ANIMALIA EXOTICA

International Scientific and Professional Seminar on Exotic Animals



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Preface

It is a pleasure to introduce the *Animalia Exotica 2026 Book of Abstracts*, published on the occasion of our annual scientific and professional seminar dedicated to exotic, wild, and zoo animals. The event brings together researchers, veterinary practitioners, other professionals, and students with a shared interest in the biology, health, welfare, and conservation of these animals.

The mission of *Animalia Exotica* is to encourage dialogue and collaboration across veterinary medicine, biology, and related disciplines, providing a forum for exchanging scientific knowledge, practical experience, and new perspectives on animal care and conservation.

All abstracts included in this publication have undergone review by the **International Scientific Committee**, supporting the scientific quality of the contributions. The Organising Committee warmly thanks all authors, reviewers, and editors for sharing their expertise and contributing to this year's publication.

We hope that this Book of Abstracts will provide a valuable resource for readers, inspire further research, and strengthen the connections between those working with exotic, wild, and zoo animals.

On behalf of the Organising and Scientific Committee,
Seven Mustafa and Iliana Ruzhanova-Gospodinova
Editors-in-Chief, Animalia Exotica 2026

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ORAL PRESENTATIONS

The following abstracts correspond to oral presentations delivered during the scientific sessions of Animalia Exotica 2026. Each contribution was reviewed and accepted by the International Scientific Committee. The lectures reflect a broad range of topics within exotic animal medicine, biology, and conservation, highlighting the diversity of research and professional practice presented at the seminar.

Bears And Humans: A Shared History Written in Bones

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The relationship between bears and humans has been shaped by fascination, fear, exploitation, and changing attitudes towards animal welfare. Bears have occupied a prominent place in human imagery and cultural traditions, while also being hunted, displayed, and trained for entertainment. In Bulgaria, the rescue of former dancing bears and their placement at Belitsa Bear Sanctuary represent an important transition towards lifelong care and greater recognition of their biological needs.

This study aims to describe selected dental and skeletal changes in brown bears associated with Belitsa and to interpret them in relation to individual life histories, with particular attention to longevity and the potential accumulation of age-related changes under long-term care. Material from 15 brown bears (*Ursus arctos*) was examined, although the anatomical regions available differed among individuals. Gross anatomical examination, supported by computed tomography and three-dimensional documentation, included 12 skulls, 10 vertebral columns, and limb material from nine bears. Dental changes were identified in eight of the 12 skulls, marked vertebral changes in seven of the 10 vertebral columns, and marked appendicular changes in six of the nine bears represented by limb material. Findings included altered canine crowns, alveolar resorption, mandibular remodelling, vertebral osteophytes, and changes in major joint surfaces.

These observations were considered alongside the animals' documented histories, taking into account ageing, individual variation, and previous conditions of captivity. Improved living conditions and sustained veterinary care may support longer lives, allowing age-related changes to develop or progress. Consequently, skeletal alterations in older rescued bears should be interpreted in relation to both earlier adverse experiences and extended survival under improved care. The absence of wild controls and comparative survival data limits conclusions about the respective contributions of captivity and longevity. Integrating life histories with skeletal morphology highlights the value of these specimens for research, veterinary education, and understanding the needs of ageing bears under human care.

Keywords: human–bear relationships, brown bear, dancing bears, longevity, skeletal morphology, animal welfare

Clinical Approach to Encephalitozoonosis in Rabbits: Diagnostic Challenges and Therapeutic Decision-Making

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Encephalitozoonosis remains a diagnostic and therapeutic challenge in rabbit practice. Exposure to *Encephalitozoon cuniculi* does not necessarily result in clinical disease, while neurological, renal and ocular abnormalities require careful consideration of alternative causes. This presentation discusses the interpretation of diagnostic findings and their role in individual therapeutic decisions, supported by results from our research.

The study included 63 rabbits, both with and without clinical signs, divided into three groups according to their serological status: IgM-/IgG- (n=21), IgM-/IgG+ (n=30), and IgM+/IgG+ (n=12). Anti-*E. cuniculi* IgM and IgG antibodies were assessed using an indirect fluorescent antibody test (IFAT), with titres ≥1:80 considered positive. Biochemical parameters and serum protein electrophoretic fractions were compared using the Kruskal–Wallis test. Significant overall differences among groups were identified for total protein ($p=0.021$), albumin ($p=0.008$), globulins and the albumin-to-globulin ratio (both $p<0.001$). Differences were also observed in the gamma-globulin fraction ($p<0.001$), blood urea nitrogen ($p=0.028$) and creatinine ($p<0.001$), whereas phosphorus did not differ significantly ($p=0.424$). Descriptively, rabbits

positive for both IgM and IgG had the highest median gamma-globulin fraction and the lowest median albumin-to-globulin ratio. Their median blood urea nitrogen and creatinine concentrations were also highest, although both remained within the reference intervals used.

These findings demonstrate associations between serological status and laboratory profiles but do not establish that *E. cuniculi* caused the observed abnormalities or clinical signs. Positive serology should therefore be interpreted together with the clinical examination, differential diagnoses and complementary investigations.

Therapeutic decision-making considers the presence of clinical signs together with IgM serological status, while recognising that IgM positivity alone does not confirm clinical disease. Treatment is tailored to the individual rabbit's clinical condition, suspected organ involvement and concurrent diseases, integrating antiparasitic treatment, appropriate control of inflammation, supportive care and management of clinical signs. Distinguishing exposure from clinical disease is essential for interpreting test results and selecting a justified treatment plan.

Keywords: *Encephalitozoon cuniculi*, rabbits, serology, serum protein electrophoresis, clinical management

Beyond the Stars: New Insights into the Biology, Behaviour, Genetics, Proteomics and Conservation of the Indian Star Tortoise (*Geochelone elegans*)

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The Indian star tortoise (*Geochelone elegans*), distributed across India, parts of Pakistan, and Sri Lanka, is increasingly threatened by habitat loss, illegal collection, and wildlife trafficking. Effective conservation and rehabilitation require a better understanding of its morphological variation, behaviour, population genetic structure, and physiological health indicators. This study integrates findings from our investigations of morphometry, body condition, plasma biochemistry, and proteomics with published literature on the behaviour and population genetics of *G. elegans* to evaluate their implications for evidence-based veterinary management and conservation strategies.

Recent population-level genetic analyses identified two strongly differentiated genetic groups: a northwestern lineage occurring primarily in Gujarat and Rajasthan, and a southern lineage

distributed across southern India and Sri Lanka. The estimated divergence between these lineages, approximately two million years ago, together with the high genetic diversity retained in wild populations, indicates substantial evolutionary structure within the species. These findings support the consideration of geographic origin and genetic lineage when managing confiscated individuals and planning conservation translocations.

Recent behavioural observations have expanded the known behavioural repertoire of the species, including the documentation of aquatic behaviour, indicating that its behavioural ecology may be more diverse than traditionally recognised and warranting further investigation of its use of aquatic environments.

Morphometric assessment of captive *G. elegans* housed at five locations following confiscation revealed significant effects of sex and geographical location on body mass, as well as a significant interaction between these factors. Body mass was strongly correlated with curved carapace length and carapace width. These findings suggest that BCS may provide complementary information when assessing body condition alongside morphometric measurements. A species-specific approach to body-mass estimation based on calculated body volume and an estimated mean body density of approximately 650 kg/m³ was also evaluated.

Plasma biochemical and proteomic profiling of healthy captive adults established baseline biochemical parameters and identified 12 differentially expressed proteins associated with cytoskeletal organisation, lipid transport, coagulation, and immune pathways. These proteins represent candidate biomarkers for further investigation in health assessment and veterinary monitoring.

