nerve network in the rat ileal mucosa

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Objective: We previously clarified three-dimensional structures of nerve network in the lamina propria (LP) of the rat ileum, and showed that these nerve fibers were in contact with various types of cells, especially subepithelial fibroblast-like cells (FBLCs). We here sought to clarify how the mucosal nerve network is formed during development.

Methods: We performed immunohistochemistry for various neuronal markers using the ileal mucosa obtained from early postnatal (P0), preweaning (2wk), and postweaning (4wk) rats euthanized by inhalation of isoflurane. We also examined postnatal changes in the frequency of adjacency between tubulin beta-III (Tuj1)$^+$ nerve fibers and platelet-derived growth factor-α (PDGFRα)$^+$ subepithelial FBLCs.

Results: Tuj1$^+$ nerve fibers were already extending into the mucosa at P0. The density of Tuj1 immunopositivities in LP was significantly higher at 2wk than at either P0 or 4wk. Among the other neuronal markers, only immunopositivity for the vesicular acetylcholine transporter was observed in LP at P0, and its density was highest at 2wk. The immunopositivity for vasoactive intestinal peptide, neuropeptide Y, somatostatin and substance P were also observed in LP at 2wk, although those for somatostatin and substance P were very rare, and these densities in LP increased toward 4wk. Tuj1$^+$ nerve fibers were most frequently adjacent to PDGFRα$^+$ subepithelial FBLCs at 2wk.

Conclusion: These results suggest that the mucosal nerve network functionally matures by changing their network structures before and after weaning and diversifying their neurotransmitters after weaning. Subepithelial FBLCs might be involved in inducing the transient extension of nerve fibers that occurs by 2wk.

Keywords: enteric nervous system, intestine, rat

P-30

Detection and studies of some macrostructural variations of human bones by the use of Anatomage Table

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Objective: The examination of human bones by the virtual dissection table Anatomage allows visualization of their dimensions and detection of the differences of macrostructures. Students and tutors can use this information for learning and teaching anatomy. This study aimed to investigate some anatomical variations in three types of digital human bones.

Methods: The Anatomage method was used for the visualization of human bones. In this descriptive study, data were collected and compared from four digital human cadavers of the Anatomage Table's database (Anatomage Table 6.0.3) in the Department of Morphology of Rīga Stradiņš University. Variations of the patella, last ribs and sternum with its parts were macroscopically observed by one Human Anatomy course tutor during spring 2022. The Ethical approval was not applicable.

Results: Patella manifested a variety of shapes, sizes and the asymmetry between medial and lateral facets, and its thickness between digital male and female cadavers. The 8th–10th ribs presented variants of their fusion, affecting the anterior portion of them. Differences in sizes were also detected for the 11th and 12th ribs on both sides. In digital four human bodies the main

sternal variations were as follows: xiphoid process with elongated its size or one oval sternal foramen, or sharp bifid ends.

Conclusion: There exist different sternums, last ribs and patella with several morphological expressions, including sizes, shapes, patterns, external contours, etc. Identification of variations of these bones by use of the Anatomage Table is important to study, differentiate and discover several normal or pathological conditions more frequently.

Keywords: Anatomage Table, patella, ribs, sternum, variations

P-31

Evaluation of the multiple tissue factors in cartilage of performed primary and secondary rhinoplasty in patients affected by cleft lip palate

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Objective: Cleft lip and palate (CLP) is one of the congenital craniofacial defects. The aim of our study was to determine the appearance and differences of tissue factors in cartilage of CLP patients during primary and secondary rhinoplasty.

Methods: Cartilage was obtained from CLP patients during primary and secondary rhinoplasty. The primary group consisted of 35 patients, the secondary group consisted of seven patients, and the control group - from 11 subjects. Immunohistochemistry was performed with MMP-2, MMP-8, MMP-9, TIMP-2, IL-1α, IL-10, bFGF, and TGFβ1. The semi-quantitative census method was used for the quantification of structures. The Spearman rank correlation coefficient and Mann-Whitney U test were used for the statistical analysis. A written consent form from the parents was obtained.

Results: MMP-2, -9, IL-1a, and bFGF demonstrated higher number of positive cells in patients, while number of MMP-8, IL-1a, -10 and TGFβ1 cells were higher or equal to the control subjects. A significantly higher number of TIMP-2 positive chondrocytes was observed only in the primary CLP patient group compared to the secondary CLP group (U=53.5; p=0.021). The median value of the primary CLP group has a moderate number of TIMP-2 positive chondrocytes compared to numerous in the secondary CLP group. No statistically significant difference was found between primary and secondary rhinoplasty patients for other tissue factors.

Conclusion: Commonly, cleft affected cartilage rich expression of different tissue factors suggests the stimulation of higher elasticity of cartilage. Statistically significant TIMP-2 elevation in primary operated cartilage indicates the selective tissue remodelation impact for hard tissue.

Keywords: CLP, cartilage, rhinoplasty, immunohistochemistry

P-32

Nerve branches to the human sternoclavicular joint

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Objective: The sternoclavicular joint (SCJ) is important for shoulder motion. The innervation of SCJ is a key to discuss its proprioception and motor control of the pectoral girdle. However, little is known about innervation of the SCJ and possible cause for the disorder of SCJ proprioception. The aim of this study was to clarify the innervation of SCJ and to provide anatomical basis for understanding the proprioception of SCJ contributing to the shoulder motion.

Methods: Six sides of nerve branches to the SCJs were dissected and observed under stereomicroscope, after maceration in trypsin solution to facilitate removing muscle and connective tissue, and pursuing fine nerve branches to the SCJ. The protocol of this study was approved by institutions of the authors.

Results: In all six sides, nerve branches from the medial supraclavicular nerve (MSN) went medially along the clavicle and reached the anterior and/or superolateral part of the articular capsule of SCJ. In four sides, nerve branches from the lateral pectoral nerve (LPN) went medially between the clavicle and first rib, and reached the inferior part of the articular capsule of the SCJ. In other two sides, a similar branch from the LPN did not reach the SCJ but ended at the periosteum of manubrium and/or perichondrium of first costal cartilage.

Conclusion: The SCJ was innervated by nerve branches from the MSN and LPN, or MSN only. Findings of this study suggest that the proprioception of SCJ could be disordered by injury of the clavicle or upper pectoral region.

