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**Proceedings of 13th Meeting of the Young
Generation of Veterinary Anatomists (YGVA),
Sarajevo, Bosnia and Herzegovina
22–24 July, 2026**

ABSTRACTS YGVA 2026

Oral presentations

**001 | From Skull to Simulation: A Rabbit Head Model Bridging
Airway and Dental Anatomy with Clinical Training**

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ABSTRACT: Rabbits present several anatomical features that make airway management particularly challenging. A deep and narrow oral cavity, limited mandibular excursion, large incisors, and a relatively large tongue restrict access to the airway, while the glottis is often difficult to visualize. Because of these constraints, airway instrumentation requires considerable experience and careful handling. In clinical practice, attempts at endotracheal intubation are usually limited to three tries, as repeated manipulation increases the risk of trauma to the larynx and trachea. Airway management in rabbits can be performed using three main techniques: endotracheal intubation, nasotracheal intubation, and supraglottic airway devices. However, opportunities to practice these procedures are limited, and realistic training models are limited. The aim of this project is to develop a realistic rabbit head model that combines anatomical learning with practical clinical training. A real rabbit skull will be scanned using the Artec Space Spider handheld 3D scanner from Artec 3D (Luxembourg, Luxembourg) to accurately reproduce cranial anatomy, including dental structures, the restricted oral opening, and the spatial relationships within the oral cavity. The model will then be printed using the Stratasys J55 Prime 3D printer from Stratasys (Eden Prairie, Minnesota, USA; Rehovot, Israel). Based on the scan data, soft tissues such as the tongue, oral cavity, and airway structures will be digitally reconstructed and printed using flexible materials. The model will allow students to practice and compare endotracheal, nasotracheal, and supraglottic airway management techniques in a controlled training environment. In addition, the model will enable students to study rabbit dental anatomy and common dental malformations frequently encountered in veterinary practice. By integrating anatomical accuracy with functional training capabilities, the model aims to bridge the gap between anatomical education and clinical skill development and represents a first step toward a comprehensive rabbit training simulator for veterinary education and research.

Keywords: rabbit anatomy, veterinary education, airway management, dental anatomy, 3D model



**002 | Development of Virtual 3D Models of the Goat's Gastric
System: First Steps for Upgrading the Quality and Accessibility
of Learning Materials**

AUTHORS: Joachim Truelsen¹, Julia Hollenbach¹, Elisabeth Engelke¹, Matthias Lüpke², Kerstin von Pückler³, Johanna-Marie Haumann⁴, Lara Ott⁴, Sandra Wissing⁴, Kristin Elfers⁵, Christiane Pfarrer¹

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ABSTRACT: Cadaver-based dissection classes are considered golden standard in anatomical education. Learning materials handed to students for preparation of dissection classes are typically two-dimensional, and many students have difficulties applying the content to the three-dimensional specimens in the course. Virtual 3D models as supplementary learning material can improve spatial imagination and hence support better preparation for dissection classes. As the ruminant forestomach represents a clinically relevant complex system, the aim of our study was to develop high-fidelity virtual 3D models of the goat's gastric system. Goats acquired for dissection classes were used for the generation of a topographical and an isolated gastric 3D model (approval authority number TiHo T-2025-10). To ensure detailed visualization of internal structures, the gastric contents were replaced with air via insufflation. First, whole-body computed tomography (CT; accomplished by Phillips IQon Spectral CT) scans were conducted in lateral recumbency. Then the gastric system was exenterated to perform isolated CT scans. Segmentation of the CT scans was performed with the software Amira-Avizo®. Post-processing was done combining Amira-Avizo® and Maxon ZBrush® softwares. The resulting models were exported with Materialize 3-matics® to generate 3D PDFs, ensuring easy access to the 3D models with Adobe Acrobat®. The topographical 3D model showed the stomach in its native anatomical relationship with adjacent organs, including the spleen, diaphragm and heart. Virtual sectioning of the isolated gastric 3D model allowed detailed visualization of its compartments, while internal structures such as ostia, pilae, papillae, and cristae were

rendered in a spatially resolved manner. Owing to the high level of detail in depicting both internal and external structures, as well as spatial relationships, these models are well suited for dissection course preparation. Their effectiveness in improving the efficiency of preparation for dissection sessions will be evaluated this summer by veterinary students during the regular anatomy course.

Keywords: Anatomical education, virtual 3D models, goat's gastric system

Funding: Foundation Innovation in Higher Education, project number 3003-1280.

003 | Use of the Elnady Technique in Creating a Canine Vaginal Cytology Training Model

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ABSTRACT: Simulation-based approaches are becoming increasingly important in veterinary clinical education by providing ethical and effective alternatives to training on live animals. This study describes the development of a reusable canine vaginal cytology simulator using the Elnady plastination technique and examines its usefulness as a teaching tool for undergraduate veterinary students. Two female canine cadavers were processed using a modified Elnady preservation protocol to create flexible, anatomically accurate models suitable for repeated instructional use. Twenty-four fourth-year veterinary students completed a training program comprising a theoretical introduction, instructional video, and hands-on practice with the simulator. Educational outcomes were evaluated through questionnaires administered before and after training, an adapted Objective Structured Assessment of Technical Skills (OSATS), and a post-training satisfaction survey. Prior to instruction, most participants reported limited or no experience performing canine vaginal cytology sampling. After completing the training, students demonstrated increased confidence in carrying out the procedure, and all participants indicated that they felt capable of attempting the technique on a live animal. OSATS scores revealed consistently strong performance in procedural knowledge and communication, while greater variation in instrument handling and procedural efficiency reflected the expected learning curve associated with acquiring new practical skills. Student feedback indicated high levels of satisfaction with the simulator, particularly regarding its anatomical fidelity, opportunity for repeated practice, provision of immediate feedback, and ability to support learning in a low-stress environment. These findings suggest that the Elnady plastinated canine vaginal model is a practical, affordable, and durable resource for teaching vaginal cytology sampling. Incorporating this simulator into veterinary curricula may strengthen clinical skills training while supporting the reduction of live animal use in education.

Keywords: veterinary education, vaginal cytology, Elnady plastination

Funding: This study was co-funded by Ministry for Science, Higher Education and Youth of Canton Sarajevo, Bosnia and Herzegovina, project grant number 27-02-35-33087-35/24.

004 | The Use of Anatomical Specimens of Limbs in Equine Clinical Discipline at the University of Veterinary Medicine and Pharmacy in Košice

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ABSTRACT: The anatomy of the distal part of the equine limb is complex and requires effort to understand and subsequently apply the knowledge in clinical practice. The presence of important bony structures, synovial structures, nerve branches, and vessels make this area a challenge for the correct interpretation of results obtained using imaging modalities such as X-ray, ultrasound, computed tomography, and magnetic resonance imaging. The aim of this paper was to prepare innovative anatomical specimens by combining different preparation techniques (dissection, plastination, sectioning, and corrosive preparations). In the work, we used thoracic (n=5) and pelvic autopodia (n=5) from 5 horses. The anatomical specimens prepared by us were used during the Farriery and Equine Diseases course (practicals and clinical practice), where it was possible to demonstrate anatomical structures on bones during X-ray examinations of horses. Synovial structures, such as joint capsules and tendon sheaths, were filled with self-curing resins for better visualization and to enable understanding of their topographical-anatomical relationships, which were subsequently compared during ultrasound examinations. However, in only one case were we able to visualize the podotrochlear bursa. From the vascular system, it was necessary to highlight the importance of digital veins, which are used when performing phlebography in laminitis patients. The anatomical preparations prepared have been smoothly introduced into the teaching process of clinical disciplines for several years and represent inseparable tools for the correct comprehension of topographical-anatomical relationships during examinations of the musculoskeletal system of horses. In our opinion, anatomical models should be a part of every clinical workplace and thus represent a very effective study aid for students studying clinical disciplines, as well as for clinicians themselves for reviewing anatomical relationships, which can result in better diagnostics and therapy.

Keywords: Applied anatomy, equine, plastination, skeletons, topography

005 | Evaluation of the Usability of the Focus Stacking Method for Imaging Small and Highly Detailed Structures in Veterinary Anatomy

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ABSTRACT: Detailed examination of anatomical structures is of great importance in veterinary anatomy education and research. Especially when imaging highly detailed structures such as small bones, foraminifera, joint surfaces, and fine morphological formations, the limited depth of field makes it difficult to obtain all surface details clearly in a single image. This can negatively impact both anatomical assessments and digital documentation work. Focus stacking is an image processing technique that allows the creation of a single image with high depth of field by combining images obtained at different focal planes. This study aims to evaluate the applicability of focus stacking in imaging small and highly detailed structures in veterinary anatomy. Five anatomical structures (cranium, atlas, os hyoideum, os sacrum, and os coxae) from a rat skeleton, each with different morphological features and surface details, were used as material in this study. Each specimen was imaged from different angles, and numerous photographs were obtained at different focal planes for each angle. The obtained images were combined using focus stacking software, and the resulting images were evaluated in terms of the visibility of anatomical details, surface clarity, and overall image quality. As a result of the focus stacking application, it was observed that many anatomical details that were not sufficiently distinguishable in single-frame images became more prominent. In particular, it was determined that small protrusions, grooves, foramina, and fine surface structures were more clearly visualized. Furthermore, it was found that the method significantly reduced depth-of-field blurring and allowed for a holistic evaluation of anatomical structures. In conclusion, it is evaluated that the focus stacking method is an effective and applicable technique for visualizing small and highly detailed structures in veterinary anatomy, and can make significant contributions, especially in the preparation of educational materials, digital archiving studies, and advanced imaging applications.

Keywords: Focus stacking, Veterinary anatomy, Anatomical imaging, Depth of field, Morphological structures

007 | Mandibular size and shape in wild canids of Bosnia and Herzegovina

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ABSTRACT: Studies on wild canids from Bosnia and Herzegovina have mainly focused on population dynamics, genetics, and diseases, while the morphology of the Bosnian population of Dinaric-Balkan grey wolf, continental golden jackal, and red fox remains understudied. The head skeleton serves as a good model

for researching genetic variation and ecological adaptations. This study aimed to explore sexual dimorphism and patterns of mandibular shape and size variation in these species using geometric morphometrics. In total, sample consisted of 40 wolves, 50 jackals and 47 foxes. Animals were obtained from osteological collections and during the legal hunting season. Fresh specimens underwent tissue removal by boiling or bacterial maceration, followed by bleaching in hydrogen peroxide. After photographing mandibles under the same conditions, image preparation and landmarking were performed in tpsUtil and tpsDig, while geometric morphometric and statistical analyses were conducted in R. The analyses revealed species-specific patterns of mandibular variation, with the greatest shape changes occurring in landmarks representing the mandibular ramus rather than the corpus, suggesting greater morphological plasticity of the ramus. Male wolves exhibited significantly larger centroid size than females (Wilcoxon rank-sum test, $p=0.035$), while shape did not differ between sexes. In jackals, significant sexual size dimorphism was detected (Procrustes ANOVA, $p=0.0007$), with males larger than females. Although shape was not affected by sex, a significant size $\times$ sex interaction indicated sex-specific allometric trajectories. Foxes did not differ in centroid size ($p=0.08$), but shape variation remained significant after removing the size effect. Similarly, to jackals, the significant size $\times$ sex interaction in foxes suggested different allometric patterns between sexes. These findings indicated that allometry is the primary source of shape variation in canids, particularly in wolves, which are hypercarnivorous, whereas jackal and fox mandibles exhibited greater plasticity consistent with their more omnivorous diet. This study provides a baseline for future investigations of geographical variation in canid cranial morphology, especially considering recent genetic studies reporting distinct haplotypes in Bosnian populations. Combined morphometric and genetic analyses provide suitable methods for exploring adaptations in wild canids.

Keywords: Canidae, mandible, sexual dimorphism, size, shape

Funding: This study was funded by Federal Ministry of Education and Science, Bosnia and Herzegovina, project grant number 05-35-3616-1/25

008 | Tongue Morphology and Histological Structure in Gurcu and Abaza Goats

AUTHORS: *Semine Dalga¹, Şahin Aslan², Serap İlhan Aksu², Kadir Aslan¹, Dilem Ermutlu²*

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ABSTRACT: This study aimed to examine and compare the anatomical and histological aspects of the tongue, which plays a crucial role in taste and swallowing. Fourteen skulls (n:7 Abaza, n:7 Gurcu) were used in the study. Latex injection was performed into the common carotid artery to visualize the arterial supply of the tongue. Then the tongues were dissected from the skulls, and measurements were taken for descriptive statistical analysis. According to descriptive statistical data, the average total length of the tongue in Gurcu goats was measured as 124.56 mm, while in Abaza goats it was 120.33 mm. The average width of the apex

linguae in Gurcu goats was analyzed as 7.60 mm, and its length as 32.33 mm. In Abaza goats, the width of the apex linguae was recorded as 8.29 mm, and its length as 33.91 mm. In Gurcu goats, it was observed that the right lingual artery disappeared immediately after branching off from the right external carotid artery. The arterial supply to the right side of the tongue was found to be provided by a strong branch originating from the left lingual artery. For histological examination, Crosmonn's trichrome stain was applied to tongue samples taken from goats. Papillae were observed in all regions of the tongue. Microscopic examinations revealed similar histological findings in both goat breeds. The epidermis, lamina propria, submucosa, and muscle layers of the tongue tissue were distinguished. Histologically, the goat tongue was found to have a thin lamina propria layer, relative to the size of the tongue tissue, beneath a thick keratinized epithelial layer on the dorsal side. The tongue papillae were identified as the *papillae filiformes*, *papillae conicae*, *papillae lentiformes*, *papillae fungiformes*, and *papillae vallatae*. It was observed that the *papillae filiformes* and *papillae lentiformes* existed in two types.

Keywords: Lingua, *papillae linguales*, goats

009 | Hidden Vulnerabilities: An Anatomical Perspective on Fatal Human–Dolphin Interactions

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ABSTRACT: Bottlenose dolphins (*Tursiops truncatus*) are resident in the Adriatic Sea, where intense fisheries, maritime traffic and tourism expose them to frequent human–dolphin interactions. Some of these interactions result in lethal lesions. This study characterizes the anatomical factors underlying injuries associated with fishing activities and illegal shooting determined in 103 (24.3%) of 423 bottlenose dolphins found dead along the Croatian Adriatic coast between 1990 and 2025. As obligate air-breathing mammals with limited dive duration, bottlenose dolphins are highly susceptible to asphyxia during entanglement. Thirty-five individuals exhibited pulmonary oedema consistent with drowning following capture in fishing gear. In 20 dolphins depredating from nets, torn net fragments became anchored around the larynx. The extreme dorsorostral elongation of the arytenoid and epiglottic cartilages, together with the positioning of the laryngeal aditus inside the nasopharynx, predisposed to laryngeal strangulation. In 14 cases, ingested fishing gear accumulated in the forestomach, whose large capacity, adapted to accommodate up to 10 kg of prey per feeding event, favored chronic retention. Penetrating thoracic trauma in five deliberately injured dolphins disrupted the prominent *rete mirabile thoracis*, a vascular network specialized for cerebral oxygen supply during diving, resulting in fatal haemorrhage. External appendages also contributed to morbidity. The pectoral fins, dorsal fin and fluke, essential for stabilization and propulsion yet protruding from the streamlined body line, facilitated entanglement resulting in severe cutaneous lacerations in four dolphins. The dorsally positioned nasal opening necessitates surfacing of the head during respiration. This

anatomical feature rendered the neurocranium vulnerable to illegal shooting, causing penetrating brain injury and death in one dolphin. Additionally, fracture of the slender and elongated mandibles—structures integral to prey capture and biosonar function—was documented in one dolphin attempting to escape a trawl net. This study highlights how specialized evolutionary and anatomical adaptations may increase vulnerability under anthropogenic pressures.

Keywords: Bottlenose dolphin, anatomical adaptations, human–dolphin interactions

Funding: This study has been funded by the European Union under the National Recovery and Resilience Plan 2021–2026, grant number: NPOO – 2.

010 | Hand and Foot Musculature of the Common Marmoset (*Callithrix jacchus*)

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ABSTRACT: The common marmoset (*Callithrix jacchus*) is a New World Monkey that since the 1960's frequently serves as a model in biomedical research. Its much smaller size, shorter reproduction cycle, and easy handling are a few advantages compared to the use of the rhesus monkey (*Macaca mulatta*). Our knowledge of its anatomy is the fundament of the provision of the correct environment, housing, and care together with offering accurate medical attention in the case it gets wounded. The marmoset's hand plays a pivotal role in the interaction with the environment and conspecifics. Their arboreal support in the housing facilities that are provided with plenty of branches requires a well-functioning foot. Surprisingly, anatomical works on the common marmoset are scarce. The available books and atlases are either outdated in terms of illustrations, providing only simplified line drawings, and/or fail to recapitulate the anatomy of the hand and foot using contemporary anatomical nomenclature. This poster illustrates the myology of the hand and foot, based on dissections of eight common marmoset cadavers, four of either gender, by means of color photographs taken during the subsequent steps of the examinations. Dorsal and palmar/plantar views of the antebrachial/crural muscles with influence on the carpus/tarsus and hand/foot as well as the intrinsic hand/foot musculature are scrutinized. The findings are discussed in view of potential contradictions with the available literature. In addition, comparison is made with the rhesus monkey whose hand and foot musculature was recently revisited by the authors. It is concluded that the hand and foot musculature of both species is highly similar although remarkable differences are present. This work could serve as an anatomical foundation for medical interventions of the injured hand and foot by the responsible veterinarian. The presented anatomical data could also be valuable to gain a better understanding of the marmoset's locomotion.