Integrating morphometric, biochemical, and proteomic findings with published evidence on behaviour and population genetics

provides a broader basis for the veterinary management, rehabilitation, and conservation of *G. elegans*. These findings highlight the value of complementary health assessment methods and genetically informed conservation strategies, while supporting further validation of candidate proteomic biomarkers.

Keywords: *Geochelone elegans*, conservation genetics, morphometry, proteomics, wildlife rehabilitation

Thermo Ecology of Reptiles: The Importance of Microclimate Diversity in Reptiles' Environment

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Reptiles are ectothermic animals whose body temperature depends largely on environmental heat sources and behavioural thermoregulation. Understanding their thermal ecology is therefore essential for providing appropriate conditions in captivity. Rather than a single target temperature, their environment should offer diverse microclimates that allow animals to select suitable conditions throughout the day.

This lecture draws on data collected over the past ten years through field studies of various reptile species in Bulgaria, complemented by observations of native and tropical species maintained under controlled conditions. These observations provide a basis for discussing how reptiles use the thermal opportunities available within their environment and why microclimatic diversity deserves particular attention in captive husbandry.

The practical discussion focuses on translating observations from natural habitats into terrarium design and management. Particular emphasis is placed on the availability of warmer and cooler areas, the placement of heat sources and shelters, and opportunities for animals to move between different microclimates. The limitations of describing an enclosure by a single temperature measurement are also considered.

By connecting field observations with experience in controlled environments, the lecture highlights the importance of providing reptiles with meaningful opportunities for behavioural

thermoregulation. This approach encourages husbandry practices that reflect the complexity of the environments these animals occupy in nature.

Keywords: reptiles, thermal ecology, microclimatic diversity, behavioural thermoregulation, captive husbandry

Feathers and Prejudice: The Pigeon as a Patient - A Practical Approach in Veterinary Practice

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Urban pigeons are frequently subject to misconceptions that may influence their reception and management in veterinary practice. This lecture examines common prejudices surrounding these birds and provides a practical framework for approaching them as veterinary patients. Selected aspects of pigeon biology and behaviour are discussed in relation to clinical assessment, handling, and care.

The presentation outlines the fundamentals of history taking and clinical examination, with attention to the challenges associated with birds of unknown origin and medical history. It reviews common diseases encountered in urban pigeons and discusses their recognition, diagnostic investigation, and implications for patient management. Particular emphasis is placed on appropriate handling, assessment of the bird's general condition, and identification of cases requiring further diagnostic evaluation or supportive care.

A dedicated section addresses the care of young pigeons, including recognition of developmental stages, suitable feeding practices, and basic requirements for rearing. The importance of adapting care to the bird's age and condition is highlighted.

By combining clinical guidance with a critical examination of common misconceptions, the lecture aims to improve veterinarians' confidence when examining and treating pigeons. It encourages an objective, compassionate, and evidence-based

approach that supports informed clinical decisions and appropriate care for these frequently underestimated avian patients.

Keywords: urban pigeons, avian medicine, clinical examination, pigeon diseases, juvenile care, animal welfare

Acquired Dental Disease in Pet Rabbits

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Rabbits (*Oryctolagus cuniculus*) are one of the most commonly kept small companion animals, with their recorded increasing number becoming comparable to that of more traditional pets, such as cats and dogs. Their hypselodont, aradicular dentition, masticatory patterns highly adapted to herbivory, craniofacial changes associated with selective breeding, and other peculiarities of the lagomorph stomatognathic system render domesticated rabbits particularly susceptible to dental disease. Acquired dental disease (ADD) is a chronic, progressive syndrome characterised by disruption of physiological occlusal relationships, often associated with pathological tooth elongation, curvature and malposition. Its clinical presentation is complex and highly variable, ranging from subclinical disease to pronounced, frequently non-specific clinical manifestations and secondary complications.

This lecture aims to examine current concepts and controversies surrounding the etiology and pathophysiology of ADD, focusing on the roles of dietary factors and masticatory biomechanics. The complementary roles and limitations of clinical examination, intraoral endoscopy and other imaging techniques will be discussed alongside therapeutic approaches and preventative strategies. The lecture seeks to provide veterinary practitioners

with a comprehensive understanding of ADD, essential for its recognition and treatment, as well as possible prevention.

Keywords: acquired dental disease, diagnostic imaging, lagomorph dentistry, malocclusion, masticatory biomechanics

Bone Healing and Fracture Repair in Rodents

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Fracture management in rodents presents unique challenges related to their small body size, delicate cortical bone, relatively rapid bone healing, and species-specific anatomical and biomechanical characteristics. Compared with larger companion animals, these features may substantially influence implant selection, fracture stabilization, postoperative care, and expected clinical outcomes.

This review focuses primarily on the practical approach to fracture repair in clinical rodent patients, with emphasis on techniques applicable to rats, hamsters, guinea pigs and chinchillas. Principles of fracture assessment, stabilization, and surgical planning will be discussed, including the indications and limitations of external coaptation, intramedullary pinning, external skeletal fixation, and miniaturized plate-and-screw systems. Particular attention will be given to achieving adequate mechanical stability while minimizing surgical trauma and preserving the vascularity of the fracture site.

The biological characteristics of rodent bone healing, including the generally rapid reparative response, will be briefly considered in relation to clinical decision-making. Species, fracture configuration, patient size, bone quality, and expected limb loading should all be incorporated into treatment planning. The aim is to provide a clinically oriented overview of current fracture repair strategies and practical considerations that can improve outcomes in rodent patients.

Keywords: bone healing, orthopedics, pet rodents, rat

Anatomical Characteristics of the Chinchilla (*Chinchilla lanigera*)

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The chinchilla (*Chinchilla lanigera*) is a South American rodent increasingly kept as a companion animal and widely used as an experimental model, particularly in auditory research. Knowledge of its anatomical characteristics is important for clinical examination, diagnostic imaging, surgical procedures and the interpretation of experimental findings. This overview summarizes the principal anatomical features described for the chinchilla, with emphasis on the musculoskeletal, respiratory, digestive and reproductive systems, as well as structures of particular comparative and clinical significance. The chinchilla has a compact body, a relatively large head, prominent ears and short limbs. Its tympanic bullae are notably large, and the anatomy and physiology of the inner ear show similarities to those of humans, supporting its use in studies of hearing and middle-ear disorders. The vertebral column is described as comprising seven cervical, thirteen thoracic, six lumbar, two sacral and twenty-three caudal vertebrae, with thirteen pairs of ribs. The forelimb includes a clavicle, while the radius and ulna are separate bones; in the hindlimb, the tibia and fibula are also unfused. The digestive tract displays adaptations associated with herbivory and hindgut fermentation. The stomach is simple and unilocular, the caecum is large and sacculated, and the ascending colon is divided into proximal, intermediate and distal portions. The liver is

multilobulated, and the pancreas is strongly lobulated. Reproductive anatomy includes a duplex uterus with two cervices in females. In males, the testes may retract through the inguinal canals, and the penis has an S-shaped configuration. These anatomical characteristics distinguish the chinchilla from other commonly studied rodents and are relevant to species-specific veterinary care and research. A detailed understanding of normal anatomy provides a foundation for clinical assessment and for the appropriate interpretation of imaging and experimental observations.

Keywords: anatomy, digestive system, hindlimb, inner ear, rodent

When the Patient Can't Come to the Clinic: The Challenges of Zoo Anaesthesia

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Anaesthesia in zoo medicine follows the same fundamental principles as anaesthesia in domestic animal practice. However, species diversity, limited opportunities for preanaesthetic assessment, and logistical constraints require adaptations to established clinical procedures. When transport to a fully equipped veterinary facility is impractical or inappropriate, anaesthetic management must accommodate the patient's needs, the enclosure, and the available resources.