Keywords: lateral pectoral nerve, medial supraclavicular nerve, peripheral nerve, sternoclavicular joint

P-33

Anatomy education within Australian and New Zealand osteopathic programmes

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Objective: Anatomy plays a key role in health professionals' education. The aim of this study was to analyze the anatomy

curricula within Australian and New Zealand osteopathic programmes.

Methods: A survey was distributed to all osteopathic programmes. Data on programme structure, delivery methods, assessment, resources, teaching academic profiles, and staff to student ratios were collected in 2020. This study was approved by the Macquarie Human Ethics Research Committee.

Results: All four osteopathic programmes participated in this study. The mean number of total contact hours in anatomy was 203.1 (SD±59.0). The anatomy teaching staff to student ratio varied between 1:17 to 1:35. All programmes employed a regional-based approach to anatomy content delivery with a variety of resources including cadavers, plastic models, interactive software, and medical images. The high proportion of clinically qualified academic staff involved in the delivery of anatomy education and relatively low staff to student ratios compare favorably with those in medical education. Despite the challenges posed by the Covid-19 pandemic, the delivery of anatomy within osteopathic programmes were placed online with minimal interruptions, while complying with all accreditation requirements.

Conclusion: Anatomy holds an important position in osteopathic education within Australia and New Zealand and compares favorably with anatomy education within other health disciplines such as physiotherapy and chiropractic. This study adds to the understanding of the status of anatomy within osteopathic education in Australia and New Zealand. Currently, Australia has no national guidelines for the teaching of anatomy in osteopathic education, further research is required on a core anatomy syllabus.

Keywords: anatomy education, osteopathic education, Australia, New Zealand

P-34

Anatomy and anatomical variations of cerebral vascularization: clinical and surgical correlations

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Objective: The circle of Willis has an almost pentagonal conformation and constitutes a wide anastomotic network between the four cerebral arteries. Its variations can interfere with cerebral blood perfusion. The study aims to identify the main anatomical variations of PW and cerebral vascularization reported in the literature, correlating them with the main clinical manifestations and surgical implications, contributing to the review of the theme by students and medical professionals.

Methods: This is a bibliographic review carried out in the PubMed and SciELO databases, whose search criteria consist of articles published in the last five years, which addressed the anatomy of cerebral vascularization, including the PW and its variations, as well as their correlation. with clinical manifestations and implications in the surgical area, using 17 articles. Articles addressing the correlation of these with clinical manifestations and implications in the surgical area were also included, with 17 articles selected.

Results: Variations were found in the arteries: internal carotid, anterior communicating, posterior communicating, middle cerebral, posterior cerebral, anterior cerebral and in the PW configuration. Aplasia, hypoplasia and fetal configuration were the most reported variations in the literature used, especially in the A1 segment of the ACA, anterior segment or posterior semicircle and persistence of the fetal configuration of the PW, respectively.

Conclusion: Such variations significantly interfered with the prognosis in invasive exams, neurosurgeries and after strokes. However, its relationship with symptoms needs further studies.

Keywords: circle of Willis, cerebral vascularization, anatomic variation

P-35

Anatomical investigation of the transverse dural venous sinuses

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Objective: The lack of imaging technology available in Sub-Saharan countries makes locating the transverse dural venous sinuses challenging. Furthermore, superficial, external landmarks proved too unreliable in locating these venous sinuses. Therefore, it is imperative to further examine the anatomy of the transverse dural venous sinuses (TS). This study aims to investigate the anatomy and possible variations found within the transverse dural venous sinuses.

Methods: The TS were exposed in 32 formalin-fixed human adult cadavers, located in the Department of Anatomy, University of Pretoria, by removing the calvaria and the brain. The width and length of the TS were taken, at three different locations along its course: origin, midpoint, and termination. These measurements were taken on both the dura mater as well as the impressions of these sinuses within the cranial cavity

Results: The average length of the TS on the left side was longer than that on the right for both within the transverse sulcus of the occipital bone (left: 73.96 mm; right: 71.49 mm) as well as the attached border of the tentorium cerebelli of the

dura mater (left: 71.11 mm; right: 68.97 mm). The right side had on average a wider termination point (L: 9.79 mm; R: 10.85 mm) within the dura mater. The right side for both the dura mater and the transverse sulcus were on average wider

Conclusion: More studies on the TS are needed to improve the understanding of the sinuses. Asymmetry of the TS is an important aspect of its anatomy.

Keywords: dura mater, transverse dural venous sinuses, transverse sulcus

P-36

The myotendinous junction: new ultrastructural aspects by transmission electron microscopy

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Objective: The interface morphology of the myotendinous junction (MTJ) is altered by different stimuli and is the principal force transmission area between muscle and tendon tissues. This way, MTJ is a region characterized by its ultrastructural tissue plasticity. The present study aimed to investigate the MTJ morphology of the biceps brachii muscle.

Methods: Four Wistar rats (90 days old) were used for ultrastructural analysis by transmission electron microscopy. The procedures applied in this study were approved by the Committee on Ethics in Animal Use of the Institute of Biosciences of the São Paulo State University (CEUA - nº 2207).

Results: The sarcoplasmic projections, the invaginations and evaginations, follow the changes in the interface between muscle and tendon structure. In the extracellular matrix, the structures presented the collagen support layer formed by transversal collagen fibers and bounded by telocytes in the distal region. They contribute to the tendon support front of force transmission provided by muscle contraction and proximal to the MTJ, and adjacent basal lamina parallel to the myotendinous interface was evidenced. At the distal region of the muscle tissue, serial sarcomeres were observed in parallel that are divided into distal and proximal sarcomeres and form the region of muscle contraction and compose the sarcoplasmic evaginations.

Conclusion: The MTJ has new structures discovered that contribute to its functionality and support in this region identified by transmission electron microscopy such as the telocytes and their prolongations (telopodes) and the presence of support collagen layer with their transversal collagen fibers.

Keywords: myotendinous junction, sarcomere, muscle, tendon, telocytes

P-37

A CT-based and morphological approach to measure sex- and age-related differences in shoulder morphology and body size

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Objective: For human scapulae, we have described a significant sexual dimorphism. However, when it comes to correlation with body size, the database is still weak, particularly for women and smaller sized individuals. Previous studies from our group revealed contradictory results for the correlation of upper limb dimensions to body size. Furthermore, in the elderly, potential osteoporotic compression fractures have to be considered. Thus, there is a demand to compare scapula dimensions with body size in a larger data set with special emphasis on aged and female individuals.