Keywords: Common marmoset, anatomy, musculature, hand, foot

011 | Digital Imaging-Based Morphometry of the Feline Fundus: Regional Vascular Variations and Evolutionary Adaptations

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ABSTRACT: Standardized quantitative data regarding the feline fundus is essential for establishing anatomical norms and identifying reliable vascular biomarkers. This study aimed to quantify the optic nerve orifice (ONO) dimensions and retinal vascular calibers in healthy cats, investigating potential variations associated with sex and regional topography (tapetal vs. non-tapetal zones). Digital fundus images were acquired from 40 eyes of 20 healthy adult cats (10 males, 10 females) using a high-resolution handheld camera (Smartscope PRO, Optomed; 5 MP, 40° field of view). Morphometric analyses were conducted via ImageJ software. Retinal vascular equivalents, including Central Retinal Artery Equivalent (CRAE) and Central Retinal Vein Equivalent (CRVE), were determined using the specialized Singapore I Vessel Assessment (SIVA) protocol. Statistical significance was evaluated using Independent Samples t-test for sex-related comparisons and Paired Samples t-test for regional topography. The analysis revealed a predominant central trifurcation pattern of the primary retinal vessels, where major vascular trunks converge near the center of the optic disc. The ONO exhibited an elliptical morphology, with the mediolateral diameter being marginally larger than the dorsoventral diameter. While ONO dimensions showed a higher numerical trend in male cats, statistical analysis confirmed no significant sexual dimorphism between groups ($p > 0.05$). Notably, a highly significant regional variation was identified; both CRAE and CRVE values were significantly wider in the superior tapetal zone compared to the inferior non-tapetal zone ($p < 0.05$). The mean Arteriole-to-Venule Ratio (AVR) remained consistent at 0.59 ± 0.04 . These findings suggest that feline retinal vascularity exhibits a centralized emergence followed by functional asymmetry, driven by the high metabolic demands of the superior tapetal zone. This regional dominance is consistent with the feline species' evolutionary adaptation as nocturnal predators; the wider vessels in the tapetal area facilitate enhanced nutrient and oxygen delivery to support specialized photoreceptors responsible for optimized low-light vision and hunting efficiency.

Keywords: Feline Fundus, morphometry, tapetum lucidum, central trifurcation, Smartscope PRO.

012 | Computed Tomography as a Tool for Breed Differentiation and Functional Cranial Analysis in Dogs and Wolves

AUTHORS: *Dimitar Bozinovski¹, Vlatko Ilieski¹, Martin Nikolovski¹, Monika Dovenska¹, Jane Vlahov¹, Bozidar Zivkoski¹, Lazo Pendovski¹*

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ABSTRACT: The use of advanced technologies, such as computed tomography (CT) and three-dimensional (3D) reconstruction, has become an important tool in veterinary anatomical research, enabling

detailed morphological and functional analyses of the cranial region. In this study, we use CT as a reliable method to identify and quantify interbreed differences in dogs through craniomorphometric analysis, temporomandibular joint (TMJ) evaluation, and endocranial volume assessment. Craniomorphometric analyses, as well as measurements of the temporomandibular joint and endocranial volume, were performed on 60 dogs, while the estimation of bite force was conducted on 10 dogs and 5 wolves. High-resolution CT datasets provide detailed views of the animal body and enable precise measurement of cranial parameters, resulting in objective data for breed differentiation, particularly in morphologically similar populations. Furthermore, CT-based volumetric analysis enables the reconstruction and quantification of masticatory muscles, providing insight into their functional capacity. By integrating muscle volume measurements with anatomical data, CT can serve as an indirect tool for estimating bite force in both domestic dogs and wolves, contributing to understanding of functional adaptations related to feeding behavior, ecological roles, and evolutionary divergence. The results show that CT imaging facilitates accurate morphometric differentiation between breeds and supports the functional interpretation of cranial structures. TMJ morphology appears relatively conserved, while variations in craniomorphological architecture and endocranial volume provide significant breed-specific and evolutionary discriminatory values. Additionally, muscle volume analysis represents a promising non-invasive method for biomechanical assessment of bite force. Overall, computed tomography is important not only in the clinical sector but also in education and research, providing valuable insight into veterinary anatomy. It represents a multidisciplinary tool in veterinary science, bridging anatomy, functional morphology, and biomechanics, and offering new perspectives in breed characterization and comparative studies between domestic and wild animals.

Keyword: CT, endocranial volume, bite force, Craniomorphometry, TMJ

013 | Correlation Between Canine Skull Morphotypes and Oligodontia: A Retrospective CT Study

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ABSTRACT: Skull morphotypes can be categorized using the cephalic index (CI), a ratio of head width to length, although all standard dog breeds are already divided into three groups. According to this criterion, a dog can have brachycephalic, mesocephalic or dolichocephalic skull morphotype. Oligodontia is a dental anomaly characterized by the absence of multiple teeth. Teeth may be missing due to congenital abnormalities (hypodontia) or acquired causes. The aim of this study is to find a potential correlation between skull morphotypes and oligodontia in dogs. Computed tomography (CT) of 343 archived canine scans from the Veterinary Teaching Hospital were reviewed. Among all head CT scans, regardless of the indication, pathologies related to maxillary, mandibular, and dental abnormalities were recorded in 107 dogs (31%). Oligodontia

was observed in 58 dogs (54%), which were further classified by breed, age, skull morphotype, and the number of missing teeth (single or multiple). 18 mixed breed (31%) and 40 purebred (69%) dogs were identified. For mixed-breed dogs, CI was used to determine the skull morphotype. The results showed that oligodontia occurred in 6 dolichocephalic dogs (10%), with a mean age of 9.83 years; 36 mesocephalic dogs (62%), with a mean age of 10.75 years; and 16 brachycephalic dogs (28%), with a mean age of 10.69 years. No breed predisposition was identified, owing to the high proportion of mixed-breed dogs (31%). Multiple teeth were missing in 53 dogs (91.4%), while 5 dogs (9.6%) had a single tooth missing. Mesocephalic dogs predominated in cases involving both single and multiple missing teeth. Contrary to expectations, mesocephalic dogs were most affected by oligodontia in this CT-based cohort, followed by brachycephalic dogs. Due to lack of data, the etiology of oligodontia was not investigated. There was no significant difference in the mean age of dogs affected with oligodontia across skull morphotypes.

Keywords: Oligodontia; skull morphotype; computed tomography (CT); dog

016 | Challenges of Neuronal Tracing *In Vitro* and *In Vivo*

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ABSTRACT: Over the last decades, neuronal morphology has been both intriguing and challenging to study due to the diversity in cell size, function, and organization in mammals. Several fluorescent proteins have been developed and widely used in histology, particularly in neuroscience. To the best of our knowledge, there is no perfect tool for cell tracing; however, detailed morphological analysis can be achieved using a combination of different approaches. For the purposes of this study, we used the Thy1-YFP-16 mouse strain, which expresses green fluorescent protein in approximately 20% of neurons, as well as human induced pluripotent stem cells (iPSCs) with lentivirally integrated green fluorescent protein. Here, we demonstrate detailed neuronal morphology during embryonic development in mouse embryos and after transplantation into the mouse brain affected by stroke. Moreover, in human cells, we used green fluorescent protein to visualise neuronal morphology throughout *in vitro* differentiation in both 2D and 3D systems, including cerebral organoids and cortico-striatal assembloids, in the context of Down syndrome. Using mouse embryonic development and two neurodegenerative conditions, we further illustrate neuronal morphology. Our data reveal detailed dendritic and axonal morphology, including diameter, length, branching, terminal points, and Sholl analysis. Additionally, we observed differences in cell fate associated with neurodegenerative disorders. A limitation of our approach is that we could not analyse dendritic spine numbers both *in vitro* and *in vivo*. Based on our findings, we conclude that green fluorescent protein is a powerful and sufficient tool for neuronal tracing and micro-morphological analyses.

Keywords: Neuronal morphology, cell tracing, neurodegenerative disorders

Funding: Adris Foundation, NPOO-NextGeneration (NPOO-12, NEURO-MORF), Croatian Science Foundation (HRZZ-UIP-2025-02-5828), CRP-ICGEB (CRP/HRV25-03)

017 | The Multilayered Network - Insights into Animal Fascial System.

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ABSTRACT: Understanding the fascia as an integrated anatomical system requires moving beyond a reductionist approach to account for its multilayered nature and regional specialization. This research conducted a comprehensive analysis of fascial structures across different animal species (dogs, cats, pigs, and rats), encompassing the superficial, muscular (aponeurotic and epimysial), and so-called visceral, and neural fasciae. Utilizing complementary morphological methodologies, ranging from classical anatomical dissection and histology to scanning electron microscopy (SEM), tissue architecture was evaluated at both macro- and microscopic scales. For histological analysis, fascial samples were post-fixed in 4% buffered formalin and embedded in paraffin. 4µm sections were cut and stained with haematoxylin and eosin, Weigert's resorcin fuchsin for elastic fibers, Picrosirius red and Alcian blue. Specimen surface and structure were verified using a Jeol JSM-7600F scanning electron microscope. The findings corroborate the thesis that the fascia constitutes a continuous, systemic network characterized by a precise organization of stiff collagenous layers interspersed with lubricant layers rich in hyaluronan. SEM and histological analyses revealed that, depending on the anatomical site and species, the organization of these layers adapts to specific functional demands; parallel fiber alignment predominates in areas of high tensional force transmission (e.g., aponeurotic fascia), whereas interwoven, multidirectional structures facilitate multi-axial gliding mobility. These observations align with the most recent definition of the fascial system as a complex network that ensures both structural integrity and necessary sliding interfaces between adjacent anatomical structures. In conclusion, the observed morphological variability, coupled with the preservation of systemic continuity across species, suggests that animal fascia should be classified not as a single tissue, but as a sophisticated system essential for the functional and structural coherence of the entire organism.

Keywords: Fascial system, comparative anatomy, connective tissue, veterinary anatomy

Funding: This research was supported by statutory research and development activity funds assigned to the Wrocław University of Environmental and Life Sciences and University of Zielona Góra.

018 | Multispecies Investigation into Cardiac Heterotopic Cartilage and Bone Structure, Formation and Prevalence

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ABSTRACT: Cardiac bone and cartilage have historically been known to exist in many mammalian and non-mammalian species. These include *ossa cordis* and *cartilago cordis*, as well as other areas of ossification and chondrogenesis within the heart. This comprehensive, systematic review focused on heart bone and cartilage not located in the fibrous cardiac skeleton and therefore cannot be described as *ossa cordis* or *cartilago cordis*. Literature from multiple literature database searches were compared in relation to the reported histological and anatomical structures and locations of cardiac bone and cartilage. Information including species prevalence, anatomical and histological architecture, number of structures, potential developmental indicators, possible function(s), and correlation to disease processes were gathered. Regarding anatomical location, cardiac bone and cartilage were commonly found in the aortic and mitral valves in humans, however they were also discovered in additional heart structures, including the myocardium in other species. Lamellar bone was the most typical bone found in hearts, and hyaline was the most frequent form of cartilage. Some studies in humans discovered that bone formed in the aortic valve leaflets as a disease process in aortic valve stenosis. In many cases there was no evidence as to why, or how, the bone or cartilage developed. Theories reported have included that they provide structural support or form in response to a disease process such as inflammation. Developmental links between cardiac bone and cartilage were established in selected cases, with some occurrences of endochondral ossification within the cardiac tissue. In conclusion, cardiac bone and cartilage exhibit a wide range of structures, with differing functions and locations, with species variations regarding prevalence and presentation. There may be many more species with cardiac bone and/or cartilage, as these structures may be missed during postmortem/pathology investigations due to their, sometimes, extremely small size and variable location.

Keywords: Cardiac, cartilage, chondrogenesis, heart, ossification.

Funding: We acknowledge funding from the School of Veterinary Medicine and Science, University of Nottingham, UK, especially for scholarships for EW-F and OB. The Hounsfield Facility received funding from the European Research Council (Futureroots Project), the Biotechnology and Biological Sciences Research Council of the United Kingdom, and The Wolfson Foundation.

Ethics: This research received appropriate ethical permissions from the University of Nottingham School of Veterinary Medicine and Science ethics committee under UK approved ethical guidelines (#3186 200604, 1843 160905, 3186 200604, 1843 160905, 3524 211209).

020 | Anatomical and Histological Characterization of the Porcine Pudendal Nerve

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ABSTRACT: Lower urinary tract (LUT) disorders profoundly affect quality of life and social well-being. In response, a range of surgical and neurotechnological approaches has been developed, with the porcine model widely adopted owing to its close anatomical and dimensional resemblance to humans. The pudendal nerve, comprising both somatic and autonomic fibers, plays a pivotal role in the motor and sensory functions of the pelvic floor. A precise anatomical and histological characterization of this nerve is therefore essential to inform and refine targeted neuromodulation strategies for the treatment of LUT dysfunction. In this study, we characterized surgical access to the pudendal nerve, its root-level topography, and its microstructural organization in mini pigs (n = 5) and farm pigs (n = 15). A caudolateral intermuscular approach was primarily evaluated to expose the pudendal nerve. Experimental animals previously enrolled in other studies were included. The pelvic region was dissected, and the nerve was traced from the sacral plexus to its terminal branches. Tissue samples were collected for histological and immunohistochemical analyses. Hematoxylin-eosin, Luxol Fast Blue, and Masson's Trichrome staining were performed; additionally, immunolabeling for tyrosine hydroxylase (TH), choline acetyltransferase (ChAT), Neurofilament (NFP) and substance P was conducted to characterize the neurochemical composition of the nerve fibers. The transgluteal approach provided consistent access to the pudendal nerve with minimal tissue damage, achieved through blunt dissection between *musculus gluteobiceps* and *musculus gluteus medius*. Histological analysis revealed that the pudendal nerve consists of approximately 30–50 fascicles and is formed by the confluence of branches originating from the L6, S1–S3 spinal roots. Immunohistochemical analysis revealed neurofilament-positive nerve fibers distributed across all fascicles. Conversely, motor and sensory fibers—labeled for ChAT and substance P, respectively—exhibited a restricted distribution limited to specific fascicles, whereas TH-positive preganglionic sympathetic fibers were present throughout all fascicles. These findings provide a detailed morphological and topographic map of the porcine pudendal nerve, establishing a solid anatomical basis for future bioengineering and neuromodulation studies.

Keywords: Pudendal nerve, pig model, pelvic innervation, immunohistochemistry, neuromodulation

021 | Characterization and Quantitative Analysis of Primary Bovine Mammary Epithelial Cells

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ABSTRACT: Understanding bovine lactation physiology and the cellular mechanisms of milk-producing mammary epithelial cells is essential for advancing dairy science and may contribute to the development of alternative and more sustainable approaches to milk production. This study aimed to establish and characterize an in vitro model based on primary bovine mammary epithelial cells. Primary bovine mammary epithelial cells were isolated from udder tissue of lactating cows obtained after slaughter and cultured in RPMI 1640 supplemented with fetal bovine serum and penicillin/streptomycin. Lactogenic differentiation was induced using a stimulation medium additionally containing epidermal growth factor (EGF), insulin, bovine holo-transferrin, β -estradiol, progesterone and hydrocortisone. Cellular characterization was performed by immunocytochemistry using antibodies against the epithelial cell adhesion molecule (EpCAM), cytokeratin 18 (CK18), α -smooth muscle actin (α -SMA), and the oxytocin receptor (OXTR). All markers were validated in paraffin-embedded bovine mammary tissue sections. Quantitative analysis was performed by flow cytometry using EpCAM and OXTR. On paraffin sections EpCAM and OXTR stained all epithelial cells. Luminal epithelial cells lining the alveoli stained positive for CK18, while α -SMA labeled the myoepithelial cell layer surrounding the luminal cells. Initial flow cytometry analysis of unstimulated cells using EpCAM and OXTR antibodies revealed two distinct cell populations. These cell populations are presumed to represent luminal epithelial and myoepithelial cells. In the next step triple-staining approaches using EpCAM, α -SMA, and CK18 or OXTR, α -SMA, and CK18 will be performed in unstimulated and stimulated cells to further characterize the different cell populations. These analyses will allow determination of the relative proportions of luminal epithelial and myoepithelial cells in unstimulated and lactogenically stimulated mammary epithelial cell cultures. Further experiments will focus on determining the optimal stimulation duration of the cells for the subsequent synthesis of milk components such as β -casein.