Drawing on practical clinical experience, this descriptive overview compares the principal stages of anaesthetic management in domestic animal practice and zoo settings. Patient assessment and preparation, induction, endotracheal intubation, intravenous catheter placement, drug administration, monitoring, and recovery are considered through a comparative, species-oriented approach. Attention is given to behavioural characteristics, restricted patient access, equipment availability, and coordination between veterinary and animal-care teams. Clinical examples illustrate how these factors influence the selection, sequence, and implementation of anaesthetic procedures.

The comparison highlights how procedures routinely performed in a clinical environment may require substantial modification in zoo practice. Decisions at each stage have implications for subsequent interventions, patient monitoring, and recovery management. Effective planning therefore requires consideration of both species-specific characteristics and the practical conditions under which

anaesthesia is performed. Preparation, appropriate equipment, and coordinated teamwork provide the foundation for adapting established anaesthetic principles to the diverse circumstances encountered in zoo medicine.

Keywords: zoo anaesthesia; zoo medicine; species-specific adaptations; patient monitoring

Gastrointestinal Nematodes of Roe Deer ond Red Deer in Central Poland: Morphological, Molecular and Histopathological Characterization

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Gastrointestinal nematodes (GINs) are common parasites of wild ruminants, but data on their composition in sympatric deer are limited. This study combined parasitological survey with molecular confirmation to characterize the GIN community in the abomasum of roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*) from Kampinos National Park. Twenty-six animals (13 roe deer, 13 red deer; aged 2-7 years) culled during the regular hunting season were examined post-mortem. Abomasal content was sedimented and examined microscopically; nematodes were identified morphologically to species level and counted to assess infection intensity. For molecular confirmation, a fragment spanning the internal transcribed spacer 1 and the 5.8S ribosomal

RNA gene was amplified and sequenced from ten nematodes identified as *Haemonchus contortus* or *Ashworthius sidemi*. All animals were infected with at least one of nine GIN species from six genera. Roe deer harboured a more diverse community, dominated by *Ostertagia leptospicularis* (77%), *O. kolchida* (69%) and *H. contortus* (54%), whereas red deer carried four species, chiefly *A. sidemi* (85%) and *Spiculopteragia boehmi* (62%). *Haemonchus contortus* was detected exclusively in roe deer and *A. sidemi* exclusively in red deer. Sequencing yielded a 175 bp *H. contortus* sequence and a 190 bp *A. sidemi* sequence, deposited in GenBank (PZ600403 and PZ600301, respectively). Median infection intensity (295 nematodes) did not differ significantly between host species but was significantly higher in males and increased significantly with age. Histopathology revealed mild to moderate chronic mixed inflammatory infiltration with prominent eosinophils, lymphoid follicle hyperplasia and fibrosis leading to glandular atrophy; a parasitic granuloma occurred in one case. These findings demonstrate distinct, host-specific GIN communities in sympatric deer and provide the first molecular confirmation of the blood-sucking nematode *A. sidemi* in Central Poland, highlighting the value of integrating classical parasitology with molecular approaches for monitoring invasive nematodes in wild ruminants.

Keywords: *Ashworthius sidemi*, *Haemonchus contortus*, host specificity, Kampinos National Park, wild ruminants

When Hissing Turns to Wheezing: Respiratory Infections in Pet Snakes

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This retrospective analysis reviews snakes examined and treated for respiratory signs at the University Veterinary Clinic, Faculty of Veterinary Medicine, University of Forestry, Sofia, Bulgaria. Undertaken from 2024 onwards and incorporating earlier cases, it integrates microbiological findings, PCR results, antimicrobial susceptibility reports, and clinical outcomes.

Among 29 snakes representing nine species, the most frequently cultured bacteria were *Pantoea agglomerans* and *Pseudomonas aeruginosa* (9/29 each; 31.0%), followed by *Kluyvera intermedia* (8/29; 27.6%). A case of chronic Aspergillus-associated pneumonia in *Morelia spilota* illustrates the contribution of repeated respiratory sampling and complementary diagnostic methods.

PCR testing detected reptarenavirus in 2/8 boas (25.0%) and serpentovirus in 7/11 pythons (63.6%). *Mycoplasma* spp. was detected in 3/5 tested pythons (60.0%), including two also positive for serpentovirus. Eleven non-duplicate susceptibility reports showed variable profiles: enrofloxacin was reported as susceptible in 8/10 tested panels (80.0%), while amoxicillin–clavulanate was reported as resistant in 9/10 (90.0%). Treatment selection, nebulisation, and clinical responses are discussed.

Small sample sizes, overlapping datasets, and non-uniform testing limit generalisation. Nevertheless, the findings broadly align with published reports and illustrate the value of combined diagnostics. Positive viral PCR results do not exclude bacterial or fungal involvement, while microbial isolation does not exclude viral infection. Results require interpretation alongside clinical signs, sampling site, and other diagnostic findings.

Keywords: snakes, respiratory infections, retrospective analysis, microbiology, PCR, antimicrobial susceptibility

POSTER PRESENTATIONS

The Poster Session of Animalia Exotica 2026 is proudly supported by the ***Faculty of Veterinary Medicine, University of Forestry, Sofia.*** *The session provides an open platform for students, researchers, and professionals to present original studies, case reports, and innovative observations in the field of exotic animal science. The Organising Committee acknowledges the University's contribution to promoting young scientists and encouraging active participation in research and education.*

A Fatal Case of Wallaby Characterized by Hemorrhagic Syndrome and Progressive Renal Failure Suspected Secondary to Anticoagulant Rodenticide (Brodifacoum) Toxicosis

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This report describes the clinical, laboratory, and radiological findings of a fatal brodifacoum toxicosis in an adult wallaby (*Macropus* spp.) presenting with lethargy and severe hematuria, suspected of being secondary to anticoagulant rodenticide (brodifacoum) toxicosis. Serial laboratory evaluations (July 31, 2025 → August 07, 2025) revealed profound depression, pale mucous membranes, urinary tract hemorrhage, severe acute hemorrhagic anemia (RBC: 6.23 → 1.88 M/µL; HCT: 49.9 → 14.6%; HGB: 18.9 → 5.8 g/dL), profound consumptive thrombocytopenia (PLT: 240 → 34 K/µL), and leukocytosis (WBC: 6.90 → 13.74 K/µL). Concurrently, blood biochemistry demonstrated rapidly escalating azotemia (Creatinine: 7.4 → 11.6 mg/dL; BUN: 64 → >130 mg/dL) reflecting secondary ischemic acute kidney injury induced by hypovolemic shock. Whole-body Computed Tomography successfully ruled out traumatic injury and demonstrated marked cervical and thoracic esophageal distention with hyperdense luminal contents, consistent with recent oral ingestion. Following a delayed anamnesis disclosing rodenticide placement in the enclosure, Vitamin K1 antidote therapy and

intensive supportive care were initiated; however, the animal died after one week. Although definitive toxicological confirmation, post-mortem necropsy and coagulation profiles (PT/aPTT) were unavailable due to institutional constraints, the combined clinical observations, acute ischemic renal failure, CT features, and exposure anamnesis strongly suggest anticoagulant rodenticide toxicosis. This case highlights the hazard of rodenticide placement in exotic animal habitats and the necessity of considering anticoagulant toxicosis in acute hemorrhagic syndromes

Keywords: acute kidney injury, anticoagulant rodenticide, brodifacoum, computed tomography, wallaby

Aspergillosis in Newly Hatched Emu Ostriches

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Two out of three newly hatched emu chicks (*Dromaius novaehollandiae*) at a farm raising ostriches and other animals died two to three days after hatching. The purpose of the study was to determine the cause of their death. Necropsy revealed hepatic lesions. The liver was hemorrhagic and studded with light-brown granulomas. Samples were collected for microbiological analysis, leading to the isolation of *Aspergillus flavus* and *Staphylococcus saprophyticus*. The isolated bacteria demonstrated susceptibility to antimicrobial agents from nearly all classes. Resistance was observed only against the beta-lactam antibiotics Penicillin G and Amoxicillin, as well as the broad-spectrum antibiotic Tetracycline and the combination of Sulfamethoxazole and Trimethoprim.