Methods: Computed tomography (CT) scans were performed prior to dissection on human body donors and included the shoulder girdle and arms. Shoulder parameters were measured on subsequently isolated scapulae and by 3D-CT reconstructions of the gleno-humeral joint performed according to Friedman. Body height was determined using different methodological approaches and correlated to scapula size to create a data set in the elderly with special emphasis on women. The project was approved by the cantonal ethics committee.

Results: In this multimodality study, we establish a morphological and CT-based data set of the gleno-humeral joint in human body donors, which serves to compare and extrapolate scapula and body sizes also in other specimens to be later expanded to include more individuals.

Conclusion: We aim at establishing a systematic basis of scapula parameters and body sizes for future studies in physiology, comparative and translational research and in diverse pathologies.

Keywords: computed tomography, female body size, shoulder dimension

P-38

Foot fault test: a scoring system and its application

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Objective: Research in peripheral nerve regeneration is growing with the use of animal models. The re-achievement of

motor function of the affected muscles requires a measurement tool to qualitatively assess the achievement of the regeneration process that occurs, and can also be used to assess the initial success of making animal models. This study aims to create a measuring instrument to describe the motor function status of Wistar rats with a qualitative assessment that focuses on only one extremity.

Methods: Animals are directed to walk on a ladder that is placed horizontally. The ladder is arranged using metal wire with a diameter of 2 mm, spacing of 2 cm, a total length of 100 cm and a width is 13 cm. Methods are described for assessing the performance of one extremity examined, including limb placement and finger gripping on steps.

Results: The results obtained are in the form of the percentage of foot performance that is examined with an interpretation close to 0 which indicates total disability, and close to 100 which indicates normal motor function.

Conclusion: The foot fault test can be used effectively to assess the motor function status of the muscles in one extremity being examined. Furthermore, a specific assessment strategy for each muscle is needed to increase the specificity of the test.

Keywords: foot fault test, motor function, measurement tool

P-39

Current situation of cadaveric donation: how much is known?

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Objective: To determine the general knowledge involving the Cadaveric Donation Programme at the Faculty of Medicine, Universidad de la República, in Uruguay; to analyze the demographic characteristics of confirmed donors and to analyze the received Corpse's registration.

Methods: A poll was carried out through Google Forms platform, generating a probability sampling. Data was digitized from 2003 through 2021, tabulated on Microsoft Office Excel © and processed on SPSS © v23.0 for Windows. Qualitative variables were crossed through Chi squared test. A p-value less than 0.05 was considered significant. Ethical approval was not required to carry out this investigation.

Results: Out of 1600 poll answers, 66.1% denied knowledge of the Programme, 27.1% were unwilling to donate their corpse, being the main reason for "Personal / familiar reasons". There's a statistically significant association between the desire of not being a donor and having completed a tertiary level of education. With regard to the analysis of people who have already donated, we determined an average of 53.6 donators with standard deviation of 21.2, finding female predominance.

Conclusion: Even though there's a lack of knowledge about the Cadaveric Donation Programme, the Faculty has managed to receive a significant amount of corpses annually, owing a faithful donator and received register so far.

Keywords: corpse, donor, education

P-40

Epileptogenesis phases investigation: hippocampal morphology and function in rat model of lithium chloride pilocarpine-induced epilepsy

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Objective: Epileptogenesis mechanisms are critical for understanding epilepsy and developing therapeutic strategies for epilepsy management. Hippocampal-mediated functions and structure were investigated in a lithium-chloride pilocarpine rat model of epileptogenesis

Methods: Forty-eight male Wistar rats weighing (80–120 g) were assigned into groups A–D (n=12 each). Group A was administered 0.3 mL normal saline, while B (acute), C (latent) and D (chronic) were administered (lithium-chloride (127 mg/kg) and pilocarpine (30 mg/kg) and sacrificed on days 30, 60 and 90 respectively. Open field and RAM behaviors were assessed. Rats for biochemical assays were sacrificed by cervical dislocation while rats for histology and immunohistochemistry were transcardially perfused with normal saline and 10% neutral buffered formalin. Sequel to sacrifice, coronal brain slices were obtained at the level of the optic chiasma and processed for routine paraffin embedding procedure. Hippocampal cytoarchitecture and astrocyte morphology evaluation was by H&E and GFAP respectively. Glutamate, GABA and TNF-α levels & GAD activity were assayed. Data obtained were analyzed by ANOVA followed by Tukey's posthoc test for multiple comparisons

Results: Exploratory activity, memory impairment and hippocampal neurodegeneration characterized all phases of epileptogenesis, while GFAP immunoexpression dominated the chronic phase of epileptogenesis. GABA level was significantly lowered at the latent phase. TNF-α level significantly increased at the chronic phase.

Conclusion: This study demonstrated reference memory impairment, hippocampal neurodegeneration, reactive astrocytes and neuroinflammatory changes with pronouncement at the

chronic phase of epileptogenesis. With the current understanding of the mechanisms of neurological deficit in epileptogenesis, the development of therapeutic targets in epilepsy management seem essential.

Keywords: epileptogenesis, hippocampus, neurotransmitters, memory, astrocytes

P-41

Gross anatomy of the extrinsic muscles of the thoracic limb in the Tamandua mexicana

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Objective: The Tamandua mexicana is a mammal of the superorder Xenarthra with great biological and clinical interest, so the anatomical study of this species is necessary to contribute to these areas. Taking into account that the muscles of the thoracic limbs adapt according to the phylogenetic and the type of locomotion, the main objective is to characterize the macroscopic anatomy of the extrinsic muscles of the thoracic limb of the Tamandua mexicana

Methods: Four specimens donated by CORTOLIMA were used, which died of natural causes, unrelated to the study. Subsequently, they were fixed with 10% formalin through subcutaneous and intramuscular injections. Once fixed, a superficial to deep dissection was performed, taking a photographic record of the muscles and describing their origins and insertions

Results: The M. trapezius was found fused with the M. brachiocephalicus, presenting the same innervation (N. accessorius) because of this was called M. brachiotrapezius. Two Mm. rhomboideus were found, the M. rhomboideus cervicis, and the M. rhomboideus thoracis, which at its insertion fused with the M. serratus ventralis thoracis. As for the pectoral girdle, were found the M. Pectoralis transversus and M. pectoralis descendens. While two Mm. pectoralis profundus were found, innervated by the same muscular branch of N. pectoralis caudalis, these muscles were named as M. pectoralis profundus cranialis and M. pectoralis profundus caudalis.