Keywords: Primary bovine mammary epithelial cells, lactation physiology, flow cytometry (FACS), cellular characterization

022 | Expression of Selected Markers in the Harderian and Lacrimal Glands of Male and Female Warsaw Wild Captive Pisula Stryjek (WWCPS) Rats: An Immunohistochemical Analysis

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ABSTRACT: The expression of laminin, cytokeratins 7 and 18 (CK7, CK18), desmin, vimentin, and actin was analyzed to provide a comprehensive characteristic of cellular organization within the lacrimal and Harderian gland in rat. This panel of markers enabled the identification of epithelial (CK7, CK18), myoepithelial and muscle (desmin, actin), and mesenchymal (vimentin) components, as well as the assessment of basal membrane integrity (laminin), allowing for the evaluation of tissue architecture and the functional differences description of the examined glands. The aim of the study was to evaluate differences in marker expression between sexes and between the Harderian and lacrimal glands. The study was conducted on a patented rat line (patent no. Z-320033), Warsaw Wild Captive Pisula Stryjek (WWCPS), comprising 17 males and 15 females aged 6 months. Only post-mortem material was used, and animals were not sacrificed for the purposes of this study. Immunohistochemical analysis was performed using DAB and monoclonal antibodies to minimize any false-positive reactions. The results were evaluated using the Immunoreactive Score (IRS) according to Remmele and Stegner. The Harderian gland exhibited pronounced sex-dependent differences in the expression of epithelial and stromal markers. In males, strong expression of CK7 and CK18, together with elevated laminin levels, indicated enhanced epithelial differentiation and well-developed basement membrane organization, likely driven by androgenic stimulation. In females, reduced epithelial marker expression was accompanied by a relatively greater contribution of stromal and myoepithelial components (vimentin, desmin, and actin), suggesting a shift toward a more structurally supportive phenotype. In contrast to the Harderian gland, the lacrimal gland displayed a more stable and less sex-dependent profile. Moderate to strong expression of CK7 and CK18 was observed in both sexes, indicating consistent epithelial differentiation. Additionally, vimentin and desmin expression remained low, while laminin and actin showed moderate levels, reflecting a relatively constant tissue architecture. These findings suggest that sex hormones differentially regulate epithelial and stromal compartments, leading to distinct organizational patterns in the Harderian gland, whereas the lacrimal gland maintains a more functionally stable phenotype.

Keywords: lacrimal gland, Harderian gland, rat, immunohistochemistry, WWCPS

025 | The Comparison of the Tumour Microenvironment in Canine Mast Cell Tumours Classified by Sentinel Lymph Node Metastasis

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ABSTRACT: Canine mast cell tumours (MCTs) represent the most common form of cutaneous malignancy in dogs. Despite their prevalence, limited information is available regarding the tumour

microenvironment (TME), which has been shown in other cancers to play a critical role in disease progression, prognosis, and the identification of immunotherapeutic targets. Among the available prognostic factors (such as histological grading, Ki67/proliferative index, c-kit exons mutations), the metastatic status of the sentinel lymph node (graded from negative HN0 to overtly metastatic HN3 according to the Weishaar (2014) criteria) stands out as one of the most significant predictors of disease progression and overall prognosis. On balance, in this study, we aimed to characterize and compare the TME across different stages of nodal metastatic progression in canine MCTs. Formalin-fixed, paraffin-embedded primary tumour sections from 42 cases were analyzed, including non-metastatic (HN0, n=9), pre-metastatic (HN1, n=12), early metastatic (HN2, n=12), and overt metastatic (HN3, n=9) groups. Immunohistochemistry targeting the IBA-1 antigen was performed to assess pan-macrophage infiltration. Preliminary results revealed no significant differences in IBA-1-macrophage prevalence among the groups ($p = 0.42$), suggesting no apparent association between overall macrophage presence and nodal metastatic status. These findings contrast with previous studies employing alternative grading systems, which reported increased macrophage infiltration in high-grade tumours. To validate these observations, further analyses with an expanded sample size are planned. Given the functional heterogeneity of macrophages, future investigations will focus on distinguishing macrophage subtypes, including pro-inflammatory M1 and pro-tumoural M2 phenotypes, using markers such as MHCII and CD163, respectively. In addition, lymphocyte populations within the TME will be evaluated through immunohistochemical staining for CD3 (T-lymphocytes), FoxP3 (regulatory T-cells), and CD20 (B-lymphocytes). Comprehensive characterization of these immune cell subsets will contribute to a more detailed understanding of the TME in canine MCTs and may inform future prognostic and therapeutic strategies.

Keywords: Canine mast cell tumours, tumour microenvironment, immunohistochemistry, IBA-1, macrophages.

026 | Comparative Morphology of the Maxilla in the Aardwolf (*Proteles cristata*) and the Spotted Hyena (*Crocota crocuta*)

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ABSTRACT: The maxilla is a key element of the viscerocranium, and its morphology often reflects trophic specializations. Although the aardwolf (*Proteles cristata*) and the spotted hyena (*Crocota crocuta*) belong to the same family (Hyaenidae), they differ markedly in ecology and feeding habits. This study aimed to compare the maxillary morphology of these two species in the context of their divergent dietary adaptations. The material consisted of eight skulls (three aardwolves and five spotted hyenas). Morphological analysis focused on externally visible bony structures. In both species, the maxilla forms the lateral facial wall and consists of a body and a frontal process. However, several significant differences are observed. The palatine process of the maxilla contributes more substantially to the bony palate in the aardwolf (38.05%) than in the spotted hyena (28.84%). Furthermore, the infraorbital canal is notably shorter in the aardwolf (approx. 5.4 mm) compared to the spotted hyena (approx. 14.8 mm). A further distinction lies in the formation of the zygomatic arch, where the maxillary body participates in the spotted hyena, a feature absent in the aardwolf. Additionally, variations exist in the position of the major palatine foramen and the number of minor palatine and interincisive foramina. These morphological variations reflect distinct feeding strategies. In the aardwolf, the maxilla shows features consistent with insectivorous specialization. In contrast, the spotted hyena's morphology reflects adaptations to significantly stronger bite forces and higher mechanical loading associated with bone-cracking behavior.

Keywords: comparative morphology, Hyaenidae, maxilla, feeding strategies, trophic morphology

Poster presentations

P01 | Digital Reconstruction of a Primate Skeleton and Development of a Scalable 3D-Printed Educational Model

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ABSTRACT: Osteological specimens are essential in veterinary anatomy education and comparative anatomy, yet access to real skeletons is often limited by ethical, financial, and supply constraints. This study aimed to create a scalable, reproducible digital osteology resource by digitally reconstructing the complete skeleton of the Rhesus Monkey (*Macaca mulatta*) and enabling downstream 3D printing and re-scaling for education and research.

One naturally deceased individual was obtained through a wildlife unit. Each bone was separated, identified, and digitized individually using three different 3D scanning systems. Scanner selection was guided by bone size and surface complexity: small, high-detail elements (e.g., carpal bones) were scanned effectively with Artec Spider 2, whereas larger elements such as the skull and mandible were captured efficiently with EinScan Shining 3D. All outputs were saved and archived as polygon meshes in PLY format. All skeletal elements were successfully modeled in 3D and transferred to an electronic repository as PLY files. The creation of a complete digital skeleton archive for *M. mulatta* provides an ethical and sustainable alternative to repeated handling or acquisition of rare osteological materials. Because the models can be re-scaled and repeatedly 3D printed, the dataset supports flexible use in teaching, training,

and future research by any investigator with access to standard 3D printing workflows.

Keywords: Digital osteology, monkey osteology, veterinary anatomy

P02 | Morphological Residual Mismatch Regions in the Forelimb Long Bones of Otters (*Lutra lutra*)

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ABSTRACT: In this study, we aimed to reveal morphological differences between the right and left sides of the forelimb long bones in two male otters from Turkey using a 3D surface-based comparison approach. For each individual, the scapula, humerus, radius, and ulna were modeled separately in 3D, and the left-side bones were mirrored to ensure consistent laterality for right-left comparison. The bones were then globally aligned and superimposed, and the regions that did not fully overlap (residual mismatch areas) after alignment were visualized. Despite good global alignment, residual mismatch regions were observed in specific anatomical areas; the fact that these regions appeared at the same anatomical locations across repeated runs suggested that the deviations may reflect a consistent regional asymmetry pattern, rather than random methodological variation. In particular, mismatch regions were consistently evident around the scapular hamate and suprahamate processes, the superior part of the epicondylar region of the humerus, and the olecranon region in the forearm bones in both individuals. In conclusion, 3D bone models combined with software-based alignment and superimposition workflows enable the visual mapping of localized mismatch regions even in small sample sizes and provide an intuitive way to display and interpret morphological features that may be associated with within-individual bilateral asymmetry.

Keywords: Bilateral asymmetry, mirroring, surface alignment, superimposition

P03 | Comparative Evaluation of Long Bone Morphometry in Parrot Species

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ABSTRACT: This study aimed to evaluate interspecific morphometric variation among parrot species by analyzing the maximum length and mid-diaphyseal thickness of four long bones: the humerus, ulna, femur, and tibiotarsus. Linear measurements were obtained from specimens representing eight parrot groups: Lovebird,

Forpus, Cockatiel, Lori, Rosella, Green parrot, Alexandrine parakeet, and African grey parrot. For each specimen, a thickness/length index was calculated, and segmental ratios including humerus/ulna, femur/tibiotarsus, and total forelimb/hindlimb length ratios were evaluated at the species level. The greatest absolute bone lengths were observed in the African grey parrot, followed by the Alexandrine parakeet and the Green parrot, indicating a clear size gradient across the dataset. In contrast, Forpus and Lovebird specimens represented the smallest skeletal dimensions. Evaluation of thickness/length indices showed that, among species represented by at least three specimens, the highest humerus index occurred in Forpus (8.75%), whereas the lowest values were observed in larger-bodied species. The highest ulna index was recorded in the Cockatiel (6.29%), while the highest femur index was found in the African grey parrot (8.31%). Overall, the findings demonstrate that parrot species exhibit distinct patterns of skeletal scaling and limb proportion, reflecting both differences in overall body size and segment-specific morphological adaptations.

Keywords: Avian skeletal structure, comparative anatomy, limb proportions

P04 | Comparative Analysis of Dental Numerical Anomalies in Wild Canidae Species of Lithuania

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ABSTRACT: Dental numerical anomalies, including hypodontia and hyperdontia, reflect genetic and evolutionary influences on dentition. This study aimed to compare the prevalence and patterns of these anomalies in the grey wolf (*Canis lupus*), red fox (*Vulpes vulpes*), and raccoon dog (*Nyctereutes procyonoides*) in Lithuania. Material was obtained from the Kaunas Tadas Ivanauskas Museum of Zoology and included 230 red fox, 126 raccoon dog, and 67 grey wolf skulls. Analyses were performed at the species level; sex was not considered as a separate factor. Macroscopic examination of dentition was performed to identify numerical anomalies. The anomalies were categorized as general hypodontia, mandibular third molar agenesis, oligodontia, and hyperdontia. Statistical analysis was conducted using chi-square and Fisher's exact tests with Bonferroni correction for interspecific comparisons. The overall prevalence of hypodontia was 18.7%, with no significant interspecific differences ($\chi^2 = 3.11$, $p = 0.211$). In contrast, mandibular third molar agenesis showed a highly significant interspecific difference ($\chi^2 = 14.26$, $p < 0.001$), with raccoon dogs exhibiting a markedly higher frequency (18.3%) than foxes (7.0%) and wolves (4.5%). Extreme patterns such as oligodontia were rare (1.42% overall) and observed only in wolves (3.0%) and foxes (1.7%), but not in raccoon dogs ($p = 0.163$). Hyperdontia was also infrequent (1.18% overall; $p = 0.165$), occurring primarily in wolves and foxes. In summary, wild canid species in Lithuania exhibit distinct patterns of dental numerical anomalies, with raccoon dogs showing a significantly higher prevalence of mandibular third molar agenesis, suggesting species-specific developmental variation.

Keywords: Hypodontia, Baltic region, wild carnivores.

P05 | Morphological and Anatomical Investigation of the Vertebral Column in a Red-necked Wallaby (*Notamacropus rufogriseus*)

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ABSTRACT: The vertebral column exhibits species-specific morphological variations that are important for comparative anatomical studies. This study aimed to investigate the morphological and anatomical characteristics of the vertebral column in a red-necked wallaby (*Notamacropus rufogriseus*). The atlas exhibited a characteristic rectangular shape with a well-defined incisura alaris, whereas the axis was distinguished by a blunt and robust den. In the cervical region, the seventh cervical vertebra (C7) was characterized by the presence of the foramen transversarium. In the thoracic region, the spinous processes displayed a transitional morphology, appearing rounded in the cranial vertebrae and becoming progressively flattened caudally. In the caudal region, well-developed transverse processes were observed in the proximal vertebrae, gradually diminishing and disappearing in the distal vertebrae. In conclusion, this anatomical characterization of the vertebral column in *N. rufogriseus* provides baseline data for comparative anatomy and contributes to the veterinary osteological literature on diprotodont marsupials.

Keywords: Cervical morphology, comparative osteology, diprotodont marsupial, veterinary anatomy

P06 | Head and neck cancer organoids for radiosensitivity assessment with applications to feline oral squamous cell carcinomas

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ABSTRACT: Feline oral squamous cell carcinomas (FOSCC) and human HPV-negative head and neck squamous cell carcinomas (HNSCC) are aggressive malignancies with similar biology and poor prognosis despite multimodal treatment. Most FOSCC patients are euthanized due to high recurrence rates and limited therapeutic options. Radiotherapy is used in veterinary clinics but only benefits a subset of FOSCC patients. Patient-derived organoids (PDOs) provide a promising preclinical platform with the potential to recapitulate individual tumor biology and to predict therapeutic response. Given the biological similarities between FOSCC and HNSCC, organoid-based screening could guide treatment selection in feline patients and inform the search for radiosensitizing agents, bridging veterinary oncology and human cancer research. Eight

PDO models were established from biopsied or resected HNSCCs. Genetic profiles were confirmed by whole exome sequencing (WES) of organoids and corresponding FFPE tumors. Histological analysis using Haematoxylin-Eosin (HE) staining and immunohistochemistry markers Ki67, p40, and CK5/6 verified squamous cell carcinoma phenotype. For radiosensitivity assessment, PDO models were treated with increasing radiation doses and evaluated using the ATP-based CellTiter-Glo assay. Clonogenic assays were additionally performed on 4 models. To examine whether radiosensitivity could be modulated, hypoxia-mediated radioresistance was induced by cultivating and irradiating PDOs under hypoxic conditions. Hypoxia was detected using the fluorescently labeled hypoxia marker pimonidazole. Both clonogenic and CellTiter-Glo assays effectively identified dose-dependent decreases in survival and significant differences in radiosensitivity between models, establishing them as reliable approaches for individual tumor radiosensitivity assessment. Hypoxia was confirmed in organoids using pimonidazole staining. Clonogenic survival analysis demonstrated significantly enhanced radioresistance following pre-treatment and irradiation under hypoxic conditions. PDO-based screening enables assessment of individual radiosensitivity phenotypes and modulation of radioresistance, providing the potential to investigate underlying resistance mechanisms. The established HNSCC PDO protocol could be adapted for feline oral squamous cell carcinomas, given their biological similarities.

Keywords: Patient-derived organoids, squamous cell carcinoma, therapy screening.

P07 | Anatomy of the Mouse Lymphatic System: A Historical Overview

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ABSTRACT: The macroscopic mapping of the murine lymphatic system remains a developing area of anatomical science, historically constrained by technical limitations and the extrapolation of data from the rat model. This study examines the historical and conceptual evolution of murine lymphology, progressing from early pathological observations to contemporary genetic approaches that have established a functional anatomical framework. Starting in the 1930s, MacDowell and colleagues identified key lymphoid regions through the analysis of leukemic expansion. This work relied on the gross enlargement of nodes in diseased tissue to establish an initial functional map. In 1950, Barone and colleagues conducted comparative anatomical studies of the lymphatic system, examining the mouse (*Mus musculus*), rat (*Rattus norvegicus*), and guinea pig (*Cavia porcellus*), identifying structural distinctions that challenged the prevailing rat-centric paradigm. Between 1954 and 1966, the works of Dunn, Kawashima, and Cuq established a systematic anatomical basis for the murine lymphatic system. Dunn defined healthy tissue standards to distinguish normal anatomy from pathological changes. Kawashima and Cuq developed detailed topographical maps and formalized the lymphocenter concept in mice. By classifying nodes according to regional drainage

patterns rather than physical location alone, these works provided a framework for comparative anatomy and experimental research. Then, Cook's atlases (1960s and 1980s) provided practical reference materials for biomedical research. Later, in the 21st century, Van den Broeck and Komárek tried to standardize the nomenclature in accordance with the Nomina Anatomica Veterinaria (NAV). Finally, the integration of the Vegfr3-CreERT2 knock-in murine model has enabled the genetic targeting of lymphatic endothelial cells. This tool allows for lineage tracing and the functional characterization of the lymphatic vasculature, complementing macroscopic findings with cellular-level resolution. Collectively, the evolution of mouse lymphatic system mapping shows the importance of methodological refinement and nomenclatural standardization in recognizing that mice possess a distinct lymphatic architecture, a consideration necessary for accurate experimental interpretation.