The sudden death of the three-day-old emu chicks was attributed to acute mycosis caused by *A. flavus*. Despite the application of Imaverol nebulisation and F10SC disinfection, followed by itraconazole for a period of four weeks, the third emu chick also died. This indicates that the disease is not merely aspergillosis, but probably complicated with staphylococcosis and aspergillotoxicosis, although it was not possible to conduct histological and mycotoxicological examinations to confirm this. Rainy days and high humidity during the spring, the period when the chicks developed the acute mycosis, created favorable conditions for fungal growth. Fungal proliferation in the feed poses

a particular danger to the animals. As a primary preventive measure, the feed must be protected from moisture and air exposure, given that molds are aerobic organisms requiring moisture to thrive.

Keywords: *Aspergillus flavus,* emu, mortality, mycosis

Behavioral Disorders in Parrots Kept Under Domestic Conditions

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Behavioral disorders in parrots kept under domestic conditions represent a significant welfare concern, with their frequency and severity varying according to species size, cognitive abilities, and social needs. The most commonly observed disorders include stereotypic behavior, excessive preening, feather pecking, and self-injurious or autoaggressive behavior. Their etiology is generally multifactorial and may involve chronic stress, social isolation, insufficient physical and mental stimulation, inappropriate housing conditions, and concurrent diseases. The report presents clinical observations of behavioral abnormalities in seven different parrot species kept as companion animals.

In small parrot species, such as the budgerigar (*Melopsittacus undulatus*) and the rosy-faced lovebird (*Agapornis roseicollis*), behavioral disorders are relatively uncommon and most frequently manifest as excessive preening or localized feather plucking. In medium-sized parrots, including the cockatiel (*Nymphicus hollandicus*) and green-cheeked conure (*Pyrrhura molinae*),

behavioral problems occur more frequently and may be associated with restricted physical activity, lack of environmental enrichment, or social stress.

The most severe and chronic forms are observed in large parrots, including the Eclectus parrot (*Eclectus roratus*), African grey parrot (*Psittacus erithacus*), and blue-and-yellow macaw *(Ara ararauna*). In these species, feather plucking may progress to self-trauma and generalized feather loss. The observed cases highlight the need for a comprehensive diagnostic approach, including exclusion of underlying medical conditions, assessment of housing and management practices, and implementation of behavioral therapy. Early recognition of abnormal behavior and timely environmental enrichment are essential for preventing chronicity and reducing the severity of behavioral disorders.

Keywords: parrots, behavioral disorders, feather plucking, environmental enrichment, chronic stress, animal welfare.

Chytridiomycosis in Frogs: Current Treatments and Emerging Therapeutic Strategies

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Chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis*, is a major threat to amphibian biodiversity and has contributed to population declines and extinctions worldwide. Despite ongoing research, disease management remains challenging due to differences in species susceptibility, treatment-associated toxicity, and difficulties controlling infection in wild populations. This review aims to compare established treatments and emerging therapeutic strategies for chytridiomycosis in frogs, evaluating their efficacy, limitations, and relevance to veterinary medicine and amphibian conservation.

Scientific literature on pharmacological treatments, thermal interventions, microbiome-based approaches, and antimicrobial metabolites was reviewed. Particular attention was given to published treatment outcomes, pathogen clearance, potential adverse effects, and applicability to captive and wild amphibians. Itraconazole remains an established antifungal treatment, although its use may be limited by toxicity and variation in tolerance among species and life stages. Recent studies of voriconazole have demonstrated promising pathogen-clearance rates in critically endangered frog species, supporting further investigation of its therapeutic potential. Thermal therapy offers a non-pharmacological alternative by exploiting the temperature

sensitivity of the pathogen, while solar-heated thermal refugia represent a promising conservation tool for facilitating infection clearance in wild populations. Microbiome-based interventions and antimicrobial metabolites are also being investigated, although their effectiveness and practical applicability require further validation.

The available evidence indicates that no single intervention is universally suitable for all amphibian species and clinical situations. Treatment selection should consider host susceptibility, clinical condition, environmental factors, and the risk of reinfection. Combining targeted antifungal therapy with supportive care, appropriate biosecurity, environmental management, and post-treatment monitoring may improve treatment outcomes. Further research is needed to establish species-specific protocols and determine whether emerging approaches can provide reliable long-term protection. Comparing these strategies may help guide future clinical decisions and support the development of more effective approaches to amphibian disease management and conservation.

Keywords: amphibian conservation, antifungal therapy, *Batrachochytrium dendrobatidis*

Clinical Evaluation of Anorexia and Severe Systemic Inflammation in a Captive Argentine Black and White Tegu (*Salvator merianae*)

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The Argentine black and white tegu (*Salvator merianae*) is increasingly kept in zoological collections, however, comprehensive clinical reference data for this species remain limited. This case report describes the diagnostic evaluation and clinical course of a 9-year-old male tegu housed at the Reptile House of the Faculty of Veterinary Medicine, University of Zagreb, which presented with progressive anorexia and food refusal for the last 2 months. The animal had a history of nutritional secondary hyperparathyroidism (NSHP) during its juvenile period. The animal was housed in a terrestrial enclosure with UVB lighting and supplemental heating. He was fed an omnivorous diet composed of a majority of vegetables combined with eggs, pinky mice, chicken meat and insects. He was supplemented weekly with calcium powder. Hematological and biochemical analyses, radiography, and ultrasonography were performed following clinical examination and fluid therapy. Radiography revealed normal skeletal density without evidence of NSHP. The lungs appeared clear, with no gastrointestinal foreign bodies or visible

urate deposits. Prominent bilateral soft-tissue densities consistent with large fat bodies were observed. Ultrasonography revealed mild hepatomegaly without other apparent abnormalities. Manual hematological analysis revealed severe microcytic anemia accompanied by marked inflammatory leukocytosis, with hematocrit of 16% and hemoglobin of 5.5 g/dL compared with reference values of 25 ± 2.6% and 11.4 ± 1.6 g/dL, respectively. The erythrocyte count was 2.8×10^6/µL; erythrocyte indices were MCV 57 fL, MCH 19 pg, and MCHC 34 g/dL. A pronounced leukocytosis (63.7×10^3/µL) was characterized by heterophilia (63%; 40.1×10^3/µL), monocytosis/azurophilia (27%; 17.2×10^3/µL), and relative lymphopenia (8%; 5.2×10^3/µL), consistent with a marked inflammatory response. Biochemical analysis revealed ALT 276 IU/L, AST 44 IU/L, calcium 11.32 mg/dL, phosphorus 3.68 mg/dL, uric acid 0.941 mg/dL, and total protein 7.2 g/dL. Mild hepatomegaly and increased ALT may suggest hepatic involvement. Supportive therapy and animicrobial treatment with ceftiofur (5 mg/kg q48h) combined with marbofloxacin (2 mg/kg q24h) were administered for five weeks. Despite treatment, the animal died. Necropsy was not performed because of advanced post-mortem autolysis, preventing definitive etiological diagnosis. This case highlights the diagnostic challenges associated with severe systemic disease in captive tegus and underscores the importance of integrating hematological, biochemical, and diagnostic imaging findings in the initial evaluation and clinical assessment. However, these diagnostic modalities alone were insufficient to establish a definitive diagnosis or facilitate successful therapeutic management, emphasizing the need for further, complementary diagnostic investigations to elucidate the underlying disease process and enable the implementation of appropriate and effective treatment.