Conclusion: The extrinsic muscles of T. mexicana present dispositions not reported for this species, however, they present similarities with some other species belonging to the Xenarthra.

Keywords: insertion, locomotion, myology, origin

P-42

Distribution of the radial nerve in the Northern Tamandua (Tamandua Mexicana, Saussure, 1860)

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Objective: The Tamandua mexicana is a mammal of the superorder Xenarthra with great clinical interest. The anatomical knowledge of the nerves is necessary for the clinical evaluation and surgical procedures, including the radial nerve, which innervates brachial, forearm and hand muscles. For this, the aim of this study was described the distribution of the radial nerve in Tamandua Mexicana.

Methods: Four specimens donated by CORTOLIMA were used, which died of natural causes. They were fixed with 10% formalin through subcutaneous and intramuscular injections. Once fixed, a brachial plexus dissection was performed, describing the distribution of the radial nerve.

Results: The radial nerve originated from C5-T1. It was found at the middle level of the humerus passing through to the lateral part of the arm to innervate the Mm. Triceps brachii, Anconeus and Tensor fasciae antebrachii. It continues on the craniodistal third of the arm, drilling the M. brachialis, giving rise to the ramus superficialis which passes between the brachioradialis and extensor carpi radialis muscles. This branch was divided into a ramus lateralis passing through the craniolateral aspect, and on the hand forms the Nn. digitales dorsales communes, while the Ramus medialis reached the hand to originate the N. common dorsal digital for digit I. The N. cutaneous antebrachii lateralis was not found.

Conclusion: The distribution of the radial nerve was similar to that reported in other species, however it had a different characteristic like the absence of the N. cutaneous antebrachii lateralis.

Keywords: innervation, muscles, origin

P-43

Spatiotemporal gait characteristics of adolescents (12–14 year-old girls) engaged in professional sports

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Objective: Athletic performance depends on the progress of biomechanical research. AIM: to study the spatiotemporal gait

characteristics of adolescents professionally engaged in rhythmic gymnastics.

Methods: Gait parameters of 47 adolescent girls aged 12–14, professionally engaged in rhythmic gymnastics for at least 5 years (Group 1) and 42 age-matched healthy females not involved in sports (Group 2) were evaluated using three-dimensional video data analysis. Biomechanical parameters were recorded using a Vicon motion capture and analysis system (Vicon, Oxford, UK), including 10 Vicon T40 infrared cameras, an AMTI dynamometer platform (OR6–5–1000, Watertown MA, USA), Vicon Nexus and Vicon Polygon software (UK). The study was approved by the institutional ethics committee (Protocol N12, 2018-09-17) with written informed consent obtained from all participants.

Results: In Group 1 compared to Group 2 cadence and limp index were increased (118±1.2steps/min vs. 109±1.3steps/min; and 1.18±0.08, vs. 0.93±0.09 respectively, $p<0.05$); while step length and time of single support were decreased (0.56±0.022m vs. 0.63±0.025m; and 0.41±0.019s, vs. 0.49±0.016s, respectively, $p<0.05$). No other significant differences in such parameters as time of double support, step width, step time, gait speed, contralateral foot contact, contralateral foot off, were found between the groups.

Conclusion: The difference in the spatiotemporal characteristics of the gait of girls involved in rhythmic gymnastics indicate changes in the musculoskeletal system due to regular training load. Increased cadence leads to a shortened step length. Reduced time of single support and increased limp index indicate adaptive changes in the ankle joint biomechanics and the attempts to reduce the load exerted on it during walking.

Keywords: motion capture, rhythmic gymnastics, adolescents

P-44

Peri-intercalated duct sheath composed of fibroblasts in major salivary glands of the rat

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Objective: Inter/intra-lobular connective tissues provide blood supply and innervation for acinar and ductal components of the salivary glands, thus researches on the salivary gland interstitium have targeted the distribution of blood vessels and autonomous/sensory nerves, therefore, studies focused on fibroblasts, the most major cellular component in the interstitium, have been very rare.

Methods: This study investigated the localization and detailed morphology of fibroblasts in adult rat major salivary glands immunohistochemically using anti-47kDa-heat shock protein (Hsp47) antibody as a specific marker of fibroblasts. Immunostained sections were observed and analyzed by the confocal microscopy and the three-dimensional images were reconstructed.

Results: At the intercalated ducts in parotid, sublingual, and submandibular glands, Hsp47-immunopositive fibroblasts with long processes elongating along the ductal axis were observed. Fibroblastic bodies and processes were tightly approximated with the basal surface of duct cells and myoepithelial cells. These findings were also observed in electron microscopy. However, such specific localization of fibroblasts was not found in the exocrine pancreas without myoepithelial cells. Intralobular fibroblasts were smaller than interlobular ones, but fibroblasts along the intercalated duct possessed longer processes than other intralobular ones. Three-dimensional reconstruction revealed that the fibroblasts at the duct bifurcation of the intercalated duct run circularly, whereas those at the straight portion run longitudinally.

Conclusion: These results suggest that "peri-intercalated duct sheath of fibroblasts" exists in rat major salivary glands and it reinforces the duct by strong salivary flow and longitudinal contraction of myoepithelial cells at the intercalated duct.

Keywords: Intercalated duct, fibroblast cell, major salivary glands

P-45

Establishing the safe use of the Bridging Infix method for anterior pelvic fixation

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Objective: Established subcutaneous internal fixation techniques have shown better outcomes but still have significant complications, like injury of the lateral femoral cutaneous nerve (LFCN). A novel modified technique, the Bridging Infix, has been proposed to aid in the reduction of complications. The at-risk anatomical structures for the procedure are unknown. Therefore, the study aims to determine the relationship between the Bridging Infix and neighboring structures.

Methods: A total of fifty formalin-fixed cadaveric specimens (n=50) and two fresh frozen cadaver specimens (n=2) were utilized (Ethical clearance: 182/2021). Any cadavers with evidence of previous pelvic or abdominal surgery, pathology or damage

were excluded. The Bridging Infix was placed by surgeons as per the technique guide. Superficial and deep dissections were completed and measurements of the distance between adjacent structures and the implant as well as bony landmarks were taken to determine safe zones.