Keywords: Lymphoid regions, lymph nodes, lymphatic drainage, mouse models

Funding: MorphoPHEN (Human Diseases Models Morphological Phenotyping), an Erasmus Mundus Joint Master (Project n° 101082155).

P08 | Research on the Lamellar Structure of Bone – *Os membranaceum lamellosum*

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ABSTRACT: Bone tissue occurs in two basic forms: *os membranaceum reticulofibrosum* and *os membranaceum lamellosum*. Lamellar bone represents the mature form of bone tissue, characterized by a highly organized arrangement of collagen fibers within lamellae, ensuring optimal mechanical properties. The aim of this study is to analyze the histological and functional characteristics of lamellar bone, with particular emphasis on its role in the biomechanical stability and adaptation of the skeleton. The study is based on a comparative and descriptive analysis of available histological and anatomical data concerning the lamellar organization of bone tissue, including the structure of compact and spongy bone. Lamellar organization provides high resistance of bone to various types of mechanical stress due to the specific arrangement of collagen fibers. In compact bone, lamellae are organized into osteons (Haversian systems), which represent the basic structural and functional units, whereas in spongy bone they are arranged in trabeculae. This organization enables efficient vascularization, innervation, and metabolism of bone tissue, as well as continuous remodeling through the activity of osteoblasts and osteoclasts. The lamellar structure of bone represents a key factor in the biomechanical stability and functional efficiency of the skeleton. Its organization ensures an optimal combination of strength and elasticity, as well as the ability of continuous adaptation to changing mechanical loads.

Keywords: Lamellar bone, osteon, Haversian canal, biomechanics, remodeling

P09 | Histological Characteristics and Functional Adaptations of the Gastrointestinal Tract of the Indian Python (*Python molurus*)

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ABSTRACT: The Indian python (*Python molurus*) is a model species for extreme digestive plasticity among reptiles. As an ambush predator that feeds infrequently on large prey, it exhibits reversible structural and metabolic adaptations of the gastrointestinal tract. The aim of this study was to characterize the histological organization of the digestive tract and associated organs and interpret these findings within an evolutionary and clinical framework. Samples of stomach, small and large intestine, liver and gallbladder were fixed in buffered formalin, paraffin-embedded, sectioned at 5 µm, and stained with haematoxylin and eosin. Quantitative morphometric analysis assessed epithelial thickness, mucosal and muscular layers, hepatocyte lamellae, and sinusoidal dimensions. The gastric mucosa consisted of a folded glandular epithelium with deep tubular glands and a distinct lamina muscularis mucosae. The small intestine displayed simple columnar epithelium with prominent microvilli and goblet cells, supported by a well-developed tunica muscularis enabling effective peristaltics. Hepatic parenchyma was arranged predominantly in duplex hepatocyte lamellae with abundant sinusoids and melanomacrophage pigmentation. The gallbladder showed tall columnar epithelium adapted for bile concentration. Compared with many colubrids and viperids, pythons exhibited distinct histological features of the digestive tract, including a highly developed glandular gastric mucosa with deep tubular glands, a well-organized intestinal epithelium with abundant goblet cells and prominent microvilli, and a robust tunica muscularis. These histological characteristics reflect structural specialization of the gastrointestinal system in pythons. Clinically, defining normal histological architecture provides an essential baseline for diagnosing gastrointestinal and hepatic disorders, improving captive management, and optimizing welfare in zoological and rehabilitation settings. This study contributes to comparative reptilian anatomy by linking microstructural organization to digestive physiology and ecological strategy.

Keywords: *Python molurus*; gastrointestinal histology; digestive plasticity; reptile evolution; comparative anatomy.

Funding: The authors received financial support from the Slovenian Research and Innovation Agency program P4-0053.

P10 | Histological Characterization of Myofascial Junctions and Multilayered Organization of the Canine Fascia Lata

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ABSTRACT: For years, fascial tissues have been perceived as a simple system whose functions are limited to the protective wrapping of other organs and muscles. However, the 21st century has brought new research and conclusions that have recognized and appreciated the significant role of fascia. Attention has focused on the transfer and reduction of energy during muscle contraction, biomechanics, and proprioception. Over time, we are discovering more and more of this structure's biological abilities. The latest scientific perspective allows to view it not as a single, independent element, but as a complete and integral system. The presented analysis was based on microscopic examination of samples obtained post-mortem from 21 domestic dogs. The samples were collected to represent the fascia lata in contact with the tensor fascia lata muscle. They were post-fixed in 4% buffered formalin, embedded in paraffin, and 4-µm sections were cut from them. Histological sections placed on microscope slides were stained using four methods: hematoxylin and eosin, Weigert's resorcin fuchsin, Picosirius red, and Alcian blue. Histological examination revealed that the fascia lata is a multilayered architecture consisting of two to three layers of dense connective tissue. The thickness of these layers varies depending on the region. Collagen fibers are primary structural component and are organized in a wavy, undulating pattern. In contrast, elastic fibers are relatively sparse and primarily localized within loose connective tissue in association with larger blood vessels. The study identified two types of myofascial connections. First of them were direct junctions, where muscle fibers merge directly with fascial layers. The second ones were indirect, where loose connective tissue containing adipocytes separates the structures. The highest density of blood vessels and neural structures was observed in loose connective tissue. However, blood vessels were present in greater numbers than nerves. Hyaluronic acid was present in all fascial layers.

Keywords: Fascia lata, deep fascia, microstructure, myofascial connections, dog.

Funding: This conference presentation is the result of research carried out during the project MINIATURA (DEC-2023/07/X/NZ4/00620) entitled 'Influence of specimen length on results of biomechanical properties measurements of a muscular fascia – a preliminary study in the context of myofascial pain syndrome pathogenesis.', financed by the National Science Center, Poland.

P11 | Introducing the SUPROMIK Project: Super-Resolution Microscopy for Improved Tissue Analysis

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ABSTRACT: Light microscopy is an essential tool for understanding the underlying causes of disease and developing effective therapies in veterinary medicine. However, most cellular structures are smaller than 200 nm, making them difficult to visualize with conventional light microscopy due to its resolution limits. As conventional high-resolution microscopy techniques are often expensive and technically demanding, alternative approaches that do not require electron microscopy are increasingly being explored. The aim of the project "Exploring the potential and developing protocols for super-resolution microscopy to improve tissue analysis (SUPROMIK)" is to investigate the potential of super-resolution microscopy – particularly the combination of expansion microscopy and super-resolution radial fluctuations. It focuses on developing a protocol for improved tissue analysis using conventional light microscopes. The project includes optimization of sample preparation, methodological adjustments, staining protocols and imaging procedures. Initially, previously prepared histological samples will be used to establish and optimize methodological parameters. Subsequently, newly collected tissue samples from fish, reptiles, birds, and wild animals will be processed and analyzed to evaluate the applicability and reproducibility of the developed protocol across different types of tissue. The project contributes to the advancement of biomedical and veterinary sciences by introducing accessible and precise methods for the analysis of cellular structures in tissues. Validated super-resolution microscopy protocols will enable researchers to better understand morphological and pathophysiological processes, supporting progress in diagnostics, education and research. As these methods can be implemented using conventional light microscopes, advanced tissue analysis will become more accessible to institutions without electron microscopy facilities. This broadens potential applications from histology to pathology and advanced diagnostics, indirectly contributing to animal health and the One Health concept. The project also has educational value by transferring knowledge and technical skills to early-career researchers and strengthening competencies in modern microscopy.

Keywords: Veterinary histology; tissue analysis; super-resolution; expansion microscopy; super-resolution radial fluctuations

Funding: This study has been funded by the European Union under the National Recovery and Resilience Plan 2021–2026, grant number: NPOO – 24.

P12 | Morphometric Analysis of Wild Boar (*Sus scrofa*) Kidneys

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ABSTRACT: The wild boar (*Sus scrofa*) is a species with a wide distribution across Eurasian wildlife. Due to their ability to adapt easily to the wild and their rapid reproductive capacity, they pose a threat to agricultural lands. In regions where agricultural lands overlap with wildlife habitats, efforts are made to reduce wild boar populations. The kidney performs vital functions such as maintaining homeostasis and filtering waste products from the blood. The renal vasculature has a distinct and complex architecture that enables the kidney to perform its numerous and critical physiological functions, ultimately achieving homeostasis. In particular, the proper functioning of glomerular filtration is directly related to the preservation of the integrity of the podocytes and pedicel structures on the glomerulus. In our study, we aimed to examine the structure of the pig kidney using scanning electron microscopy (SEM) following a macroscopic examination. For this purpose, three wild boar kidneys were used. The harvested kidneys were washed with phosphate buffer and then fixed in 2.5% glutaraldehyde. After post-fixation in 1% osmium tetroxide, they were processed through a graded series of acetone and dried by the critical-point drying. They were then coated with gold-palladium. A detailed examination of the medulla and cortex was performed. Scanning electron microscopy was used to assess the morphometric features of diaphragm slit intervals in three wild boar kidneys. There were 116 measurements in total (41, 38, and 37 measurements per individual, respectively). Instead of using pooled measurements, the analysis was performed using individual means to prevent pseudoreplication. In this study, the width of the diaphragm slits was compared with findings from studies on other mammalian species, such as rats and humans, to examine the three-dimensional architecture of the kidney structure in pigs, particularly the glomerulus.

Keywords: Diaphragm slits, kidney, scanning electron microscopy, wild boar.

P13 | Impact of Microplastic Exposure on Animal Brain Structure and Function

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ABSTRACT: Nowadays, one of the major global concerns is the massive production of plastic, which exceeds one million tons per year. This raises an important question: how does it affect animal and human organisms? Microplastics (MPs) are small, water-insoluble synthetic polymer particles ranging in size from 1 micrometre to 5 millimetres. MPs are commonly found in the environment and

are ingested daily through oral, dermal, and inhalation routes of exposure. The aim of this review is to summarize the current knowledge on how MPs affect the brain in animals. Most studies have focused on aquatic organisms, showing accumulation of plastic particles in the brain, causing inhibition of acetylcholinesterase (AChE) activity, and resulting in hyperactive behaviour. A few studies on mammalian models have shown that MPs can cross the blood–brain barrier and exert potential neurotoxic effects. Like findings in fish, they can inhibit AChE activity, causing cognitive and memory deficits. Accumulation of MPs in different brain regions can lead to various neurological disorders. For example, deposition in the hippocampus is associated with an impair in cognitive function, while accumulation in the cortex declines higher brain functions such as learning, memory, and problem-solving. Furthermore, MPs can induce neuroinflammation, leading to cellular damage and structural alterations in the brain. Results from human studies propose a possible link between MP exposure and several neurodegenerative diseases, including Alzheimer's disease, amyotrophic lateral sclerosis, and certain disorders on the autism spectrum. While most studies focus on human research, there are only a few that have explored the effects of MPs on the animal brain. Animals are known as simpler subjects for research, so this lapse emphasizes the need for further studies on animals, which can lead to better understanding how the MPs impact the development of neurodegenerative diseases in humans.

Keywords: Microplastics, cognitive function, cell damage, neurodegeneration, animal models

Funding: European Union – NextGenerationEU; NPOO-15

P14 | from BSL-2 to BSL-1: Can Adeno-Associated Viruses Replace Lentiviruses for Efficient Transduction of Human Dermal Microvascular Endothelial Cells *In Vitro*?

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ABSTRACT: Angiogenesis, the process of new blood vessel formation from pre-existing vasculature, plays a central role in numerous pathological conditions. Yet, the understanding of the regulatory proteins involved in different parts of the angiogenic process remains incomplete. Such regulatory proteins are frequently identified through gene knockdown. In vascular research, efficient gene delivery into primary endothelial cells remains a major challenge. Viral vectors, particularly lentiviral systems, are widely used due to their high transduction efficiency and stable gene integration. However, their application is restricted to biosafety level 2 (BSL-2) laboratories in many countries in the European Union, limiting accessibility and experimental flexibility. This study aims to investigate whether, and if so to what extent, adeno-associated viral (AAV) particles can serve as a viable alternative for transduction under biosafety level 1 (BSL-1) conditions. With a specific focus on the protein vimentin, a key regulator of cell shape and motility, short hairpin RNA sequences will be designed to induce gene knockdown in endothelial cells. Following transduction of the human dermal microvascular endothelial cells (HDMECs) with both the AAV

vectors and the previously established lentiviral vectors encoding vimentin, the HDMECs will be cultivated under established proangiogenic conditions for up to 50 days. At predetermined time points (days 5, 10, 15, 25, 35 and 50) the cells will be harvested to assess protein expression levels using qPCR and Western blot analysis. Furthermore, digital imaging will be performed to quantify the angiogenic process *in vitro*. This comparative approach of the two viral systems aims to determinate whether AAV vectors represent a practical and effective substitute for lentiviral transduction in endothelial cell cultures. The findings may broaden experimental possibilities for laboratories without access to BSL-2 facilities and contribute to optimizing gene delivery strategies in vascular biology.

Keywords: Vascular remodeling, gene silencing, microvascular biology, endothelial metabolism, angiogenic proteins

P15 | Morphological and Morphometrical Characteristics of the Ethmoid Bone in Red Fox (*Vulpes vulpes*)

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ABSTRACT: The ethmoid bone is an unpaired and non-visible bone from the external aspect of the skull, situated between the cranial and nasal cavities, forming the rostral boundary between them. The lamina cribrosa is one of the components of the ethmoid bone, through which bundles of the olfactory nerve pass from the nasal cavity to the olfactory bulb of the forebrain. In most textbooks of veterinary anatomy and in the scientific literature to date, detailed information regarding the dimensions of the ethmoid fossa, its volume, and the exact number of cribriform foramina is lacking. In this study, five red fox skulls were examined. A detailed description of the ethmoid fossa was performed, and morphometric parameters of the skull, cranial cavity, and ethmoid fossa were measured using a digital caliper. Additionally, the volumes of the cranial cavity and the ethmoid fossa were determined, and the exact number of cribriform foramina was counted. The results showed that the mean volumes of the cranial cavity and the ethmoid fossa were 49.67 ± 3.42 cc and 1.84 ± 0.15 cc, respectively. The average number of cribriform foramina was 183 ± 28.1 per side (range: 139–216). Each side of the ethmoid fossa was divided into three parts by fine ridges running in a dorsolateral direction, and many foramina in the dorsolateral region opened into the frontal sinuses. In conclusion, this study provides new information on the detailed morphology of the ethmoid bone in wild carnivores such as the red fox, particularly regarding the number of cribriform foramina. These findings contribute to a better understanding of ethmoid bone morphology and may have implications for comparative cranial anatomy.

Keywords: Brain cavity volume, cribriform holes, lamina cribrosa, wild carnivores

P16 | Histological and Histochemical Characteristics of the Harderian Gland in the Eurasian Sparrowhawk (*Accipiter nisus*, *Accipitriformes*)

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ABSTRACT: In birds, the Harderian gland (HG) is a vital component of the ocular protective apparatus, producing secretions that protect and moisten the ocular surface. Given the primary role of vision in raptors, analyzing the HG provides valuable insights into its morphological and secretory organization. Although studied in various birds, data on the Eurasian Sparrowhawk (*Accipiter nisus*) remain limited. This study aimed to characterize the histological and histochemical properties of the HG in this species. Biological material was obtained post-mortem from four wild Eurasian Sparrowhawks that died of natural causes (collected under relevant permits). Glands were fixed in 4% buffered formaldehyde, paraffin-embedded, and sectioned. Staining included: H&E, Movat pentachrome, Mallory trichrome, and methyl green-pyronin. Histochemical analysis involved PAS, alcian blue (AB) pH 1.0, AB pH 2.5, AB pH 2.5/PAS, and colloidal iron. The HG is enclosed by a thin capsule of dense collagenous tissue with reticular and elastic fibers, surrounded by adipose tissue. Connective tissue trabeculae divide the parenchyma into lobes of various sizes. The gland is classified as Type I (Burns' classification) and exhibits a compound tubuloacinar structure. Primary ducts are lined by tall simple columnar epithelium, while secondary and tertiary ducts feature simple cuboidal epithelium. Glandular acini consist of pyramidal cells surrounded by myoepithelial cells. Small numbers of plasma cells and lymphocytes are present in the stroma, particularly around primary ducts. Histochemically, the gland is PAS-negative, shows weak positivity with AB pH 1.0 and 2.5, and moderate positivity with colloidal iron and AB pH 2.5/PAS. The HG of the Eurasian Sparrowhawk is a Type I compound tubuloacinar gland with a

well-developed duct system and periductal immune cells. Its histochemical profile indicates acidic secretory components. This organization likely supports ocular protection and maintenance during intensive, visually guided hunting activities.