Key words: *Salvator merianae*; anemia; systemic inflammation; hematology; hepatic involvement

Does Blood Sampling Site Matter in the Indian Star Tortoise (*Geochelone elegans*)

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Blood sampling in tortoises can be challenging, particularly when repeated health monitoring is required. Besides the accessibility of the sampling site, sample quality is important because admixture with lymph may affect haematological measurements. The aim of this pilot study was to compare five blood sampling sites in adult Indian star tortoises (*Geochelone elegans*) and assess their suitability for routine haematological evaluation.

Five adult *Geochelone elegans*, maintained at the Faculty of Veterinary Medicine, University of Zagreb for approximately three years following confiscation, were examined during routine health assessment. Blood collection was attempted from five sites: the dorsal coccygeal vein (DRV), subcarapacial sinus (SCS), jugular vein (VJ), occipital sinus (OCS), and brachial site (BS). Sampling success was recorded, and haematocrit (HCT; %), erythrocyte count (RBC; $\times 10^{12}$/L), and leukocyte count (WBC; $\times 10^{9}$/L) were determined. HCT was used as the principal indicator when comparing samples because dilution with lymph or other tissue fluids may substantially affect packed cell volume.

Twenty of 25 attempted samples were successfully obtained. Sampling was successful in all five tortoises from DRV and BS, in four from VJ and OCS, and in two from SCS. HCT differed among

sampling sites. The BS yielded the highest HCT among successfully sampled sites in each of the five tortoises, ranging from 19 to 29% (median 23%), compared with 4 to 15% (median 10%) at the DRV. Within individual tortoises, HCT at the BS was 8–19 percentage points higher than at the DRV. WBC showed a similar sampling-site-related pattern, with lower values at the DRV and higher values at the BS, whereas differences in RBC were less pronounced.

Blood sampling site influenced the haematological results obtained from these adult *Geochelone elegans*. The consistently lower HCT at the dorsal coccygeal site is compatible with variable dilution of the sample, including possible admixture with lymph, as reported in other chelonian species. In this small group, the brachial site combined successful sampling in all animals with consistently higher HCT values. These results indicate that sampling site should be standardised when haematological parameters are used to assess the health status of *Geochelone elegans* and support further evaluation of the brachial approach in a larger number of animals.

Keywords: *Geochelone elegans*, Indian star tortoise, blood sampling, haematocrit, haematology, lymph dilution

Dystocia (Egg Binding) in Companion Birds: A Review

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Dystocia, commonly referred to as egg binding, is a potentially life-threatening reproductive disorder in companion birds, particularly small psittacines. This review summarises its predisposing factors, clinical signs, diagnosis, and treatment. Causes include mechanical obstruction and impaired oviductal contractility, with nutritional deficiencies, hypocalcaemia, dehydration, obesity, and excessive reproductive stimulation acting as predisposing factors.

Clinical signs include lethargy, anorexia, straining, abdominal distension, reduced faecal output, and respiratory distress. Prolonged retention may cause oviductal injury, egg rupture, coelomitis, and secondary infection. Diagnosis combines clinical examination with radiography, supplemented by ultrasonography and laboratory investigations when indicated.

Treatment depends on clinical stability and the underlying cause. Stabilisation may include thermal support, fluids, and calcium supplementation when indicated. Medical management, assisted egg removal, or surgery may be required. Forceful manipulation risks egg rupture and internal injury.

Early recognition and appropriate treatment are essential. Prevention focuses on balanced nutrition, appropriate husbandry and lighting, and control of excessive reproductive stimulation.

Early recognition and individualized treatment are essential for successful management. Preventive measures focus on balanced

nutrition, appropriate husbandry and lighting, and reduction of excessive reproductive stimulation.

Keywords: egg binding, dystocia, companion birds, reproductive disorders

Evaluation of Humeral Nonunion Stabilization Using a Supracutaneous Plate and Rehabilitation in an Eastern Imperial Eagle (*Aquila heliaca*)

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Humeral fractures in raptors are clinically important because restoration of wing function is essential for flight, while chronic nonunion can substantially complicate recovery. This case report evaluates clinical and functional outcomes following surgical stabilization and postoperative rehabilitation of a humeral nonunion in an Eastern Imperial Eagle (*Aquila heliaca*). The bird presented with a chronic transverse fracture involving the proximal diaphysis of the left humerus with established nonunion. Surgical stabilization was performed using a retrograde Kirschner wire combined with a supracutaneous locking plate. One month after surgery, a structured rehabilitation protocol was initiated every three days and included hot-cold compresses, passive flexion-extension exercises, stretching, and soft tissue mobilization. Recovery was assessed weekly by measuring carpal and cubital joint angles and propatagial parameters. Initial evaluation showed a propatagial tendon length of 28 cm, a tendon-to-cubital joint distance of 9.5 cm, a carpal joint angle of 145°, and a cubital joint angle of 110°. During follow-up, the cubital angle increased to 145° and the carpal angle to 180°, while propatagial length increased to 33 cm and the propatagium-to-cubital distance

decreased to 8 cm. These changes were consistent with improved joint range of motion and soft tissue flexibility. Active flight had not yet been observed during the ongoing follow-up period. The findings indicate that supracutaneous locking plate fixation combined with structured rehabilitation may support functional improvement in raptors with humeral nonunion. Nevertheless, continued rehabilitation and longer-term follow-up are necessary to determine the final functional outcome and restoration of flight.

Keywords: avian orthopedics, fracture healing, physical therapy, propatagium, wildlife medicine

Fecal Estrogen and Progestagen Metabolites for Reproductive Monitoring in Wild Felids

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Understanding reproductive activity in wild felids is important for breeding management and conservation. Fecal hormone analysis provides a noninvasive approach because samples can be collected repeatedly without direct handling. This allows endocrine changes to be followed over extended periods while reducing disturbance to the animals.

This review summarizes published information on fecal estrogen and progestagen metabolites in wild felids, focusing on ovarian activity, reproductive cycles, ovulation, luteal function, seasonality, and pregnancy assessment. It also considers the biological meaning of hormone profiles and the factors that may affect their interpretation.

Fecal estrogen metabolites can provide information about follicular activity, whereas progestagen metabolites are used to assess luteal activity after ovulation. Serial sampling is more informative than isolated measurements because it reveals changes in hormone profiles over time. However, fecal values provide retrospective information because circulating hormones must first be metabolized and excreted. Profiles may vary with species-specific steroid metabolism, sample collection, and the analytical method used. The duration and pattern of hormonal changes can provide additional information, but their diagnostic value varies among species.

Reliable monitoring therefore requires consistent sample collection, repeated measurements, and validation of the selected assay for the species being studied. Hormonal findings should be interpreted together with behavioral observations and, when available, other reproductive examinations. Used within these limits, fecal estrogen and progestagen metabolite analysis can support long-term reproductive assessment and breeding decisions in conservation programs.

Keywords: estrogen, fecal steroid metabolites, progestagens, wild felids

From Standard Grey to Leucistic: Colour and Coat-pattern Diversity in the Sugar Glider (*Petaurus breviceps*)

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Sugar gliders (*Petaurus breviceps*) are nocturnal marsupials native to Australia, Indonesia, and New Guinea. In recent years, the species has become increasingly popular as an exotic pet worldwide, with growing interest also observed in Bulgaria. Selective captive breeding has contributed to the development and spread of numerous colour morphs and coat-pattern variations.