Results: The mean distance from the most medial implant screw to the LFCN was 37.97 mm (SD: 12.20). The iliohypogastric nerve was the closest structure to the rod-to-rod connector with a minimum distance of 5.40 mm and 3.14 mm on the left and right, respectively. The ilioinguinal nerve was a minimum distance of 12.36 mm on the left and 7.12 mm on the right.

Conclusion: The Bridging Infix has shown no damage to important adjacent anatomical structures. Thus, the surgical procedure can be considered safe if the screws are directly inserted into the iliac crest and no pressure is applied within three finger breaths from the anterior superior iliac spine or pubic tubercle along the inguinal ligament.

Keywords: anterior pelvic fixation, bridging infix, lateral femoral cutaneous nerve, minimally invasive

P-46

Audiovisual pills for the improvement of the teaching-learning process in practical classes of Human Anatomy in Health Science degrees

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Objective: The practical component is essential in learning anatomy. In some Health Sciences degrees it is not always possible to access cadaveric specimens, so anatomical models that do not always reproduce all the structures are used instead. Our main objective was to improve the learning process in the practical sessions of the Human Anatomy course in an Occupational Therapy degree, by means of audiovisual pills.

Methods: For this purpose, 5 short videos were made for 5 practical sessions, in which the essential contents of the Central Nervous System were explained on cadaveric specimens. The videos were watched by the students before each practical ("flipped classroom"). To encourage this work, compulsory questions were included to complete the videos. The viewing was recorded using the Edpuzzle programme. Subsequently, in the practical classes, the students applied the contents of the videos on models and images. This new methodology was evaluated by means of a student satisfaction survey.

Results: For 88.4% of the students, the videos helped them to make better use of the practical session and to better understand the theoretical contents (rating of 8.4±1.25 points out of 10). The students considered the duration of the pills to be adequate, rating it 8.4±1.5 points out of 10. 90.7% of the students would extend the proposed methodology to the rest of the practical classes of the course.

Conclusion: The audiovisual pills represented a considerable improvement in the teaching-learning process and students' motivation during the practical classes in which they were applied.

Keywords: audiovisual pills, human anatomy, education, practical classes

P-47

Cyclin D1 as a mediator of Leydig cells apoptosis in melatonin deficiency conditions

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Objective: In addition to its known role as a regulator of circadian rhythms, melatonin, secreted by the pineal gland, has been studied for its anti-apoptotic and anti-inflammatory biological activity. Previous studies have shown an association between melatonin and apoptosis in testicular Leydig cells (LCs), but there is insufficient data in the literature about the morphological changes in LCs in melatonin deficiency conditions. Apoptosis is a complex process that is regulated at multiple levels by a variety of pro- and anti-apoptotic proteins. The role of Cyclin D1 is examined in two directions - cell proliferation and provoking apoptotic changes in major damage to the DNA of the cells.

Methods: In this regard, we aimed to investigate testicular fragments of 3, 16 and 20- month-old Wistar rats, divided into 2 groups - animals with removed pineal glands, using the Hoffman-Reiter technique, and sham - group. The morphological changes were monitored by a routine histological analysis, and the expression of Cyclin D1, as a mediator of apoptosis, was visualized by immunohistochemistry. The research was funded by a project of MU-Plovdiv NO-02/2021 following the opinion of the Committee on Scientific Ethics at MU-Plovdiv number P-1583/2021

Results: The results show a more pronounced immunoreactivity for Cyclin D1 in adult animals with removed pineal glands, compared to the sham-group, without significant differences in its expression in young rats, and the morphological changes correlate with age-related testicular tissue alterations.

Conclusion: The interpretation of the results confirms the probable function of melatonin as an antiapoptotic agent in relation to testicular LCs.

Keywords: apoptosis, CyclinD1, Leydig cells, melatonin

P-48

De novo design of a PCR-RFLP assay for detecting the leptin single nucleotide polymorphism G-2548A in the human genome

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Objective: Leptin is an adipocyte-secreted hormone that is among the indicators of the energy status of the brain. In the leptin gene, there is a SNP involving A to G transition at nucleotide (nt)-2548 located in exon 6 upstream of the ATG start site in the LEP gene promoter. LEP G-2548A has been associated with increased leptin production and secretion by unilocular adipocytes. The same polymorphism shows a positive correlation with incidence of type II diabetes. The aim of the current study is to design a new in-house specific assay for LEP G-2548A genotyping by PCR-RFLP.

Methods: Genomic DNA was isolated from peripheral blood from healthy humans using column-based DNA extraction. The primers used for the PCR-RFLP assay were de novo designed by Primer 3. The following 22-nucleotide primer sequences were generated: Forward primer: 5'- GTTCCCG-TAATTTTCCCGTCCA – 3'; Reverse primer: 5' – AGAG-CAAAGACAGGCATAAGGG – 3'. Primer specificity was tested in a total PCR reaction mixture of 20 µL. Optimal primer annealing temperature was chosen using gradient PCR ranging from 45 °C – 65 °C for 35 cycles. All methods were carried out in accordance with the Medical University of Pleven local ethical guidelines and regulations.

Results: PCR amplicons were visualized on a 2.5% agarose gel. We detected the expected band size only at temperatures ranging from 45 °C to 58.6 °C. Furthermore, from 49.1 °C upwards we observed a significant increase of background amplification.

Conclusion: Within the tested temperature range, 46.9 °C was the optimal temperature that showed lack of non-specific amplification.

Keywords: leptin, leptin SNP, PCR

P-49

Epithelial surface and connective tissue cores of the Spix's yellow-toothed cavy (Galea spixii, Wagler, 1831) tongue

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Objective: Rodents have a wide diversity of morphologies of lingual papillae, and their description enables a better comprehension of evolution and feeding habits. This investigation aimed to characterize the morphology of lingual papillae of the Spix's yellow-toothed cavy, a Brazilian species adapted to a hot and dry climate.

Methods: Four tongues were dissected and analyzed under scanning electron microscopy to reveal the epithelial surface and connective tissue core (CTC). The research was approved by SISBio (n° 48585-1) and UFERSA Animal Use Ethics Committee (n° 20/2021).