Keywords: *Accipiter nisus*, avian eye, Harderian gland, histology, tubuloacinar gland.

P17 | Histological and Histochemical Analysis of the Superficial Gland of the Third Eyelid in the Free-Ranging Gray Wolf (*Canis lupus*)

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ABSTRACT: The third eyelid and its superficial gland are essential components of the mammalian ocular protective apparatus, contributing to mechanical protection, tear film distribution, and lubrication. While studied in various canids, detailed histological data on the superficial gland of the third eyelid in gray wolves (*Canis lupus*) remain limited. This study aims to analyze the histological structure of this gland in free-ranging individuals. Samples were collected post-mortem from eight free-ranging adult gray wolves (e.g., traffic casualties). Acquisition was conducted under permission from the General Directorate for Environmental Protection in Warsaw (No. DZP-WG.6401.179.2022.BP). Tissues were routinely processed, paraffin-embedded, and examined using: H&E, Movat pentachrome, mucicarmine, Mallory trichrome, Reticulin, Bielschowsky, Verhoeff, PAS, alcian blue (pH 1.0; 2.5; 2.5/PAS), and colloidal iron. The gland is surrounded by intraperiorbital adipose tissue and a thick connective tissue capsule, with thin septa dividing it into lobes. It exhibits a multilobar, compound branched acinar structure with serous acini. Intercalated ducts are lined with simple cuboidal epithelium, while excretory ducts within septa feature simple columnar epithelium surrounded by lymphocyte clusters. The third eyelid consists of hyaline cartilage. The palpebral conjunctiva is lined with non-keratinized stratified columnar epithelium containing numerous goblet cells and subepithelial melanin deposits. Both conjunctival surfaces show well-developed lymphoid nodules, diffuse lymphocytes, and high endothelial venules. Goblet cells are strongly positive for PAS, alcian blue, and colloidal iron, indicating acidic mucosubstances. The superficial gland of the third eyelid in the gray wolf is serous, while the third eyelid itself is rich in goblet cells and conjunctiva-associated lymphoid tissue (CALT). These features underline its

vital role in lubrication, protection, and local immune defense for a terrestrial predator exposed to variable environmental conditions.

Keywords: *Canis lupus*, conjunctiva-associated lymphoid tissue, histology, ocular surface, superficial gland of the third eyelid

P18 | Histological and Histochemical Observations of the Harderian Gland of the Smew (*Mergellus albellus*, Anatidae)

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ABSTRACT: The Harderian gland (HG) is a vital component of the avian ocular protective apparatus, contributing to lubrication, precorneal tear film stabilization, and local immune defense. Despite its importance, detailed data for many Anatidae representatives, including the smew (*Mergellus albellus*), remain lacking. This study aimed to characterize the histological structure and histochemical properties of the HG in this species. Biological material was obtained post-mortem from two adult smews (four glands total) from registered closed breeding facilities. The glands were fixed in 4% buffered formaldehyde, paraffin-embedded, and sectioned at 4 μ m. Staining techniques included H&E, Movat pentachrome, Mallory trichrome, and methyl green-pyronin. Histochemical evaluation was performed using PAS, colloidal iron, and Alcian blue (AB) at pH 1.0 and 2.5, including the AB pH 2.5/PAS combination. The HG is enclosed by a thin connective tissue capsule containing collagen, reticulin, and elastic fibers, with delicate interlobar septa dividing the parenchyma into various-sized lobes. The gland is classified as a branched tubular gland (Burns' Type II). Movat pentachrome demonstrates mucous secretory units with a strong (+++) positive reaction. Numerous primary ducts, lined by simple columnar epithelium and containing abundant plasma cells (confirmed via methyl green-pyronin), are observed. Histochemically, the gland is PAS-negative but shows moderate (++) positivity for AB pH 1.0, AB pH 2.5, and colloidal iron. A strong (+++) reaction is recorded with AB pH 2.5/PAS. The Harderian gland of the smew is a branched tubular mucous gland rich in acidic mucosubstances. The presence of numerous plasma cells and the predominance of mucous secretion indicate a robust ocular surface protection, likely representing an adaptation to frequent water exposure in this aquatic species.

Keywords: Anatidae, Harderian gland, histology, *Mergellus albellus*, mucous secretion.

P19 | Geometric Morphometrics Reveals Geographic Structuring of Wolf Brain Morphology

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ABSTRACT: The Morpholoup project aims to characterize anatomical and morphofunctional variation in French wolf populations (*Canis lupus italicus*). In this part of the project, we analysed 100 specimens from eight departments in southeastern France. Endocranial cavities were segmented to reconstruct external brain morphology (i.e. neurocranial endocasts), enabling the quantification of size, shape, and relative proportions of major brain regions. We applied a three-dimensional geometric morphometric approach based on 33 fixed landmarks, capturing overall brain geometry and defining three main regions: olfactory regions, cerebrum, and hindbrain. Geographic structuring emerges as the primary source of variation, although its contribution to total variance remains moderate. Brain architecture differs significantly among localities, with a marked contrast between Mediterranean (Alpes-Maritimes) and alpine populations (Hautes-Alpes, Savoie). Apparent latitudinal and altitudinal patterns are observed: northern populations exhibit relatively enlarged olfactory regions compared to southern populations, whereas altitude is associated with localized shape variation in the cerebrum. Differences in morphological disparity among regions remain limited, suggesting that these patterns reflect consistent morphological organization rather than variation in within-population variability. Sexual dimorphism appears to be limited to overall endocranial shape and does not affect the relative organization of major brain regions. After controlling for size, differences between males and females primarily involve global brain organization rather than specific structures. The low proportion of variance explained by sex further confirms that geographic structuring is the main driver of variation. Consistently, and contrary to patterns reported in other mammals, prefrontal size does not differ between sexes, supporting a largely shared structural organization of the brain. This study represents a first step toward a broader integrative approach for understanding anatomical variation in French wolf populations. Building on this framework, future analyses will integrate cranial architecture and muscular systems to investigate the coordinated evolution of cranial and brain structures.

Keywords: Geometric morphometrics, wolf, endocast, geography, sexual dimorphism.

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P20 | The Hidden Connector: Unveiling Emerging Insights into the Periodontal Ligament

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ABSTRACT: The periodontal ligament (PDL) is the specialised fibrous tissue connecting the tooth root with the alveolar bone. The PDL is a complex tissue, especially at its two attachment sites (entheses), i.e. the ligament-cementum and the ligament-bone interface. Several functions have been assigned to the PDL, e.g. mechanical support and shock absorption, sensory feedback during chewing and facilitating tissue remodelling and repair. Therefore, the PDL plays a crucial role in orthodontics, implant and prosthetic design and periodontal disease. However, there are still several unresolved questions about its microstructures, biomolecular components, micromechanics and entheses biology. In this literature review, we aimed to discuss current understanding of PDL anatomy and function and identify key gaps to guide future research. Our review showed that earlier studies using traditional histological techniques collected valuable data on the orientation of the PDL structure within sections. Current advances in high-resolution 3D imaging have provided new insights into the complex 3D network of PDL fibres, suggesting an oblique alignment of the fibres in 3D helical patterns. However, most mechanical modelling studies to date have not taken the fibrous microstructure into account. Instead, the PDL is modelled as a uniform material with homogeneous and linear material properties. Additionally, recent studies have provided insights on the entheses of the PDL, e.g. a gradual transition in fibres' mineral content and their organisation and insertion depth, but these findings have yet to be integrated into mechanical models of the PDL. We conclude that technical advances, especially in high-resolution imaging, have led to new insights in the anatomy and function of the PDL, but there are still major gaps in our understanding. For future studies, we propose an integrated approach combining 3D imaging, micromechanical experiments and *in silico* models to investigate the structure-function relationships underlying the mechanical function of the PDL.

Keywords: Periodontal ligament, PDL, entheses, connective tissue, entheses

P22 | Incidental Situs Inversus in a Guinea Pig (*Cavia porcellus*)

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ABSTRACT: *Situs inversus totalis* is a congenital laterality defect characterized by a complete mirror-image arrangement of thoracic and abdominal organs relative to the normal anatomical configuration (*situs solitus*). In contrast, heterotaxy (*situs ambiguus*) refers to an abnormal and non-mirror-image arrangement of thoracic and abdominal organs that does not conform to either *situs solitus* or *situs inversus*. The available literature indicates that heterotaxy is more frequently associated with congenital cardiovascular malformations, whereas *situs inversus* is often an incidental finding and may be clinically silent when isolated. Its clinical significance arises in cases associated with concurrent abnormalities, including primary ciliary dyskinesia and congenital cardiac or vascular defects, which appear to be relatively uncommon. *Situs inversus totalis* and dextrocardia have been described in rats and documented in mice, particularly in experimental models involving disruption of left-right axis development. However, to the authors' knowledge, peer-reviewed reports in guinea pigs have not been documented. We describe a 7-month-old female guinea pig (*Cavia porcellus*) presented dead to a veterinary clinic, in which complete *situs inversus* was identified during post-mortem examination. Gross anatomical evaluation revealed dextrocardia without evidence of structural cardiac abnormalities, and no additional congenital anomalies were identified. This case highlights the importance of recognizing reversed thoracic and abdominal anatomy and its potential clinical implications. Accurate identification of *situs inversus totalis* is essential for correct interpretation of diagnostic imaging and for appropriate clinical and surgical decision-making. This may be particularly relevant in guinea pigs, where gastric dilatation-volvulus is a recognized, life-threatening condition. Identification of altered visceral laterality should also prompt a systematic assessment of cardiac anatomy to exclude congenital cardiovascular defects.

Keywords: Situs inversus totalis, heterotaxia, dextrocardia, *Cavia porcellus*

P23 | Histological Structure of The Digestive Tract in the Blue-Throated Keeled Lizard (*Algyroides nigropunctatus*)

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ABSTRACT: The blue-throated keeled lizard (*Algyroides nigropunctatus*) is widely distributed along the eastern Adriatic coast, ranging from northern Italy to southern Greece. It is a diurnal species that typically inhabits degraded shrub, semi-shaded, partially overgrown rocky areas. Its diet consists mainly of ground-dwelling arthropods. The aim of this study was to describe the histological structure of the digestive tract in this species. Tissue samples of the esophagus, stomach and intestine were taken from three lizards. The tissue samples were fixed in 10% neutral buffered formalin solution, embedded in paraffin and sectioned with microtome into 6 µm sections. The sections were stained using hematoxylin-eosin and Verhoeff-Van Gieson staining methods. The structure of the organs was examined using a Digicyte DX50 microscope (Digicyte, Zagreb, Croatia), photographed with a Digicyte BigEye camera and processed with Digicyte Capture software. The digestive tract consisted of mucosa, submucosa, muscularis and serosa. The mucosa consisted of epithelium, lamina propria, and muscular layer of the mucosa. The esophagus was lined with pseudostratified columnar epithelium with apical projections. The epithelium of the stomach and intestine consisted of simple columnar cells. Goblet cells were also present in the intestines. Gastric glands were found in the anterior part of the stomach, while nonspecific tubular glands were present in the posterior part. In the intestine, the muscular layer of the mucosa was not present. The results of this study improve the understanding of the digestive tract morphology in blue-throated keeled lizard and provide a basis for future research on biology and conservation of reptiles.

Keywords: Reptiles, lizards, blue-throated keeled lizard, histology, digestive tract.

P24 | Hystomorphometrical Analysis of Cortical Bone and Articular Cartilage in Genetically Modified Mice AIRE as a Model for Autoimmune Polyendocrinopathy

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ABSTRACT: Autoimmune polyendocrinopathy (APECED) is a rare monogenetic disease caused by mutations in the autoimmune regulator (AIRE) gene, which encodes a transcription factor essential for the establishment of central immune tolerance in the thymus. In addition to endocrine disorders, skeletal changes such as osteoporosis, osteopenia and, in rare cases, reversible metaphyseal dysplasia have also been described in human patients. The literature on bone or cartilage tissue in AIRE knockout (KO) mice could

not be found. The aim of our work was to histomorphometrically assess cortical bone, epiphyseal growth plate (EGP) and articular cartilage of AIRE KO mice to determine whether the mouse model expresses any of the described skeletal manifestations of APECED. Five-month-old female AIRE KO mice ($n = 5$) and control mice ($n = 5$) were included in the study. Their femurs were isolated, fixed, decalcified, and embedded in paraffin. The prepared histological sections were stained with hematoxylin-eosin and Masson–Goldner. We examined the morphology and measured the thickness of the cortical bone at middiaphysis, the distal EGP, and individual zones of the articular cartilage on the femoral condyle. The measurements were performed histomorphometrically, and the statistical comparison between the groups was conducted using the independent samples t-test. All examined samples showed the typical histological structure of bone and articular cartilage, with no differences between the groups. Histomorphometric analysis presented no differences between the AIRE KO and the control group in the thickness of distal EGP, the articular cartilage zones and the cortical thickness. The results indicate that the absence of the AIRE gene in five-month-old mice did not induce alteration in bone or articular cartilage tissue of the femur in any animal. Further research involving a larger number of animals at different ages of puberty is necessary to better understand the impact of AIRE gene loss on skeletal system.

Keywords: cortical bone, articular cartilage zones, epiphyseal growth cartilage, histomorphometry, AIRE KO mice.

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P25 | Ultrastructural Analysis of Bovine Trophoblast Giant Cells from Day 102 of Pregnancy: First Observations

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ABSTRACT: The bovine placenta can be classified as synepitheliochorial. This term reflects the fact that a specialized population of trophoblast cells moves from the fetal trophoctoderm to the maternal uterine epithelium from around 20 days of pregnancy. These cells are called trophoblast giant cells (TGC) since they are far bigger than all other cells in the bovine placenta. TGC are formed out of uninucleate trophoblast cells throughout gestation and usually possess two nuclei. Their most important cell organelles are membrane bound granules (MBG) which are responsible for their main task: fetomaternal communication by releasing their bovine placental lactogen containing granules and other molecules to the maternal compartment. This occurs by hybrid cells resulting from fusion with maternal uterine epithelial cells. The ultrastructural characteristics of migration and fusion have been described for TGC from mid-gestation until term. However, it is not clear whether or not the same features can be observed in the first trimester, when the placentomes have just formed. Therefore, a placentome sample from

day 102 of pregnancy was scanned with a serial block-face scanning electron microscope (SBF-SEM). All TGC present in the generated z-stack consisting of 3000 images were segmented and analyzed manually by using the Microscope Image Browser Software (Helsinki). Finally, these TGC were reconstructed and visualized three-dimensionally with IMOD (Colorado). This made it possible to determine absolute numbers (approximately 80 per $5.832.000 \mu\text{m}^3$) and volumes of TGC (from 2000 to $13000 \mu\text{m}^3$), their nuclei ($2000\text{--}3000 \mu\text{m}^3$), and their protrusions, like pseudopodia at the migration front towards the maternal epithelium (shape and way of contact) as well as basally located podosomes towards the fetal basement membrane (amount and way of contact). Despite the descriptive nature of this study, the advantages of SBF-SEM became obvious as such quantifications were to date not possible with conventional transmission electron microscopy.

Keywords: Placentomes, trophoblast giant cells, Serial Block-Face Scanning-Electron-Microscope, bovine placenta

P26 | Bilateral Linear Asymmetry of the Humerus, Radius, and Ulna in Domestic Cats: A Comparative Osteometric Study

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ABSTRACT: Objective: This study examined bilateral linear asymmetry in the humerus, radius, and ulna of domestic cats, evaluating differences among bones, identifying which measurements showed the greatest asymmetry, and assessing whether asymmetry in one bone was associated with others. The dataset included 10 cats (6 males, 4 females; 1.0–6.0 years; 1.0–5.5 kg). Paired right–left measurements of the humerus, radius, and ulna were analyzed. Absolute asymmetry (AI_abs) was calculated as $|(R - L)/((R + L)/2)| \times 100$. Bone-level comparisons used Friedman and pairwise Wilcoxon tests (Bonferroni-adjusted), and relationships were assessed with Spearman correlation. The ulna showed the highest specimen-level mean absolute asymmetry ($2.57 \pm 1.13\%$), followed by the radius ($1.69 \pm 0.55\%$) and humerus ($1.34 \pm 0.38\%$). The overall difference among bones did not reach statistical significance (Friedman $\chi^2 = 5.00$, $df = 2$, $p = 0.082$), but the ulna was significantly more asymmetric than the humerus after Bonferroni correction (adjusted $p = 0.041$). At measurement level, the greatest asymmetry was observed in ulna Bd ($3.72 \pm 2.58\%$), ulna SD ($3.54 \pm 3.17\%$), humerus SD ($3.17 \pm 1.54\%$), and radius SD ($2.99 \pm 2.01\%$). Signed right-minus-left differences were centered near zero, indicating no clear directional asymmetry. Correlations among bones were weak and non-significant (Humerus–Radius: $\rho = 0.285$, $p = 0.425$; Humerus–Ulna: $\rho = 0.006$, $p = 0.987$; Radius–Ulna: $\rho = -0.176$, $p = 0.627$). Forelimb asymmetry in the examined cat material was modest overall, greatest in the ulna, and concentrated in selected measurement regions rather than uniformly distributed across each bone. The absence of strong inter-bone correlations suggests that asymmetry was expressed largely as a local trait rather than as a coordinated whole-limb pattern.