The present study examines selected color morphs and coat-pattern variations of the sugar glider, including Standard Grey, White Face, Albino, Creamino, Black Beauty, Mosaic, and Leucistic. A brief phenotypic description is provided for each, focusing on coat color, the distribution of markings, and other distinguishing visual features. These characteristics are compared with those of the standard phenotype. The study aims to organize the available descriptive information into a comparative overview, highlighting the phenotypic diversity observed among sugar gliders maintained in captive populations. This overview may provide a basis for further investigation of the genetic mechanisms underlying the development and inheritance of these traits, as well as potential

associations between particular phenotypes and health characteristics.

Keywords: *Petaurus breviceps*; coat-pattern variations; phenotypic diversity; captive breeding; exotic pets

Functional Cranial Morphology of the Otter (*Lutra lutra*)

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Otters are semi-aquatic carnivorous mammals whose cranial morphology exhibits remarkable features related to feeding, sensory organization, and neurocranial development. The aim of this study was to perform an anatomical and morphological evaluation of an otter skull using three-dimensional reconstruction in dorsal, ventral and lateral views. By examining these three projections, the neurocranium, splanchnocranium, orbital structures, dental arch, and cranial base were assessed in an integrated manner.

In the dorsal view, the neurocranium appeared markedly wider and more oval than the rostral region, with a smooth and expanded cranial vault. This configuration suggests a well-developed osseous organization associated with accommodation and protection of brain volume. The bilaterally prominent orbital openings and the balanced transition between the facial skeleton and neurocranium indicate structural adaptations related to sensory and functional demands. In the ventral view, the hard palate, dental arch, and cranial base showed a compact and well organized

arrangement. The regular alignment of the maxillary tooth rows and the distinct alveolar structures suggest strong functional specialization for grasping, holding, and processing prey. In the caudal part of the skull base, the robust configuration surrounding the occipital condyles and foramen magnum indicates a strong craniocervical articulation. In the lateral view, the rostral part of the skull was narrower and more elongated, whereas the caudal part was higher and more voluminous. This profile clearly demonstrates the functional differentiation between the facial skeleton associated with feeding and prey capture, and the neurocranium associated with neurological protection.

In conclusion, the otter skull exhibits a balanced and adaptive morphological organization related to feeding, prey capture, sensory function, and postural stability. Three-dimensional anatomical analyses provide valuable insights into the ecological adaptations and functional morphology of the species.

Keywords: otter, cranial morphology, 3D reconstruction, functional morphology, neurocranium, splanchnocranium

Morphological Evaluation of a Three-dimensional Kangaroo Skull Model

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Three-dimensional reconstruction provides a useful approach for examining complex cranial morphology and for presenting anatomical structures in a form suitable for comparative and educational evaluation. This study aimed to morphologically evaluate a three-dimensional skull model of a kangaroo using reconstruction images obtained from lateral, dorsal, and ventral views. The general configuration of the skull was characterized by a markedly elongated, narrow, and slender rostrum extending rostrocaudally. A clear proportional distinction was observed between the neurocranium and viscerocranium, with the facial skeleton appearing relatively elongated in relation to the cranial cavity. The orbital cavities were wide and prominent, and the zygomatic arch extended laterally, contributing to the overall facial contour. Ventral examination demonstrated a long and narrow hard palate and regularly arranged dental rows. The dentition showed morphological features compatible with herbivorous feeding. In the dorsal view, the rostral extension of the nasal bones and the pronounced narrowing of the anterior portion of the skull were particularly notable. Taken together, these observations

demonstrate a cranial organization associated with feeding, mastication, and craniofacial functional morphology. The three-dimensional model also enabled the principal cranial regions and their spatial relationships to be assessed from multiple anatomical perspectives without altering the specimen. These findings support the use of three-dimensional reconstructions as practical tools for morphological description, comparative anatomical assessment, and veterinary anatomy education. Such models may facilitate visualization of complex osteological relationships and provide reusable digital material for teaching and further anatomical comparisons.

Keywords: comparative anatomy, digital reconstruction, herbivory, osteology, veterinary education

Neutering Male Sugar Gliders (*Petaurus breviceps*): Anesthesia, Surgery and Postoperative Pain Management

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Sugar gliders (*Petaurus breviceps*) are small marsupial mammals native to the region of Australia and New Guinea. Under appropriate captive conditions, their lifespan can reach 10–12 years. Nowadays, sugar gliders are becoming increasingly popular as companion animals. They are recommended to be housed in groups, which most commonly consist of both males and females. Consequently, surgical castration is necessary to prevent unwanted pregnancies. Male sugar gliders are generally easier and more commonly selected for surgical sterilization.

In this study, six male sugar gliders aged 12-48 months and weighing 90-135 grams underwent orchiectomy and scrotal ablation. Premedication was administered subcutaneously using butorphanol, followed by anesthetic induction in an induction chamber with isoflurane and oxygen. Lidocaine was administered locally into the spermatic cords, and anesthesia was maintained with isoflurane. In small exotic mammals, minimizing surgical duration and maintaining appropriate body temperature are of particular importance. As the testes are located in prepenile

pendulous scrotum, the fastest and most accessible surgical approach was selected. Orchiectomy and scrotal ablation were performed using electrocautery. Following the brief surgical procedure, the animals also recovered rapidly from anesthesia. Oral meloxicam was administered for three consecutive days postoperatively. All sugar gliders recovered uneventfully, with no postoperative complications observed.

Keywords: electrocautery, orchiectomy, *Petaurus breviceps,* scrotal ablation, sugar glider

Otitis Media and Soft Tissue Infection Caused by Tooth Root Abscess in a Red-Necked Wallaby (*Notamacropus Rufogriseus*): A Clinical and Pathological Case Report

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Odontogenic infections may involve adjacent craniofacial tissues in macropods. This report describes clinical, computed tomographic (CT), and postmortem findings in a male red-necked wallaby (*Notamacropus rufogriseus*) admitted with anorexia, weakness, dehydration, and an unsteady, staggering gait. Clinical examination also identified poor body condition and nasal discharge. Hematology revealed leukocytosis with marked monocytosis. CT showed unilateral soft tissue attenuation within the tympanic bulla, while the contralateral bulla remained aerated, a finding suggestive of otitis media. Facial soft tissue thickening and asymmetry were present, together with a localized lesion lateral to the mandible consistent with an abscess. No definite cortical destruction or apical osteolysis was identified in the mandible or maxilla. The specific affected tooth could not be determined from the available findings. Treatment included isotonic and dextrose- and lactate-containing fluids, antibiotics, and a nonsteroidal anti-inflammatory drug. Despite supportive care, the animal died approximately 15–16 hours after admission. Macroscopic necropsy identified a mandibular tooth root abscess extending into surrounding soft tissues. No microbiological culture

or histopathological examination was documented; therefore, assessment was based on clinical findings, CT, and gross necropsy. Although the dental abscess and CT changes suggestive of otitis media occurred concurrently, a direct anatomical route of spread to the middle ear was not demonstrated, and causation cannot be established. Middle ear disease may have contributed to gait instability, but this relationship also remains unconfirmed. This case illustrates the value of integrating CT with gross postmortem examination when assessing suspected odontogenic infection in macropods and the need to distinguish concurrent findings from proven routes of infection.