Results: The tongue was anatomically divided into apex, body, and root (Fig. 1). The samples present filiform, fungiform, foliate, and vallate papillae. After epithelial maceration, the respective CTC was revealed. In the apex and body were revealed trifid filiform papillae with a tricuspid-like CTC, fungiform papillae were dome-like and had a round-like CTC. On the edge of lingual prominence were present robust filiform papillary lines, and the CTC of the primary line had a U-shaped morphology, while the second line had a C-shaped aspect. On the lateral surface of the prominence, the foliate papillae had clefts and were contiguous to laterally-placed fungiform papillae, CTC of the foliate papillae had laminar projections and the fungiform was round-like. The caudal region had a pair of vallate papillae, and CTC had several laminar projections.

Conclusion: The tongue of Spix's yellow toothed-cavy had species-specific adaptations. The presence and organization of the robust filiform papillary lines and fungiform laterally-placed were new characteristics for the records of the Rodentia anatomy.

Keywords: rodent, caviidae, lingual papillae

P-50

Pros and cons of an anatomical ethics and law module at UKZN

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Objective: An integral component in a broad medical and scientific curriculum is anatomical education utilizing cadavers. A major moral and ethical concern on the continent as well in our own country, is the use of unclaimed cadavers for anatomical teaching and research. In addition, there has been a drastic decline in the availability of cadaveric material for teaching and research in South Africa. Due to ethical ambiguities worldwide, cadaver procurement for teaching and research require regulations. In South Africa this is guided by the National Health Act 2003 and is regulated by statutory appointment of the provincial Inspectors of Anatomy.

Methods: In order to address the restructuring of the undergraduate medical science (anatomy) programme, the Department of Anatomy at UKZN implemented a module directed at the appreciation of ethics related to the use of cadavers for teaching and research.

Results: The module comprises a variety of discourses of anatomy ethical conundrums. It allows students to be free-thinkers by allowing self-initiated case studies which the students present in the form of role-play.

Conclusion: The implementation of the anatomical ethics and law course has been critical for Medical Scientists. This course is a step in the right direction in educating the scholars at an undergraduate level of the value of the cadaver in education, fundamental debates and discussion on current trends in procurement practice; allows for discourses in establishing common ethical and legal frameworks at Universities in South Africa by addressing several cultural, religious and socio-economic concerns of all population groups.

Keywords: anatomy ethics, anatomy education, ethical conundrums

P-51

Anatomical navigation system in thoracoscopic surgery of the esophagus

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Objective: To develop an anatomically oriented navigation system in the surgical treatment of cancer of the thoracic esophagus

Methods: The study consisted of 2 parts: anatomical experiment and clinical surgical practice. The first part of the study was carried out on 30 non-fixed human cadavers (in accordance with the protocol of the Local Ethical Committee No. 01-21 dated January 22, 2021 I. M. Sechenov First Moscow State Medical University (Sechenov University). The anatomical structure of the posterior mediastinal organs was studied and the main anatomical landmarks were determined. The second, clinical part of the study included video-assisted thoracoscopic extirpation of the esophagus with lymph node dissection, which was performed in 23 patients, 15 of them underwent surgery routinely, 8 patients - using topographic and anatomical navigation.

Results: The most important anatomical landmarks are: v.azygos, arch v.azygos, right vagus nerve, pulmonary ligament, bifurcation lymph nodes, thoracic lymphatic duct, right vagus nerve, recurrent laryngeal nerve. In the group of patients who underwent routine thoracoscopic esophageal extirpation, intraoperative damage to the thoracic lymphatic duct was recorded in 3 (13.0%) cases, thermal injury of the recurrent laryngeal nerve in 2 (8.7%) patients. The number of removed lymph nodes in the group with the use of the navigation system was significantly higher and amounted to 32±4, and in the group without navigation 27±3 lymph nodes. There were no intraoperative complications in the group using the topographic-anatomical navigation scheme.

Conclusion: Topographic and anatomical navigation reduces the number of intraoperative complications and performs an adequate amount of lymph node dissection

Keywords: thoracoscopic extirpation of the esophagus, lymph node dissection, topographic and anatomical navigation, esophageal cancer

P-52

Affected primitive streak morphology does not inhibit primordial germ cell induction in rabbit

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Objective: Mammalian germ cell induction is best understood in mice and humans. In both the emergence of the primitive streak, marking the onset of gastrulation and primordial germ cell (PGC) induction, takes place in already implanted embryos. Rabbit gastrulation is initiated before implantation, allowing observation of PGC induction on intact isolated embryos. We aimed to analyze the influence of a chemically disturbed primitive streak morphology on PGC induction in the rabbit embryo.

Methods: Embryos were collected from young adult New Zealand White rabbits in accordance with ethical standards of the German 'Tierschutzgesetz'. At 6.2 days after mating freshly isolated blastocysts (n=95) were incubated with Rho-associated coiled kinase (ROCK) overnight, fixed with paraformaldehyde and in-situ hybridized either with NANOS3 or BMP4.

Results: After ROCK-inhibition NANOS3 expression domain in 85% (n=7) of specimen is distributed in a crescent-shaped area in the posterior third of the embryonic disc, compared to a condensed expression restricted to the posterior pole in wild type specimen. BMP4 and NANOS3 expression domains overlap in 53% (n= 13) of ROCK-inhibited specimen laterally at the extraembryonic border, in 92% (n=13) in a crescent-like area along the posterior border between extra- and embryonic tissue.

Conclusion: Nanos3-expressing PGC precursors predominantly colocalize with areas of high BMP4 expression. This correlates with rabbit expression patterns of other molecules associated with PGC specification (e.g. Blimp1 and BMP2, not shown here). Therefore, we hypothesize that, although the morphology of the primitive streak is clearly affected, the molecular cascade of the PGC induction seemed to be preserved in ROCK-treated rabbit embryos.

Keywords: primordial germ cell induction, rabbit, primitive streak

P-53

Three-dimensional analysis of knee joint development during the human fetal period

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Objective: The knee joint is composed of multiple organs, and the surrounding muscles are deeply related to joint movement., which is thought to be also true during development. The purpose of this study is analyzing the developmental process and the effect of the surrounding muscles about the knee joint in the fetal period.