Keywords: Felis, forelimb, osteology, symmetry

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P27 | Three-Dimensional Geometric Morphometric Analysis of Shape Variation in the Cat Femur

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ABSTRACT: This study aimed to evaluate shape variation in the cat femur using three-dimensional geometric morphometric methods. During material preparation, the bones were boiled for 2 hours in the laboratory of the Department of Veterinary Anatomy, Faculty of Veterinary Medicine, İstanbul University-Cerrahpaşa. After boiling, the remaining soft tissue on the bone surfaces was manually removed by mechanical cleaning. To ensure complete removal of fat tissue, the bones were immersed in a 50% hydrogen peroxide solution for 3 hours. The specimens were then left to dry at room temperature for 7 days. A total of 20 femur specimens were analyzed using 16 three-dimensional landmarks. Generalized Procrustes Analysis (GPA) was applied to the landmark data, followed by Principal Component Analysis (PCA) and allometric analysis. The results showed that a substantial proportion of femoral shape variation was concentrated in the first two principal components. PC1 explained 29.61% of the total variation, while PC2 accounted for 19.72%, together representing 49.33%. The first four principal components explained 78.20% of the cumulative variance. Morphological changes were mainly concentrated in the proximal epiphysis, diaphysis, and distal condylar region. Along PC1, the most prominent variation involved relative positional changes between the proximal head-neck/trochanteric complex and the distal condylar area. Along PC2, a second pattern of variation was identified, reflecting the arrangement of the proximal epiphysis relative to the shaft and the position of the distal articular region. Allometric analysis revealed no statistically significant relationship between femoral shape and log-centroid size ($R^2 = 0.0304$; $F = 0.5643$; $Z = -0.981$; $p = 0.831$). These findings indicate that the observed femoral shape differences largely reflect size-independent morphological variation. In conclusion, three-dimensional geometric morphometric methods provide an effective approach for the detailed evaluation of anatomical variation in the cat femur.

Keywords: Allometry, femur, shape variation, geometric morphometrics

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P28 | Angiogenesis *In Vitro* Performed by Macrovascular and Microvascular Endothelial Cells of Different Species

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ABSTRACT: An all-in-one assay for quantification of angiogenesis *in vitro* was established and applied in human microvascular endothelial cell cultures (Bahramsoltani & De Spiegelaere 2016). This study aimed to evaluate the feasibility of applying this quantification method to canine dermal microvascular endothelial cells (ECs) and carotid artery derived equine macrovascular ECs. Therefore, the canine and equine ECs as well as the human dermal microvascular ECs were cultured in a proangiogenic medium under standardized conditions over a period of 50 days. At days 5, 17, 25, and 50 the ECs were documented phase contrast microscopically and defined stages of angiogenesis *in vitro* were assigned to the images. In addition, samples were collected on these days for RNA isolation in order to characterize the ECs as tip or stalk cells based on VEGFR-1 and VEGFR-2 expression. Overall, human dermal microvascular and equine macrovascular ECs performed similarly, progressing to capillary-like structures (stage 5) in the all-in-one angiogenesis assay. The canine dermal microvascular ECs showed some angiogenic activity as well, but did not develop past stage 4. The preliminary results indicate that that equine macrovascular ECs were able to run through the defined stages of angiogenesis similarly to human microvascular ECs, whereas canine microvascular ECs exhibited only limited angiogenic potential. The characterization of tip and stalk cell populations via VEGFR-1 and VEGFR-2 expression profiles is currently ongoing and will provide further information on the angiogenic potential of the three cell lines.

Keywords: Translational research, veterinary model, all-in-one angiogenesis model, companion animal model

P29 | Immunohistochemical Characterisation of Canine Osteosarcoma

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ABSTRACT: Osteosarcoma (OSA) is a highly prevalent metastatic bone tumour in dogs (13.9/100,000 incidence rate), predominantly affecting large and giant breeds, such as Scottish Deerhounds, Leonbergers, Great Danes, and Rottweilers, greater than seven years of age. The cancer has poor survival rates due to most patients having dissemination to secondary sites prior to an initial diagnosis, hence, the advancement of new novel, therapeutic protocols are required to

help overcome the growth, survival, and metastatic progression of the disease. Immunohistochemical staining and H-scoring is often used for diagnostic and prognostic purposes in human medicine, though these techniques are not yet established within the veterinary field due to ongoing investigations and developments into potential biomarkers. Four overexpressed genes of interest were selected from our previous mRNA sequencing analysis of tumour and non-tumour canine OSA samples (Simpson et al., 2020). Immunohistochemistry (IHC) and consequent H-score analysis was performed to investigate nuclear and/or cytoplasmic protein expression, encoded by the four canine overexpressed genes of interest (n=22, n=18, n=19, and n=20). Statistical analysis of nuclear/ cytoplasmic staining scores of the whole cohort, as well as sex (male versus female) and anatomical location (axial versus appendicular) differences, was conducted. Identifying protein expression of these significantly differentially expressed genes within canine OSA samples, as well as highlighting significant differences between subcellular expression levels, allows us to gain a deeper knowledge of the cancer, and hence identify avenues for the diagnosis, prognosis and treatment of canine OSA.

Keywords: Bone cancer; Differentially expressed genes; Diagnosis; Epitranscriptomic; H-scoring.

References: Simpson, S., et al., *Molecular Characterisation of Canine Osteosarcoma in High Risk Breeds*. Cancers (Basel), 2020. 12(9).

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P30 | Dorsal Fin Morphology in Bottlenose Dolphins (*Tursiops Truncatus*): Implications for Photoidentification

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ABSTRACT: The dorsal fin of the bottlenose dolphin (*Tursiops truncatus*) is built of dense connective and adipose tissue without any osseous or cartilaginous support. It contributes to hydrodynamic stability, acting as a keel during locomotion. It is also the most suitable part of the body for non-invasive identification of individuals due to its visibility and the presence of persistent natural markings, notches and scars which appear during life. Photoidentification is a method for recognizing individuals by taking photographs of the dorsal fin. This method relies on morphological features such as notches (along the cranial and caudal edge of the dorsal fin, at the tip of the fin) and/or scars (on the left and/or right side of the fin). In this study the frequency of these morphological features was calculated for 116 bottlenose dolphins photoidentified during monitoring surveys in Croatia from 2010 to 2021. Among the total number of dolphins, 81 exhibited notches along the caudal edge of the dorsal fin, 27 showed notches along both the caudal edge and the tip of the fin, 2 had notches exclusively on the tip. In 6 individuals no

notches were present. No notches were observed along the cranial border in any of investigated dolphins. Scars were present on both the left and right sides of the dorsal fin in all but one individual which had scars exclusively on the left side and without notches. The combination of notches along the caudal edge of the fin with scars on left and right side (N=81, 69.8%) was the most prevalent anatomical feature in identified individuals. These results confirm that the dorsal fin provides a reliable basis for photoidentification in bottlenose dolphins. The predominance of combined notches and scars suggests that cumulative structural modifications of the epidermis and dermis play a key role in enhancing individual distinctiveness.

Keywords: Bottlenose dolphin, morphology, dorsal fin.

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P31 | Deamidation and Glycosylation Signatures in the Surface Proteome of Rabbit Spermatozoa

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ABSTRACT: Cell surface proteins offer promising prospects for therapeutic and biotechnological applications. Their recent identification as differentially expressed in rabbit spermatozoa could support the development of sperm sex-selection technologies. Protein post-translational modifications (PTMs), such as deamidation and glycosylation, increase proteome diversity by altering protein structure, function and stability. In sperm, PTMs are essential for capacitation and fertilization competence. Deamidation of asparagine (Asn) and glutamine (Gln) residues can modify protein activity or promote degradation, while glycosylation contributes to spermatogenesis, sperm maturation and fertilization. Despite the rabbit's extensive use in reproductive studies, its sperm surface proteome remains poorly characterized. In this work, a shotgun proteomic analysis of rabbit spermatozoa enriched in cell surface proteins through biotinylation was performed, focusing on deamidation and glycosylation to gain functional insights and identify candidates for sperm sexing. Proteins were biotinylated, isolated, deglycosylated, and analyzed by LC-MS/MS. Data were processed using MaxQuant (FDR 1%), with oxidation, N-terminal acetylation, and deamidation set as variable modifications. Functional enrichment was conducted using the DAVID database, revealing the top 10 overrepresented biological processes, molecular functions, and cellular components. Among the 859 detected proteins, 803 had Gene Ontology information, with 574 predicted as globular proteins, 152 as transmembrane proteins, and 133 possessing only a signal peptide. The combined data identified 107 proteins as potential cell surface targets. Of these, 60 proteins showed no detected PTMs and were enriched in processes related to protein stabilization, folding, and proteolysis. Seventeen proteins displayed deamidation sites,

being associated with protein folding, stabilization and cellular responses. Additionally, 30 proteins containing both deamidation and N-linked glycosylation sites were mainly related to sperm-egg recognition, fertilization and acrosomal vesicle exocytosis. PTMs of rabbit sperm proteins remain poorly studied despite their biological relevance. This work expands knowledge and contributes to a more comprehensive characterization of the rabbit sperm surface proteome.

Keywords: Proteomics, bioinformatics; *Oryctolagus cuniculus*; sperm membrane proteins; protein post-translational modifications.

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P32 | Functional Cranial Analysis of Wild and Domestic Pigs (*Sus Scrofa*)

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ABSTRACT: This study shows a comparative study of wild boar and domestic pig skulls suggests that a change in feeding habits under human control may have been a factor influencing the action of the masticatory muscles in reshaping the cranium. Domesticated animals vary from their wild ancestors in many life-history traits and their underlying morphological, physiological and behavioral parameters as a consequence of the shift from natural to human-controlled environments and the effects of artificial selection. Literature findings suggest that a drastic change in pig feeding habits due to human control, may have been an important factor in triggering cranial morphological changes. These changes include a reduction in brain size, changes in growth trajectories and body proportions. Parameters used in this study are cranial morphometric variation and endocranial volume in wild pigs and domestic pigs using computed tomography (CT) and three-dimensional (3D) analysis. Finding shows specificity in the angle of the occipital and the ascending ramus of the mandibula. In domestic pigs is much closer to 90° compared to those in wild pigs. The distance from the nuchal crest to the skull and the root of the zygomatic process of the temporal bone (in domestic pigs 4.96 ± 0.11 cm while in wild pigs was larger 5.71 ± 0.08 cm). Compared to the temporal line in domestic pigs which is almost vertically positioned, the temporal line in wild pigs is obliquely positioned. The temporalis muscle, which follows perfectly in the planum parietalis (fossa temporalis), due to its origin and insertion, is set at an angle following the temporal line and ascending ramus of the mandibula. This position

contributes to the increase or the decrease of the mastication force, and is in direct relationship with the angle of temporal line. In the two cases presented above, the morphology and the angle are different, suggesting different action of the mastication muscles, generating the different bite force in identical feeding patterns. Endocranial volume analysis demonstrated significant differences between groups, suggesting that domestication may be associated with alterations in cranial capacity and internal skull architecture

Keywords: Cranial morphometric, CT, temporalis muscle

P33 | Intra-Articular Osteochondral Bodies (“Joint Mice”) in the Tarsocrural Joint of a Captive Lioness (*Panthera Leo*): Radiographic and Morphological Findings

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ABSTRACT: Intra-articular osteochondral bodies, commonly referred to as “joint mice,” are well documented in domestic species but are rarely described in large wild species. The present study reports an incidental finding of intra-articular osteochondral fragments in the tarsocrural joint of a captive lioness (*Panthera leo*). The subject of the anatomical investigation was a 12-year-old female lioness kept in a zoological park in Bulgaria for its entire life, which died of causes unrelated to the musculoskeletal system. During routine examination of the appendicular skeleton and joints, radiographic assessment of the tarsal region revealed a well-defined, lobulated mineral opacity within the cranial compartment of the tarsocrural joint. Subtle periarticular remodeling and mild osteophytosis were also noted, suggesting chronic joint alteration. Subsequent dissection confirmed the presence of two free intra-articular bodies. Macroscopic evaluation of the retrieved fragments, documented using calibrated imaging, demonstrated irregular morphology with partially smooth, cartilage-like surfaces and areas of uneven osseous texture. The average dimensions of the fragments were approximately $19 \times 21 \times 22$ mm, consistent with an osteochondral origin and indicating a chronic intra-articular process. The combined radiographic and morphological findings support degenerative joint disease and/or repetitive biomechanical stress as the most probable underlying mechanism. Comparative considerations with domestic species reveal similar pathogenetic pathways, while also emphasizing species-specific factors such as body mass and joint loading. This case contributes to limited knowledge of musculoskeletal pathology in large felids and underscores the value of integrating radiological and anatomical approaches to detect clinically silent joint alterations. It also points out the importance of considering joint health and welfare in captive wild carnivores.

Keywords: *Panthera leo*, tarsocrural joint, osteochondral body, degenerative joint disease

P34 | Scroll, Swipe... or Study from a Book: Learning Preferences of Veterinary Students in 2026

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ABSTRACT: Generation Z, born approximately between 1995 and 2012, is often described as “digital natives” characterized by high technological literacy, a preference for visual content, and flexible learning habits. Students in the second year of the Veterinary Medicine program at the University of Zagreb Faculty of Veterinary Medicine belong to this generation, although their actual learning preferences may differ from general assumptions. To explore these preferences, a short survey was conducted via Mentimeter during a lecture in the Histology with General Embryology course in 2026. A total of 75 students participated, responding to a multiple-choice question regarding their preferred learning source. The results show that 32% of students prefer video and image-based materials, 28% prefer learning from books, 21.3% learn best through discussion, and 18.7% have no stable preference and tend to study intensively only before exams. Digital learning materials - including the Instagram page *vef_hista* and the open-access database of histological slides (KUŽIR, S., L. BASTIANČIĆ, N. ŠKVORC, M. POLETTO (2023): Scanned histological slides. University of Zagreb Veterinary Faculty, Zagreb, Croatia) showed a marked increase in usage during the course, particularly before colloquia and exams. This indicates that students at the Zagreb Veterinary Faculty value visual, easily accessible, and flexible learning resources. Nevertheless, the relatively high proportion of students (28%) who prefer learning from books was unexpected. This finding highlights that written, structured materials remain essential for a substantial segment of students, despite their digital orientation. The pedagogical contribution of this study lies in emphasizing the need for a balanced approach: veterinary medicine students in Zagreb require both high-quality digital resources and reliable written materials. The VEF_HISTA+ project will further expand digital resources by producing new histological slides of wild animals, while a separate written laboratory manual will be developed independently of the project to meet the evident demand for structured textual learning materials.

Keywords: Veterinary histology, digital natives, learning preferences, digital learning materials, higher education

P35 | Lifestyle Effects on Pectoral and Pelvic Limb Musculature in Lizards: Implications of Locomotor Changes During Habitat Shifts

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ABSTRACT: Locomotion in tetrapod vertebrates results from complex interactions between morphology, muscle architecture, and environmental constraints. Lizards represent a relevant model

for studying these relationships due to their high ecological and locomotor diversity. Semi-aquatic species, which alternate between terrestrial and aquatic environments, experience distinct biomechanical constraints that remain relatively underexplored from the perspective of muscle architecture and functional organization. The aim of this study was to quantify the muscle architecture of the thoracic and pelvic limbs in terrestrial and semi-aquatic lizards from four families (Agamidae, Iguanidae, Scincidae, and Varanidae) in order to identify potential morpho-functional adaptations associated with lifestyle. Physiological cross-sectional area (PCSA), an estimator of muscle force-generating capacity, was calculated from parameters measured during dissections (muscle mass, fiber length, and pennation angle). Statistical analyses were conducted on these data to assess changes in the muscular anatomy across species with different lifestyles (terrestrial vs. semi-aquatic). Results indicate that terrestrial species generally exhibit higher PCSA values in several thoracic limb muscle groups, particularly humeral abductors, protractors, and elbow adductors. This pattern suggests a greater capacity for force production, consistent with the mechanical demands of supporting body weight and moving on solid substrates. For the pelvic limb, PCSA values are slightly higher in terrestrial species but not significantly different, possibly because semi-aquatic species still experience substantial terrestrial loading during locomotion. In contrast, semi-aquatic species display longer muscle fibers and increased mass in some muscles, including wrist, ankle, and knee flexors, which may reflect adaptations to efficient locomotion in aquatic environments. Only the pectoralis superficialis shows a significant difference between terrestrial and semi-aquatic lifestyle, suggesting a more specific functional specialization. Overall, these results suggest that ecological transitions influence locomotor systems mainly through subtle functional adjustments rather than large-scale morphological changes.