Keywords: computed tomography, macropod, necropsy, odontogenic infection, wildlife medicine

Preliminary Study of the Effect of Chitinase Concentrations on the Development of *Sitotroga cerealella* in Grain-Based Parrot Feed

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Grains are a major component of the diet of numerous parrot species. However, during storage they may be infested by stored-product pests. Among economically important pests is the grain moth (*Sitotroga cerealella* Olivier), which attacks maize and other cereals and whose larvae develop within the grain. Chitin is a major structural component of the insect exoskeleton and is essential for growth and molting. Chitinases are enzymes degrading chitin and have therefore been considered potential biological agents for the control of insect pests. Disruption of chitin metabolism represents a promising approach to the development of biopesticides. The aim of the present study was to evaluate the effect of chitinase on the development of *S. cerealella* in grain-based feed for parrots. The experiment included a control grain group without chitinase and five groups containing 1–5% w/v aqueous solution of chitinase. The results showed that the addition of chitinase to the feed reduced the number of *S. cerealella* larvae. During the 30-day observation period, the weakest effect was observed in the presence

of 1% chitinase, whereas a substantial reduction in larval abundance was observed at 4%. The highest efficacy was recorded at 5% enzyme concentration, with 91.4% reduction of larvae relative to the control. No adults were detected in the 5% chitinase group, whereas 30 adults were recorded in the control group. The data demonstrate a pronounced dose-dependent effect of chitinase, with a concentration of 5% being the most effective in limiting the development of the grain moth in parrot feed.

Keywords: Angoumois grain moth, biological control, chitinase, parrots, stored-product pests

Severe Anemia and Suspected Pulmonary Hemorrhage in a Chinese Stripe-Necked Turtle (*Mauremys sinensis*)

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Severe anemia and hemorrhagic disorders are potentially life-threatening conditions in chelonians. This case describes the clinical, hematological, biochemical, and radiographic findings in a Chinese stripe-necked turtle (*Mauremys sinensis*) presented with generalized edema, respiratory distress, and blood-tinged nasal discharge. A 6-year-old female *M. sinensis*, weighing 4258 g (BCS 6/9), was presented for emergency examination because of generalized edema, labored breathing, and foamy, blood-tinged nasal discharge. The owners reported reduced appetite and water intake during the preceding two weeks. Marked edema was observed in the limbs and prefemoral and humeral fossae. Plasma biochemical analysis revealed severe hyperuricemia (20.01 mg/dL; RI 0.8–1.9 mg/dL), while phosphorus, calcium, total protein, ALT, and AST were within the provided reference intervals. Hematological examination demonstrated profound anemia, with an RBC count of 0.025 $\times 10^6/\mu L$, hematocrit of 2%, and hemoglobin concentration of 5.3 g/dL. MCV was increased to 800 fL, indicating marked macrocytosis. The reported MCH (2120 pg)

and MCHC (265 g/dL) were markedly elevated and should be interpreted cautiously in the context of the extremely low erythrocyte count. Coprological examination and hemoparasite testing were negative.

On lateral, dorsoventral, and craniocaudal projections, the pulmonary parenchyma appeared radiolucent without evidence of pulmonary infiltration. No radiographic signs supporting pneumonia or pulmonary hemorrhage were identified. The osseous structures appeared mildly radiolucent, with mild cortical thinning. Thickening and deformation of the carpal and tarsal joints were observed, consistent with skeletal changes associated with metabolic bone disease.

This case describes a severe, life-threatening anemic syndrome in a Chinese stripe-necked turtle accompanied by generalized edema, respiratory distress, and blood-tinged nasal discharge. Despite the respiratory clinical signs, radiographic examination did not demonstrate pulmonary infiltration or other definitive evidence of pneumonia or pulmonary hemorrhage. The concurrent skeletal abnormalities were consistent with metabolic bone disease. The marked anemia, together with severe hyperuricemia and generalized edema, highlights the need for further investigation into the underlying cause of the suspected hemorrhagic syndrome. Additional diagnostic evaluation, including advanced imaging, repeat hematological assessment, and infectious and coagulation screening, may help clarify the etiology. Post-mortem examination was not performed because owner consent was not obtained, preventing definitive determination of the underlying cause.

Keywords: *Mauremys sinensis*, Chinese stripe-necked turtle, chelonian, severe anemia, hemorrhagic syndrome, hyperuricemia, metabolic bone disease

Suspected Gastric Neuroendocrine Carcinoma with Hepatic Steatosis in a Bearded Dragon (*Pogona vitticeps*)

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Gastric neuroendocrine carcinoma (GNC) is a rare and highly malignant stomach cancer primarily diagnosed in young, bearded dragons, presenting with nonspecific gastrointestinal signs. This case involves a 21-month-old male bearded dragon weighing 385 g. The patient was presented with hyporexia, watery stools and less frequent defecation. The bearded dragon had previously been treated in another veterinary clinic. They prescribed 5 days of oral metronidazole, followed by 10 days of oral sulfametoxazol/trimetoprim. Hematology showed leukocytosis, lymphocytosis, and mildly elevated hematocrit. Blood biochemistry revealed marked hyperglycemia, decreased sodium and chloride. Contrast-enhanced abdominal Computer Tomography was performed. The CT revealed diffuse circumferential thickening of the gastric wall, with relatively homogeneous contrast enhancement. These findings were suggestive of an infiltrative gastric neoplasm. Furthermore, the narrow gastric lumen contained hyperdense material, a so called ‘gravel sign”, which is indicative for reduced gastrointestinal motility. The pyloric region, gastroduodenal junction, duodenum, and pancreas were difficult to distinguish from one another. The liver showed diffusely reduced attenuation, consistent with hepatic steatosis. No apparent pathological changes were identified in the spleen and kidneys. The animal subsequently died. Necropsy was

declined by the owner; therefore, histopathological and immunohistochemical examinations could not be performed, and the suspected diagnosis of GNC remained unconfirmed. This case highlights the value of blood work and Computer Tomography in evaluating gastrointestinal disease in reptiles presenting with nonspecific clinical signs.

Keywords: bearded dragon, computed tomography, gastric neoplasia, hepatic steatosis

The Elusive Fourth Granulocyte in the Common Wall Lizard (*Podarcis muralis*): Neutrophil or Eosinophil?

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Accurate identification of reptilian leukocytes remains challenging because granulocyte morphology and staining characteristics vary considerably among species. In European lacertid lizards, an uncommon fourth granulocyte has been described in addition to heterophils, eosinophils and basophils. Its identity remains uncertain, and morphologically similar cells have been referred to as neutrophils by some authors. In the common wall lizard (*Podarcis muralis*), this granulocyte type has previously been reported at a very low frequency, accounting for approximately 0.2% of circulating leukocytes. Therefore, the aim of this study was to describe the occurrence, frequency and morphological characteristics of this fourth granulocyte population in the peripheral blood of free-ranging *P. muralis* and to compare its morphology with conventionally identified granulocyte types.

For this study, blood samples were collected from 18 free-ranging *P. muralis* on Mount Biokovo, Croatia, in July 2021, from the orbital sinus using heparinized microhaematocrit capillary tubes.

Total white blood cell counts were determined using Natt and Herrick's method. Blood smears were stained using the Pappenheim method, and differential counts of 100 leukocytes per individual were performed. In addition to heterophils, lymphocytes, monocytes, eosinophils, basophils and azurophils, a morphologically distinct granulocyte population was consistently recognized and recorded separately as neutrophil-like cells. These cells were characterized by abundant pale, finely granular cytoplasm and an eccentrically positioned, densely stained nucleus.

Neutrophil-like cells were detected in 14 of 18 lizards (77.8%). They represented 3.0% of all leukocytes examined, with individual proportions ranging from 0 to 14% and a median value of 2.5%. Their abundance was higher than previously reported for the fourth granulocyte in *P. muralis*. On blood smears, these cells morphologically resembled the previously described fourth granulocyte while remaining distinguishable from cells conventionally classified as eosinophils and heterophils.

A morphologically distinct granulocyte population was identified in the majority of examined *P. muralis* and occurred at a higher frequency than previously reported for the fourth granulocyte in this species. Although these cells could be distinguished morphologically from conventionally classified heterophils and eosinophils on Pappenheim-stained smears, their lineage cannot be established by morphology and routine staining alone. Species-specific cytochemical and ultrastructural studies are needed to determine their identity and to clarify whether they represent a distinct granulocyte type or a morphological variant of another granulocyte population.