Methods: Three-dimensional images of the pelvic, femur, tibia, and Hamstrings muscle were obtained from MRI data of normal human fetal specimens [26.8–185 mm CRL (crown-rump length)], and the morphogenesis of the femoral condyle was clarified by cross-sectional views and using Procrustes analysis of the shape of femoral condyle. In order to assess Hamstrings muscle force affecting the knee joint quantitatively, it was defined as the cross-sectional area of each muscle [mm^2] × the distance from the knee joint center point (the intersection of the central axis of the femur and tibia) [mm] to the stop of each muscle.

Results: Features of bone structure of the knee joint became clearer over time from 26.8 to 185 mm CRL, and the formation of the trochlear groove was observed from around 60 mm CRL. Muscle strength tended to increase slowly in 60–100 mm CRL, and rapidly in 100–120 mm CRL.

Conclusion: The growth of the intercondylar fossa of the femoral head and muscle occur at the same time, and the formation of the trochlear groove also coincides with muscle growth, suggesting that the morphogenesis of knee joint and surrounding muscles may interact with each other during development.

Keywords: knee, knee joint, fetus, human, muscle

P-54

Musculocutaneous and median nerve branching: anatomical variations. Case series from University of Rwanda, clinical anatomy and literature review

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Objective: The brachial plexus is highly variable, which is a well-known anatomical fact. Repeated observations on anatomical variations, however, constitute current trends in anatomical research.

Case: In an anatomical dissection course, three uncommon variations in the brachial plexus were identified in three young adults' cadavers. In one case, the musculocutaneous nerve gave a branch to the median nerve, while the median nerve gave or received musculocutaneous branches in the two remaining corpses.

Conclusion: Anatomical variations of the brachial plexus do occur in our setting. The cases we presented are about anatomical variations of branching patterns of the median and musculocutaneous nerves. Knowledge of those variations is essential for surgery and regional anesthesia of the upper limbs.

Keywords: anatomical variations, brachial plexus, median nerve, musculocutaneous nerve, upper limb

P-55

Exploring the vascular branching pattern of a horseshoe kidney in a cadaver

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Objective: Horseshoe kidney (HSK) is the most common congenital renal anomaly, estimated at about 0.25% among the general population. HSK shows variations in origin, number, and size of the renal vasculature. In this report, the detailed anatomy of a single case of HSK is described.

Case: During the abdominal dissection of a male cadaver in the Anatomy Department of AUTh, a HSK was identified. It had a symmetric U shape, and its fusion was located at the lower poles. Four renal arteries (RAs) were found. The right RA is divided into an upper polar branch and a main renal trunk that is further trifurcated into multiple branches supplying the right kidney except for the distal lower pole area. The left renal area was supplied by two RAs. The main left RA supplied a major part of the left kidney and the accessory left RA provided additional branches to the left lower pole and the isthmus. The isthmus was supplied by an isthmic artery that additionally supplied the lower poles' areas. Three renal veins (RVs) were found, the right one collected blood via three branches, the left via four, and the third drained blood from the isthmus. No ethical approval was required for the conduction of this study since

the subject was derived from the Department's body donation program, after written informed consent.

Conclusion: This case description highlights the necessity of the meticulous dissection of the HSK in layers, to record HSK variations in the vascular branching patterns.

Keywords: horseshoe kidney, variation, fusion, branching pattern, vessel

P-56

A morphological cadaveric study on the third head of gastrocnemius muscle

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Objective: The gastrocnemius muscle third head (GM6) is the most common variant of the gastrocnemius muscle (GM). It was firstly described by Kelch (1813) and its morphological variability was further investigated by Frey (1919). The accessory head may originate from the femur posteroinferior surface and join the GM medial or lateral head. Certain accessory head variants may cause popliteal vessel entrapment. The current cadaveric study determines the GM6 occurrence and highlights its variability in the course and morphology and possible relationship with popliteal vessels.

Methods: Forty formalin embalmed cadaveric knees derived from the Anatomy Department of AUTh body donation program were dissected at the popliteal area. Possible popliteal vessel entrapment was identified.

Results: A GM6 was identified in 6 out of 40 lower limbs (15%), all of female origin. The accessory head originated at the posterior distal surface of the femur, near the midline, and medial to the lateral head (83.3%). In a single case (16.6%), the accessory head originated from the GM lateral head and joined the medial head. In a unique case, the 3rd head was inserted into a distinct tendon merged with the Achilles tendon. In all cases, the accessory head was located lateral to the popliteal vessels and favored compression on them.

Conclusion: The GM6 occurs with a frequency of 15%. Its presence is of clinical importance as it may cause functional impairment due to the popliteal vessels' entrapment, especially in cases of the GM6 location in close proximity to the GM lateral head.

Keywords: accessory head, entrapment, gastrocnemius muscle third head, variation

P-57

A case of sartorius muscle duplication

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Objective: Muscle and tendon aberrations have been described in the literature for decades. The current case report describes a duplication of the sartorius muscle (SM).

Case: During the dissection of a male cadaver of 55 years of age, in the Anatomy Department of AUTh a double-headed SM was identified. No ethical approval was required for the conduction of this study, since the subject was derived from the Department's body donation program, after written informed consent. The upper and lower heads had a length of 53.2 cm and 56 cm and were of a parallel course. At the SM lower third, a muscle bundle was identified originating from the upper head that after an oblique downward course joined the lower head. The two heads by their tendons originated from the anterior superior iliac spine. Between the SM heads, in the upper third, the anterior femoral cutaneous nerve was identified, and in the lower third, a branch of the saphenous nerve was found. The SM upper head had a tendinous insertion lateral to the tibial tuberosity, and the lower head formed the superficial layer of pes anserinus. Both heads received neural and arterial supplies from the femoral nerve and artery.

Conclusion: The knowledge of this variation is crucial for both anatomists and orthopedic surgeons since it may interfere in the surgical field and can be utilized as a tendon graft of the gracilis-semitendinosus muscle for the anterior cruciate ligament reconstruction of the knee.

Keywords: accessory head, duplication, graft, muscle variation, sartorius muscle

P-58

Radiological measurements of the tentorial notch

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Objective: The tentorial notch is an area defined by the dura mater that establishes the limit between the cerebellum and the brain hemispheres. This space is involved in the mechanism of different brain injuries. We aimed to measure the tentorial notch and the third cranial nerve in overall healthy patients with Magnetic Resonance Imaging (MRI).

Methods: We performed a cross-sectional study using 60 MRIs. The measured variables were the maximum notch width (MNW), notch length (NL), interpedunculoclival (IC) distance, apicotectal (AT) distance, CN-III distance, and inter CN-III angle. A classification for the tentorial notch was developed according to the quartile distribution of MNW and NL.