Keywords: Lizards, limb musculature, locomotion, lifestyle, evolution

P36 | Intrarenal Innervation of The Kidneys in Aged Diaph1 Knockout Mice

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The study was conducted on five 18-month-old Diaph1 knockout mice. Kidneys were collected and immersion-fixed for 24 hours in 4% buffered paraformaldehyde (pH 7.4). After fixation, tissues were rinsed and cryoprotected in 18% sucrose until sinking. Subsequently, 14 µm-thick sections were prepared using a cryostat and processed for immunohistochemistry with antibodies against VACHT, DβH, CGRP, SP, GAL, and NOS. Very sparse DβH-immunoreactive nerve fibers were observed, mainly in the renal medulla, with only occasional fibers in the cortex near proximal and distal convoluted tubules. In contrast, VACHT-immunoreactive fibers were markedly more numerous, forming thick nerve bundles in the renal hilum. Numerous fibers were also present in the medulla, particularly around loops of Henle and collecting ducts, as well as in the cortex adjacent to tubular structures. Immunostaining for SP and CGRP revealed numerous CGRP-immunoreactive fibers and

only occasional SP-positive fibers in the renal hilum, cortex, and medulla. These fibers were associated with loops of Henle, collecting ducts, blood vessels, and proximal and distal convoluted tubules. A moderate number of NOS- and GAL-immunoreactive fibers were also detected in all renal regions, with a similar distribution pattern. The results indicate significant alterations in intrarenal innervation in aged Diaph1 knockout mice. The predominance of VACHT-positive fibers suggests a relatively preserved or compensatory cholinergic component. In contrast, the scarcity of D β H-positive fibers reflects a marked reduction in sympathetic adrenergic innervation, potentially affecting renal blood flow and tubular function. The sensory profile, characterized by numerous CGRP-positive and few SP-positive fibers, indicates a shift toward vasodilatory and modulatory signaling. Moderate NOS and GAL expression further supports the involvement of nitrergic and galaninergic pathways. Overall, these findings suggest a reorganization of renal innervation associated with aging and Diaph1 deficiency, with reduced adrenergic input and a relative predominance of non-adrenergic regulatory mechanisms.

Keywords: Aged mouse, diaph1, immunohistochemistry, innervation, kidney.

P37 | Trisomy 21 Leads to Aberrant Neuronal Morphology and Delayed Maturation in Individuals with Down Syndrome

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ABSTRACT: Down syndrome (DS) is caused by trisomy of chromosome 21, affects over 6 million people worldwide and is characterized by alterations in most organ systems. This trisomy can be either complete or partial, and may also involve structural mosaicism, characterized by the presence of both disomic (D21) and trisomic (T21) cells. Isogenic iPSCs were derived from an individual with structural mosaicism for DS, from which Neural Stem Cells (NSCs) were generated. For neuronal differentiation we used NSCs between P5-10 and geltrex coated coverslips for immunofluorescence or geltrex coated 6 well plates for Western blotting. Neurons were harvested at DIV40 and DIV60 and detailed morphological analysis was performed, as well as an analysis of synaptogenesis. Our results showed that T21 neurons have shorter and thicker neurites with less branches and less terminal points compared to D21 neurons. In addition to these morphological abnormalities, T21 neurons also showed a reduced number of synaptic vesicles and slower functional maturation compared to D21 neurons. Reduced synaptogenesis was shown in both presynaptic vesicles labelled with Synapsin-1 and Synaptophysin as well as postsynaptic vesicles labelled with PSD95 and Gephyrin. These findings demonstrate that trisomy of chromosome 21 in individuals with DS affects the morphology and functional maturation of neurons.

Keywords: Down syndrome, iPSCs, neuron morphology, synaptogenesis

Funding: Adris Foundation, NPOO-NextGeneration (NPOO-12, NEURO-MORF), Croatian Science Foundation (HRZZ-UIP-2025-02-5828), CRP-ICGEB (CRP/HRV25-03)

P38 | Eggshell Morphology as a Tool for Species Identification in Domestic Birds

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ABSTRACT: The morphology of avian eggshells represents an important aspect of comparative and applied veterinary anatomy, particularly when only fragmented material is available. Unlike complete eggs, which can be identified based on macroscopic characteristics, fragments require detailed analysis of micromorphological and metric parameters such as shell thickness and mammillae density. The aim of this study was to determine the species of domestic birds based on eggshell morphology and to demonstrate how these characteristics contribute to reliable identification. The analysed material originates from the archaeological site Banski dvori, located in the historic centre of Zagreb. The samples were recovered from a refuse pit dated to the 17th/18th century. A total of ten eggshell samples were analysed, with five originating from area 1 and five from area 2 of the same stratigraphic unit. Samples were cleaned in distilled water and air-dried at room temperature. Shell thickness was measured using a digital calliper, while the inner surface was examined under a stereomicroscope (Motic SMZ-171) at 30 $\times$ magnification. Mammillae density (per mm²) was quantified using digital image analysis, with six measurements per sample taken on 0.5 mm² and recalculated to 1 mm². Mean values were calculated for each sample and for each area. The obtained values of shell thickness ($\bar{x}$ = 0.33 mm) and mammillae density ($\bar{x}$ = 68.73/mm²) in the area 1 correspond to domestic chicken (*Gallus gallus domesticus*), whereas higher shell thickness ($\bar{x}$ = 0.37 mm) and mammillae density ($\bar{x}$ = 71/mm²) in the area 2 indicate domestic duck (*Anas* sp.). Although the ranges of mammillae density per mm² overlap between these species, shell thickness proved to be the determining factor in species identification. The combined use of these morphological parameters enables reliable differentiation between domestic bird species and highlights the diagnostic value of eggshell microstructure in anatomical research.

Keywords: Eggshell thickness, mammillae, birds, morphology

P39 | Anatomy and Diversity of Snake Dentition

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ABSTRACT: Snakes are vertebrates belonging to the class Reptilia, with over 4,000 species worldwide exhibiting wide range of ecological diversity. Although many aspects of snake biology have been extensively studied, dentition remains relatively under-

discussed topic. Snakes may possess from a few dozen to several hundred teeth. Most species have six rows of teeth, with two rows on the lower jaw and four on the upper jaw. These teeth are borne on the mandible, pterygoid, palatine, maxilla, and sometimes the premaxilla. Reptile teeth are composed of enamel, dentine, and cementum but lack a periodontal ligament. Snakes are modified pleurodonts, meaning their teeth are continuously replaced. This process occurs without external tooth resorption, via dentin resorption within the pulp. Snake teeth are generally not regionally differentiated; however, their shape, length, and curvature vary considerably and are closely related to feeding habits. Two main categories have been described: short and robust teeth, or thin and slender teeth. These categories are linked to prey hardness, feeding behavior, and environmental adaptations. Venomous species show additional specialization, including modified maxillary teeth known as fangs, whose main function is venom delivery. In rear-fanged species, venom is delivered through enlarged grooved fangs located at the posterior maxilla. In front-fanged snakes, the venom gland connects via a duct to fangs at the anterior maxilla. In proteroglyphous species, the fangs are fixed and contain enclosed venom-conducting canals with a visible suture line. In solenoglyphous species, such as those in the family Viperidae, the fangs also contain enclosed canals but are folded backward when the mouth is closed. Snake dentition exhibits diverse morphological adaptations shaped by natural selection and closely linked to feeding ecology. Despite its importance, this aspect of snake biology remains relatively underexplored. A better understanding of dental anatomy can provide valuable insights into snake biology, evolution, and ecological interactions.

Keywords: Evolution, fang, reptile, snake, teeth

P40 | Comparative Anatomical Study of the Hyoid Apparatus in Selected Squamata (Chamaeleonidae, Eublepharidae, Iguanidae, Lacertidae, Phrynosomatidae) - Micro-Computed Tomography (Mct)

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ABSTRACT: Many previous studies of the hyoid apparatus and tongue of different squamate species indicate that these structures are involved in chemoreception, drinking, feeding, as well as social interactions. The aim of this study was a detailed anatomical analysis of the hyoid apparatus in six species of Squamata: leopard gecko (*Eublepharis macularius*, n=2), panther chameleon (*Furcifer pardalis*, n=1), desert iguana (*Dipsosaurus dorsalis*, n=1), horned

lizard (*Phrynosoma cornutum*, n=1), green lizard (*Lacerta viridis*, n=1) and sand lizard (*Lacerta agilis*, n=2). Cadaveric heads of included species were obtained post-mortem from Ljubljana Zoo and fixed in 4% paraformaldehyde in phosphate-buffered saline (PBS, pH 7.4). Micro-computed tomography (μCT) was performed using a SkyScan 1273 system (Bruker microCT, Kontich, Belgium) at 70 kV and 214 μA, with a voxel size of 16.99 μm. Scans were acquired with an exposure time of 400 ms, a rotation step of 0.3°, and a full 360° rotation without filtration. Reconstruction was carried out using NRecon software with beam hardening correction (21%) and ring artifact reduction. Morphometric analysis was performed using CTAn software (Bruker microCT, v.1.20.8.0). Linear measurements (mm) of the hyoid apparatus were obtained from reconstructed datasets, including the entoglossus process, basihyoid (bony and cartilaginous parts), hypohyalis, ceratohyalis, ceratobranchials 1 and 2, and epibranchials. Three-dimensional visualization was performed using RGB color filters to enhance anatomical detail, with particular emphasis on the hyoid apparatus, which was highlighted in red. The hyoid apparatus of all examined species was composed of unpaired elongated lingual process (entoglossus) as an extension of the basihyoid, two pairs of ceratobranchials (1 and 2), and two pairs of hyoid cornua: the anterolateral pair (hypohyalis) and posterolateral one (ceratohyalis). μCT analysis demonstrated considerable morphological variation in the structure of the hyoid apparatus. The most noticeable difference concerned the shape and length of ceratobranchials (1 and 2) and ceratohyalis. A highly effective imaging technique such as μCT could be a useful tool for the comparative anatomical study as well as in veterinary practice.

Keywords: Anatomy, hyoid apparatus, micro-computed tomography, Squamata

P42 | Doppler Ultrasonographic Assessment of Fetal Hemodynamics in Pregnant Ewes and Does

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ABSTRACT: Doppler ultrasonography is a non-invasive, real-time imaging modality that has become a useful tool in veterinary obstetrics for assessing maternal and fetal well-being during pregnancy. The objective of this study was to evaluate the blood flow in the umbilical artery, ductus venosus and abdominal aorta (adjacent to the renal arteries) of fetuses of pregnant ewes and does throughout their pregnancy. Twenty Lacaune ewes (8–9 months of age, 35–40 kg body weight) and twelve local does (8–9 months of age, 25–30 kg body weight). Pulsed wave doppler examinations were performed using a micro-convex phased-array transducer (5–8 MHz, scanning depth 60–120 mm). Doppler examinations began in the 13th week of pregnancy and were performed at weekly intervals until parturition. A total of 8 examinations per ewe were performed for umbilical artery and 5 examinations per ewe for ductus venosus and abdominal aorta. The haemodynamic parameters calculated were the Pulsatility Index (PI), Resistive Index (RI), Peak Systolic Velocity (PSV), End Diastolic Velocity (EDV), Mean Velocity (Vmn), Systolic Acceleration Time (AT), Systolic/Diastolic Velocity Ratio (SV/DV),

Fetal Heart Rate (HR) and Time Average Mean Velocity (TAMV). With the aid of B-mode examination measured the cross-sectional area (A) of umbilical artery, aorta and ductus venosus. In order to determine the Blood Flow Volume (BFVol) the Time Average Mean Velocity was multiplying by the cross-sectional area ($BFVol = TAMV \times A$). In conclusion, ultrasonography proves to be a highly effective diagnostic tool for monitoring normal pregnancy in sheep and goat, facilitating accurate estimation of gestational age and comprehensive evaluation of fetal development and viability.

Keywords: Pulsed Wave Doppler Ultrasonography, Umbilical Artery, Aorta, Ductus Venosus, Embryology

Funding: Hellenic Foundation for Research and Innovation (H.F.R.I.), grant 20771

P43 | Ultrasonographic Assessment of Fetal Development in Sheep and Goat

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ABSTRACT: Ultrasonography is a non-invasive, real-time imaging modality that has become an essential tool in veterinary obstetrics for assessing maternal and fetal well-being during pregnancy. The aim of the present study was to evaluate fetal development during physiological gestation in sheep and goat using ultrasonography and to estimate gestational age and morphometrical parameters through mathematical formulae. A total of twenty pregnant Lacune ewes, aged 8–9 months and weighted 35–40 kg, and twelve local does, aged 8–9 months and 25–30 kg respectively, were randomly selected and included in the study. Ultrasonographic examinations were performed weekly from the 3rd week of gestation until parturition. Several maternal and fetal parameters were recorded, including gestational vesicle diameter (GVD), abdominal diameter (AD), thoracic diameter (TD), biparietal diameter (BD), placental thickness (PTD) and diameter (PD), as well as crown–rump length (CRL), femur length (FL), and kidney length (KL). All measurements were obtained using B-mode ultrasonography with a micro-convex phased-array transducer (5–8 MHz; scanning depth 60–120 mm). The ultrasonographic findings demonstrated significant correlations between the developmental stages of all evaluated maternal–fetal structures and gestational age. These correlations enabled the establishment of reliable reference values and mathematical models for gestational age and morphometrical estimation. Furthermore, the obtained measurements may serve as valuable indicators for the early detection of developmental abnormalities. In conclusion, ultrasonography proves to be a highly effective diagnostic tool for monitoring normal pregnancy in sheep and goat, facilitating accurate estimation of gestational age and comprehensive evaluation of fetal development and viability.

Keywords: Ultrasonography, Fetal biometry, Ovine pregnancy, Fetal development, Embryology

Funding: Hellenic Foundation for Research and Innovation (H.F.R.I.), grant 20771

P44 | Immunohistochemical Detection of Conserved Proteins During Zebrafish (*Danio Rerio*) Development

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ABSTRACT: The zebrafish (*Danio rerio*) is a highly suitable vertebrate model for studying organ damage and regeneration, as well as genetically or chemically induced diseases. However, the application of immunofluorescence (IF) within immunohistochemistry (IHC) is still not widely used for monitoring high-resolution microanatomical changes and protein distribution in cryosections, primarily due to the limited availability of specific antibodies. The aim of this study was to investigate selected antioxidative and cytoskeletal proteins with high homology resulting from evolutionary conservation of protein sequences, and to determine their presence and distribution in wild-type zebrafish embryos during developmental stages from 1 to 5 days post-fertilization (dpf). Proteins with high sequence homology were analyzed using IF/IHC with commercially available antibodies against heme oxygenase and inducible metallothionein, as well as a group of cytoskeletal proteins including β -actin, α - and β -tubulin, and vimentin. Secondary antibodies were conjugated with fluorescent dyes (Cy3, FITC, or DyLight), and tissue staining was performed on cryosections of zebrafish embryos from 1 to 5 dpf. Samples were examined using a fluorescence microscope (Carl Zeiss Axio Imager Z2). The results indicate that zebrafish developmental microanatomy can be successfully monitored using certain commercially available antibodies due to the high evolutionary conservation of protein sequences, although additional antigen retrieval may be required in some cases. The presence of specific proteins across developmental stages showed variations in intensity and distribution, demonstrating that both physiological and induced changes can be tracked using high-resolution microscopy of cryosectioned samples with IF/IHC techniques.

Keywords: Zebrafish (*Danio rerio*), immunofluorescence, immunohistochemistry, development, evolutionary conserved proteins.

Funding: Funded by the European Union – Next Generation EU (Class: 643-02/23-01/00016, Reg. no. 533-03-23-0006)-Project: Evaluation of efficacy and toxicity of biologically active substances (BioMolTox).

P45 | *Ossa cordis* shape, size and microstructure in the giraffe (*Giraffa camelopardalis* ssp. *reticulata*).

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ABSTRACT: Heterotopic bone and cartilage in the heart, within the skeleton, are termed *ossa cordis* and *cartilago cordis* respectively, and exist in a very limited number of species. Even fewer species have *ossa cordis* surrounded by ectopic cartilage. Little is known about *ossa cordis* in the giraffe other than a previous case study (*Giraffa camelopardalis rothschildi*) stating bone was present in the right trigone. The present novel study used X-ray computed microtomography (μ CT) in the endangered reticulated giraffe cardiac skeleton. Accompanying histological investigations included haematoxylin and eosin (H&E), special stains Von Kossa (calcium deposits), Alcian blue pH 0.2 and 2.5 (acidic polysaccharides, such as glycosaminoglycan present in cartilage) and immunohistochemistry alongside light microscopy, and picrosirius red (collagen) with phase microscopy. The literature to date shows differing histological and anatomical structures and locations of *ossa cordis*. The number of structures, presence or absence of cartilage circumventing the bone, and even correlations with cardiovascular disease also vary between individuals of the same species, and between species. This research established the size, shape and microstructure, including bone thickness throughout the giraffe *ossa cordis* using dissection and μ CT. The types of bone and cartilage were specified using histological methods, in addition to detailing aspects such as collagen quantity and types, vasculature and disease status. This work also explored the theories relating to endochondral and intramembranous ossification. Importantly, this case, described giraffe *ossa cordis* microstructures and histological features for the first time. It also highlighted the importance of searching for these structures during postmortem procedures.