Results: The classification of the tentorial notch was divided into narrow, midrange, and wide. The notch length was stratified as short, midrange, and long. All together formed an 8-category classification for the tentorial notch. There was a statistically significant difference midst sex in the MNW and inter CN-III angle. There was a strong positive correlation between NL and AT distance and right and left CN-III distances.

Conclusion: Analyzing the tentorial notch in living subjects will increase our understanding of the most accurate measures, and our knowledge about how this is involved in different brain injury mechanisms. Previous studies analyzed these same measures, although the results were different, most likely due to post-mortem processes.

Keywords: tentorial notch, brain herniation, magnetic resonance Imaging

P-59

Internal jugular vein area measurements at different Trendelenburg position angulations and head rotation

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Objective: In the Trendelenburg position the patient is positioned in decubitus supinus with the feet raised in a plan above their head. It has been described to benefit blood return, hence increasing the size of the vein. This might aid in procedures such as central venous catheterization. However, this position is not comfortable for patients for long periods of time. The aim of this study was to determine an ergonomic angulation that increased the Right Internal Jugular Vein (RIJV) transverse area and diameter.

Methods: An experimental study was carried out with healthy adults. They were randomly assigned to different positions at 15°, 10°, 5°, and 0° head down tilt, at a 5 minutes interval between each angulation. RIJV transverse diameter and area were measured at the level of the thyroid cartilage. A contralateral rotation of the head in 90°, 45° and 0° in relation to the central axis of the body was performed at each measured position.

Results: A total of 54 participants were included. Age range was 22–32 years, with a BMI mean of 24.12. At Trendelenburg position with the different contralateral rotation of the head (90°, 45°, 0°) RIPJ area measurements were: 15º=1.50, 1.62, and 1.89 mm^2, at 10º=1.33, 1.60, and 1.70 mm^2; at 5º=1.46, 1.39, and 1.52 mm^2, and at 0º=0.97, 1.11, and 1.39 mm^2.

Conclusion: Considering the low side effects of positioning patients in 5° with 45° head rotation, this was the best position for patients. Along with it, it had the best access area for RIJV.

Keywords: Trendelenburg position, central venous catheterization, ultrasound

P-60

Brachial plexus: anatomy and main variations

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Objective: The brachial plexus is a nerve network that supplies the upper limb. It is formed by the union of the anterior branches of the last four cervical nerves and the first thoracic. It is not uncommon for descriptions of variation in their classic anatomy. The objective of this study is to adress anatomical variations of the brachial plexus in order to facilitate the study by health professionals, especially doctors.

Methods: This is a review article, based on information provided by the SciELO and Google Academic databases. The search was guided by four keywords marked by "and", or "or". Anatomy books were used.

Results: The brachial plexus can receive contribution from C4 and T2. The formation of two trunks and two fascicles was reported and two upper and lower trunks formed by the union of the primary anterior branches of C5, C6 and C7, C8, T1 respectively. In addition, the formation of a common fasciculus in place in the medial and lateral fasciculus has been described, as well as the posterior fasciculus was formed by the anterior

divisions of the upper and lower trunk, indicating that, in some cases, the radial and axillary nerves may not receive fibers from C7 and C8. The pectoral nerve leaving the anterior division of the upper trunk and the absence of the musculocutaneous nerve are also described.

Conclusion: The brachial plexus has a complex anatomical structure and relationships and knowledge of anatomical variations is important for doctors during surgical procedures and to explain unexpected clinical signs and symptoms.

Keywords: brachial plexus, anatomic variation, anatomy, health personnel

P-61

Anatomy of porcine head and neck blood vessels applied in biomedical research

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Objective: Based on the CT angiography, with special regard to the Prestice black pied breed, our pilot study compares anatomy of this breed with the previously published anatomical description of porcine head and neck main vessels.

Methods: Four healthy pigs (2 males, 2 females), age 50—60 days, weight 24—36 kg, Prestice Black Pied breed; CT scanner SOMATOM go.Top (Erlangen, Germany). The literature search was performed with the use of the keywords "domestic pig", "arteries/veins of the head/neck" in the MEDLINE database, PubMed interface.

Results: Branching of main arteries and veins corresponded to the previously published descriptions. The rete mirabile epidurale caudale was not differentiated, the rete mirabile epidurale rostrale was located intracranially.

Conclusion: As a large animal model, the pig is irreplaceable also for testing new surgical and imaging methods. Demands for knowledge of anatomical differences are growing also in connection with the need for more precise planning of experiments and translation of their results. More detailed studies mapping the breed-age-sex bound vascular morphology are needed.

Keywords: domestic pig, arteries/veins, head/neck

P-62

Fish collagen peptides protect against cisplatin-induced cytotoxicity and oxidative injury by inhibiting MAPK signaling pathways in mouse thymic epithelial cells

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Objective: To provide new insights into therapeutic approaches for future applications of FCP in the prevention and treatment of age-related or acute thymic involution as well as various oxidative- or cytotoxic stress-related cell injuries in TEC.

Methods: A WST-1-based colorimetric cell proliferation assay was used to evaluate the ability of FCP to facilitate cell proliferation. The effect of FCP on the cisplatin-induced generation of ROS in TECs was detected by DCFH-DA, a ROS-sensitive fluorescent probe, under a fluorescent microscope. The levels of expression of apoptosis- and proliferation-related proteins and expression of p38 MAPK, JNK, and ERK were assessed using a western blot assay.

Results: FCP stimulates proliferation, and ameliorates cisplatin-induced cytotoxicity and oxidative stress in TECs. In addition, it was shown that the inhibitory effects of FCP on cytotoxicity are likely associated with suppression of the ROS and MAPK (p38 MAPK, JNK, and ERK) signaling pathways.

Conclusion: FCP may be a promising protective agent in TEC injury induced by cytotoxicity and oxidative stress elaborated by chemotherapeutic drugs, such as cisplatin and other cytotoxic agents. Furthermore, the data of the current study may provide new insights into the therapeutic approach for the future application of FCP in the prevention and treatment of a variety of cytotoxic and oxidative stress-mediated injuries in TECs as well as acute or age-related thymic involution.

Keywords: cisplatin, reactive oxygen species, apoptosis, MAPK pathway

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Table of Contents

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Abstracts

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