Keywords: Cardiac, cartilage, chondrocytes, heart, ossification.

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Ethics: All research included in this presentation received ethical approval from the University of Nottingham School of Veterinary Medicine and Science ethics committee under UK approved ethical guidelines (ethics number: 3186200604).

P47 | The Morphological and Histological Structure of the Nasolabial Plane in the Brown Bear (*Ursus arctos*) and the European Roe Deer (*Capreolus capreolus*)

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ABSTRACT: The aim of this study was to examine the macroscopic and microscopic structures of the nasal floor (rhinarium) in one brown bear cub and one European roe deer, which were brought to the Caucasus University Wildlife Rescue and Rehabilitation Centre (Kars, Turkey) for treatment for various reasons but could not be saved by the centre despite all interventions. The skin around the nostrils is hairless in small ruminants, dogs, and cats. The planum nasale is divided by the philtrum, a median groove. The surface of the planum at the tip of the nose features numerous shallow grooves, thought to possess individual-specific patterns. These groove patterns can be used for individual identification, much like fingerprints in humans. To achieve this objective, the nasal floor was examined macroscopically and under a light microscope. Histologically, it was observed that the rhinarium (planum nasale) in the brown bear cub had a thick keratin layer, whereas in the European roe deer's rhinarium contained glands of a serous nature. In conclusion, the nasal structure of the endangered brown bear cub and the European roe deer was examined. It is considered that the results of this study may be useful in individual and species identification, as well as in zootechnical and genetic studies.

Keywords: Brown bear, European Roe Deer, morphology, nasal plane, rhinarium.

P48 | Formaldehyde Use and Alternative Fixation Strategies in Veterinary Anatomy Teaching: A European Benchmarking Study in the Context of ESEVT Standard 5

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ABSTRACT: Formaldehyde (formalin) has traditionally been a principal fixative in veterinary gross anatomy teaching. However, its classification as a hazardous chemical and increasing emphasis on occupational health within European accreditation frameworks have prompted systematic re-evaluation of its use. ESEVT Standard

5.1.1 requires teaching materials to be educationally appropriate and aligned with current professional standards, while Standard 5.1.3 emphasizes protection of students and staff from hazardous substances. A structured analysis of EAEVE visitation, revisitation and preliminary visitation reports (2023–2025; n=66 VEEs) demonstrated that approximately 70% of accredited Veterinary Education Establishments report predominant use of fresh, frozen, plastinated or formalin-free preserved specimens. Around 20% report limited or controlled formalin use with documented monitoring of airborne concentrations, whereas <10% continue routine formalin fixation without systematic transition strategies. In selected cases, continued formalin use was explicitly associated with partial or non-compliance with Standard 5.1 due to suboptimal health protection measures. To generate comparative benchmark data, a cross-sectional questionnaire was developed and disseminated via professional academic networks, including the European Association of Veterinary Anatomists (EAVA). The survey collects structured information on formaldehyde use (purpose, concentration, estimated annual volume), laboratory safety measures (rinsing protocols, ventilation, exposure monitoring), implementation of alternatives (phenoxyethanol, salt-based methods, Thiel fixation, plastination, fresh/frozen material, digital and 3D tools), and institutional strategies for progressive reduction. Data will be analyzed descriptively and presented in aggregated form to identify trends, good practices, and practical barriers to transition. The objective is benchmarking and quality enhancement rather than hypothesis testing. In conclusion, veterinary anatomy education in Europe appears to be undergoing a structured transition toward diversification of teaching materials and reduction of hazardous chemical exposure. Systematic benchmarking may facilitate realistic transition pathways that maintain educational quality while aligning with evolving ESEVT health and safety expectations.

Keywords: Formaldehyde; Veterinary anatomy; ESEVT Standard 5; Health and safety; alternative fixation methods.

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P49 | Anatomy and Histology of the Kidneys in the Balkan Donkey (*Equus asinus*)

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ABSTRACT: The aim of this study was to describe the anatomical and histological characteristics of the kidneys of the domestic donkey. Kidney samples for anatomical analysis were collected from healthy male Serbian mountain donkeys. A gross anatomical study was performed on 11 male jacks aged 14–18 months from the Balkan donkey group. For histological evaluation, tissue samples from six left and six right kidneys were collected. Samples were routinely processed, embedded in paraffin, sectioned, and stained with hematoxylin and eosin and Masson–Goldner trichrome.

Histological sections were examined using an Olympus CX31 light microscope equipped with an Olympus UC50 digital camera and cellSens Entry software. The thickness of the renal fibrous capsule and the number of renal corpuscles per mm² of renal cortex were determined. The kidneys were smooth externally and unipapillary internally. Topographically, they were located retroperitoneally in the lumbar region. Histologically, the kidneys had a well-developed capsule, clearly differentiated cortex and medulla, and a distinct corticomedullary junction. Histomorphometric evaluation showed a mean renal capsule thickness of $71.31 \pm 17.38 \mu\text{m}$ in the left kidney and $123.28 \pm 24.59 \mu\text{m}$ in the right kidney. The mean number of renal corpuscles per mm² of renal cortex was 5.09 ± 1.47 in the left kidney and 4.46 ± 1.01 in the right kidney. The cortex contained numerous renal corpuscles, proximal and distal convoluted tubules, whereas the medulla consisted predominantly of straight tubules and collecting ducts arranged in parallel bundles. Masson–Goldner staining revealed a fine network of collagen fibers within the renal interstitium, particularly around blood vessels and tubular structures in both the cortex and medulla. The region adjacent to the renal pelvis was lined by urothelium, and mucosal glands were present within the underlying connective tissue. These findings provide baseline data on the anatomy and histology of the kidneys in the domestic donkey.

Keywords: Balkan donkey, kidney, topographical anatomy, renal cortex and medulla.

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P50 | Veterinary Anatomy Education in Post-Disaster Conditions: Challenges and Proposed Solutions

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ABSTRACT: In the post-disaster period, veterinary anatomy education in veterinary faculties is affected more profoundly than other disciplines due to its predominantly practice-based nature. In this field, priority is given to hands-on learning with fresh cadavers, as it enables students to develop essential skills in dissection, tissue manipulation, and accurate understanding of three-dimensional anatomical structures. However, following large-scale disasters such as earthquakes, damage to laboratory infrastructure, the inaccessibility of educational facilities, and deficiencies in technical equipment significantly disrupt practical courses, which constitute the core of veterinary anatomy education. In addition, difficulties in cadaver procurement and the inability to maintain appropriate storage conditions severely hinder the continuity of dissection practices. Consequently, students' ability to comprehend three-dimensional anatomical relationships is weakened, negatively affecting their professional development, reducing the quality of practical training, and leading to inequalities in educational opportunities among institutions. In the post-disaster period, psychosocial factors such as stress, anxiety, and trauma experienced by students further impair the learning process. These conditions decrease motivation and indirectly limit academic performance. A similar impact is also

observed among academic staff, as ongoing material shortages, unfavorable living conditions, and persistent stress reduce both motivation and productivity. Under these circumstances, alternative teaching methods, including three-dimensional models, digital illustrations, computer-assisted learning tools, and virtual reality applications, are increasingly employed. However, these approaches remain limited due to high costs and the lack of adequate technical infrastructure, and they are unable to fully replicate the tactile and experiential aspects of real tissue interaction. In conclusion, the sustainability of cadaver-based practical training—the primary objective of veterinary anatomy education—becomes significantly compromised in post-disaster settings, while alternative methods remain insufficient under existing conditions. Therefore, ensuring educational equity requires not only improvements in infrastructure but also the development of comprehensive and sustainable strategies that integrate multiple teaching modalities.

Keywords: Disaster, Earthquake, Veterinary Anatomy, Cadaver, Alternative Methods

P51 | Instagram as Potential Anatomical “Book”?

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ABSTRACT: Given the growing interest in social networks and media, it is important to explore possibilities for using these dynamic platforms in education. Using social networks in teaching process is a challenge for both teachers and students. Creating high-quality, yet simple posts is crucial for engaging the audience and maintaining their attention. In 2024, the FK Anatomy Instagram profile was established with the aim of promoting veterinary morphology. The goal was to increase interest in veterinary morphology among students of our university as well as among the general public. In our contribution, we would like to point out one specific question - “What type of content would you like to see more of on social networks of the FK Anatomy?” among 1st year students (who attend Anatomy classes). Anonymous responses from 200 respondents were collected and evaluated. Of the 200 respondents, first-year students represented 33.5%. The most frequently requested content included quizzes with 10 multiple-choice questions (with a choice of one correct answer) - 29.85%, videos (short educational videos) were requested by 28.35% of respondents. Students were also interested in the behind-the-scenes of anatomy (preparation of preparations) (11.94%). 20.91% respondents selected other options (graphics, clinically significant structures, photo descriptions, etc.). Since social networks are a common tool for young people, it is necessary to consider and examine their specifics in relation to learning, so that the potential of social networks proves to be positive not only in supporting interest in given topics, but also as a learning tool.

Keywords: Instagram, social networks, veterinary anatomy

P52 | High-Resolution Three-Dimensional Modeling of the Chicken Atlas Through Stereomicroscope-Assisted Photogrammetry and Focus Stacking

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ABSTRACT: The use of digital learning materials in veterinary anatomy education is becoming increasingly common. However, the limited surface area and high level of anatomical detail of small osteological structures make their accurate digitization challenging. This study aimed to create a three-dimensional (3D) digital model of the atlas bone of a chicken (*Gallus gallus domesticus*), a small osteological specimen, using a stereomicroscope-assisted photogrammetric method and to evaluate the applicability of this approach for the digitization of small anatomical structures. The atlas bone of an adult chicken was used in the study. The specimen was imaged at high resolution from different angles under a stereomicroscope, and care was taken to record all surfaces. To increase depth of field and enhance surface detail, focus stacking was applied to the images obtained from each viewpoint. The images were transferred to Agisoft Metashape software and processed through a photogrammetric workflow including image alignment, dense point cloud generation, mesh reconstruction, and texture mapping. The resulting three-dimensional model was evaluated in terms of anatomical detail preservation, surface integrity, and visual accuracy. The photogrammetric workflow produced a high-resolution three-dimensional model of the chicken atlas. Anatomical structures such as the arcus dorsalis, arcus ventralis, ala atlantis, and foveae articulares craniales et caudales were clearly distinguishable on the model. Stereomicroscope-assisted imaging combined with focus stacking provided sufficient detail for the successful transfer of fine anatomical structures and surface morphology to the model. Anatomical details were preserved, surface integrity was maintained, and high-resolution texture data were successfully transferred. The findings indicate that stereomicroscope-assisted photogrammetry is an effective method for the three-dimensional modeling of small osteological specimens. This approach has significant potential for the digitization of small anatomical structures requiring detailed surface representation and realistic texture mapping, as well as for the development of digital anatomy atlases and high-quality three-dimensional educational materials for veterinary anatomy.

Keywords: Photogrammetry, Stereomicroscopy, Focus Stacking, Three-Dimensional Modeling, Veterinary Anatomy

P53 | Development of a Deep Learning-Based Bone Recognition and Classification System for Veterinary Anatomy Education

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ABSTRACT: Veterinary anatomy education can be challenging for students due to the necessity of learning skeletal structures from numerous species as well as extensive Latin anatomical terminology. Traditional educational materials, such as atlases and anatomical models, do not always provide sufficient opportunities for independent learning without instructor guidance. This study aimed to integrate the widely used “You Only Look Once” (YOLO) deep learning algorithm into veterinary anatomy for the automatic recognition and classification of atlas and axis bones from equine and cattle species. Images of the osteological materials used in this study were obtained from bones utilized for educational purposes in the Anatomy Department Laboratory of the Faculty of Veterinary Medicine using a Sony A7 IV camera. To increase dataset diversity, images were captured from different angles and under various background conditions. Approximately 90–100 images were collected for each bone. The acquired images were annotated using the LabelImg software, and the dataset was divided into training (90%) and testing (10%) sets. Algorithm training and object detection procedures were performed using the Python programming language. During the deep learning-based object recognition process, object detection and classification were carried out using the Deep Neural Networks (DNN) module of the OpenCV library. An accuracy of 98% was achieved in the classification of atlas and axis bones of equine and cattle species in the test dataset, while a minimum confidence score of 0.80 was established as the success criterion of the study. The obtained accuracy demonstrated that the YOLO-based approach could serve as a reliable tool for supporting students’ individual active learning capacities in veterinary anatomy education. It was considered that this system could facilitate the establishment of a digital anatomical database, reduce dependence on externally sourced anatomical educational materials, and contribute to interdisciplinary studies.

Keywords: Anatomy, Deep Learning, Bone, Veterinary Medicine, YOLO Algorithm.

P54 | Macroanatomical and Histological Investigation of the Syrinx in the European Robin (*Erithacus rubecula*)

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ABSTRACT: In birds, the syrinx, the primary organ responsible for sound production, is located at the junction of the trachea and bronchi primarii and shows morphological and histological variation among species. In Passeriformes, it has a more complex organization associated with advanced vocalization ability. The European robin is a passerine songbird, and its syrinx is insufficiently described in the literature. Therefore, this study

aimed to investigate its anatomical and histological features. The material consisted of syrinx specimens from three adult individuals. After dissection, samples were examined under a stereomicroscope (SZ6, Olympus, Japan) and photographed using a digital camera (C-5060, Olympus, Japan). For histological examination, tissues were fixed in 10% formaldehyde, processed routinely, embedded in paraffin, sectioned at 5 µm, stained with Hematoxylin and Eosin and evaluated under a light microscope. In European robin, the syrinx was located at the cranial aspect of the basis cordis, at the caudal end of the trachea, and at the origin of the bronchi primarii. Dorsally, *m. syringealis dorsalis* and *m. tracheobronchialis dorsalis* were present, while *m. syringealis ventralis* was located ventrally. The *m. tracheobronchialis dorsalis* extended between the tympanum and the first bronchial half-rings, and *m. syringealis dorsalis* extended from the tympanum toward the bronchial half-rings. The *m. sternotrachealis* was identified along the trachea. The tympanum, formed by fusion of the last 3–4 tracheal rings, was thicker and wider than the remaining tracheal cartilages. At the origin of the bronchi primarii, semicircular cartilages bronchosyringales were observed. The syrinx consisted of the tympanum and these cartilages and was classified as a tracheobronchial type. The pessulus divided the lumen into right and left bronchi primarii, and the membrana tympaniformis medialis, membrana tympaniformis lateralis, and attachment of the labium mediale to the pessulus were observed. In conclusion, this preliminary study suggests that the overall organization of the European robin syrinx is similar to that reported in passerine birds.

Keywords: *Erithacus rubecula*, histology, morphology, syrinx.

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P55 | An environmentally friendly and non-toxic method for preparing dry anatomical specimens for anatomy teaching

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ABSTRACT: The preparation of anatomical teaching specimens requires specific pre-treatment procedures prior to the final preservation of organs in their natural anatomical form. Drying hollow organs enables the production of durable anatomical specimens suitable for long-term display and direct handling without the use of hazardous chemical preservatives such as formaldehyde. The aim of this study was to develop and evaluate an environmentally friendly and non-toxic method for the preparation of dry anatomical specimens suitable for educational purposes. The proposed method consists of five phases: (1) dissection, (2) cleaning, (3) soaking in a potassium aluminum sulfate solution ($KAl(SO_4)_2 \cdot 12H_2O$), (4) air-drying using a compressor, and (5) internal polyurethane foam stabilization. The method is applicable to the preparation of hollow organs, including the lungs, esophagus, stomach, intestines, reproductive organs, and urinary bladder of various animal species.

Following immersion in a potassium aluminum sulfate solution (0.1 kg per 1 liter of water) for 12–24 hours, the organ is inflated with compressed air. A balance between air inflow and outflow is maintained throughout the drying process, which typically lasts three to four days. After complete drying, polyurethane foam is gradually injected into the organ lumen. Additional foam is applied when necessary to ensure complete filling of the organ cavity. Depending on organ size, foam hardening requires between 8 and 48 hours. The resulting specimen is lightweight, structurally stable, and resistant to deformation. The hardened foam also protects internal surfaces from insect damage, while the external surface is protected by varnishing. Selected anatomical structures may be painted in different colors to facilitate identification and teaching. Potassium aluminum

sulfate functions as a non-toxic drying agent, disinfectant, natural deodorizer, and effective insect repellent, thereby protecting the specimens from biological deterioration and pest-related damage. Furthermore, the preparation process is simple, cost-effective, and environmentally friendly. The resulting specimens are durable, safe for direct student handling, and highly valuable for anatomy teaching, museum collections, and studies of organ growth and developmental changes associated with animal age.

Keywords: dry anatomical specimens; anatomy education; veterinary anatomy; eco-friendly preservation; potassium aluminum sulfate; hollow organs; polyurethane foam stabilization.