Keywords: *Podarcis muralis*; granulocytes; neutrophil-like cells; eosinophils; reptile hematology

The Scleral Ossicle Ring Morphology in Selected Squamata (Chamaeleonidae, Eublepharidae, Iguanidae, Lacertidae) - Microcomputed Tomography (µCT)

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The sclera of many reptiles contains the ocular skeleton, which may consists of a cartilaginous cup. In some species it is also complemented by 6 to 18 thin, flat or concave shaped, tightly overlapping bony plates called scleral ossicles. Due to their ring-shaped arrangement, they are collectively referred to as the scleral ossicle ring. This almost immobile ring is located at the area of the corneoscleral limbus, contributing to the process of visual accommodation. The aim of this study was a detailed analysis of the scleral ossicle ring structure in five species of Squamata: leopard gecko (*Eublepharis macularius,* n=2, young and adult), panther chameleon (*Furcifer pardalis,* n=1), desert iguana (*Dipsosaurus dorsalis*, n=1), green lizard (*Lacerta viridis*, n=1) and sand lizard (*Lacerta agilis,* n=2) with using microcomputed

tomography (μCT). Cadaveric heads were obtained post-mortem from Ljubljana Zoo, then the research material was fixed in 4% paraformaldehyde in phosphate-buffered saline (PBS, pH 7.4). μCT was conducted using a SkyScan 1273 system (Bruker microCT, Kontich, Belgium) at 70 kV and 214 μA, with a voxel size of 16.99 μm. All morphometric analysis was performed using CTAn software (Bruker microCT, v.1.20.8.0). The number of scleral ossicles, volume (mm^3) and 3D local thickness (mm) of the scleral ossicle ring of the each eye were obtained from reconstructed datasets. The lowest number of scleral ring bones (11) was observed in desert iguana, while their highest number (17) was present in young leopard gecko. The volume and 3D local thickness of the scleral ossicle ring were found to vary between individual animals, as well as between right and left eyes of the same specimen. μCT demonstrated considerable morphological variation in the structure of the scleral ring bones in selected Squamata. Moreover μCT is a non-invasive useful tool for the comparative anatomical study including the detailed analysis of the specific small plates bones characteristics.

Keywords: anatomy, eye, microcomputed tomography, scleral ossicle ring, Squamata

Three-Dimensional Geometric Morphometric Analysis of Cranial Shape Variation and Allometry in Red Deer

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This study investigated cranial shape variation and allometric patterns in red deer (Cervus elaphus) using three-dimensional geometric morphometrics. Skull specimens were obtained from previously collected materials gathered by local collectors in the Lublin region of Poland. All specimens were digitized using a high-resolution 3D scanner, and anatomical landmarks were manually placed using 3D Slicer software. The resulting landmark data were analyzed in R using Generalized Procrustes Analysis, Principal Component Analysis, and multivariate regression. The PCA revealed that the first two principal components accounted for a substantial proportion of total shape variation, capturing the main axes of cranial morphological diversity. The distribution of specimens along these axes suggested continuous morphological variation without clear clustering patterns. Allometric analysis demonstrated a significant relationship between cranial shape and size, with centroid size explaining approximately 19.17% of the total shape variation ($R^2 = 0.19165$). These results indicate that size-related shape changes contribute substantially to cranial morphology in red deer. Overall, the findings highlight the importance of allometry in shaping cranial morphology and provide a quantitative framework for understanding morphological variation in red deer populations.

Keywords: red deer, cranial morphology, geometric morphometrics, allometry, 3D analysis, centroid size

A Rare Case of Cysticercosis in an Indoor Pet Rabbit - A Case Report

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Cysticercosis is a common parasitic disease in farmed and wild rabbits, with prevalences up to 41.6% and 76% respectively. However it is rare in pet rabbits. Rabbits rarely show clinical disease. In most cases it's an incidental finding during abdominal surgery or is diagnosed during necropsy.

A seven-year-old, male castrated, Angora indoor rabbit presented with acute anorexia. Both abdominal ultrasound and full body CT scan showed two cystic structures in close proximity to the accessory hepatic lobe. Cysticersosis was suspected and conservative treatment was attempted with a course of praziquantel, with no effect. The cysts were routinely monitored ultrasonographically and slow paced growth was noted. One year later the rabbit presented with hyporexia. The rabbit had lost weight and was slightly anemic. On abdominal ultrasound the cysts had increased in size. A diagnostic laparotomy was recommend. Excision of all cystic structures in the mesentery was successfully performed. The patient recovered uneventfully from surgery. Histopathology of the excised tissue confirmed the diagnosis cysticercosis. Six months after the laparotomy the rabbit was humanely euthanized, because he was suffering from end stage dental disease, with a poor quality of life.

Conclusion and case relevance: This is a case report of a rare occurrence of cysticerosis in a rabbit kept solely indoors. It describes the diagnostic approach and successful surgical

management. It also shows that medical management with oral anti-parasitic, as suggested in the literature, was ineffective. Cysticerosis may be an unlikely diagnosis in indoor pet rabbits. Nevertheless it should be included in the differential diagnosis list, especially in rabbits with abdominal cysts.

Key words: Cysticercosis, rabbit, parasite, abdominal ultrasound, laparotomy

Trichurid Infections and Trichurid-like Findings in Exotic Pets and Zoo Animals: Differentiating True Infection from Pseudoparasitism

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Trichuridoses are parasitic diseases caused by nematodes of the family Trichuridae, which parasitize the large intestine of the host and may cause chronic typhlocolitis, anaemia, and cachexia. Diagnosis relies on detecting typical barrel-shaped eggs with bipolar plugs in faecal samples. Such eggs are frequently found in exotic pets and zoo animals. While these findings in mammals indicate pathogenic infection, they present a diagnostic challenge in reptiles and birds due to possible pseudoparasitism or morphological overlap with members of the family Capillariidae.

This study aims to highlight the diagnostic significance of these findings by reviewing available data on trichurid infections in exotic animals and proposing a differential diagnostic approach to distinguish trichuroses from capillarioses and pseudoparasitism in reptiles and birds.

Reported *Trichuris* species include *T. ovis, T. globulosa, T. discolor*, and *T. tenuis* in wild Bovidae, Cervidae, and Camelidae; *T. suis* in Suidae; *T. leporis* and *T. sylvilagi* in rabbits (*Oryctolagus cuniculus*, *Sylvilagus* spp.); *T. gracilis* and *T. muris* in guinea pigs and small rodents, respectively; *T. trichiura* in primates; and *T. vulpis* in carnivores (Canidae, Hyaenidae).

Pseudoparasitism in reptiles and birds is the passive, non-pathogenic transit of parasite eggs ingested with prey, such as *T. muris* eggs following the ingestion of an infected rodent. In

contrast, capillariid infections are clinically significant parasitic diseases requiring targeted anthelmintic therapy.

Capillariid eggs are more asymmetrical and ornamented with flatter polar plugs. However, due to morphological overlap with trichurid eggs, careful differentiation is required. In addition to egg morphometrics, the assessment should consider epizootiological context, dietary regimen, and housing conditions in order to prevent misdiagnosis, unnecessary treatment, and ineffective control measures.

Keywords: capillariidae, egg morphology, exotic animals, pseudoparasitism, trichuridae

Eucoleus dispar Infestation in Raptors

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Eucoleus dispar is a slender, thread-like parasitic nematode primarily inhabiting birds' upper digestive tract. A member of the family Capillariidae, it is an important avian parasite in veterinary parasitology. Adults are whitish, slender and thread-like. Their lemon-shaped eggs bear a polar plug at each end. Males measure 8–15 mm and females 15–25 mm in length. It inhabits the oral mucosa, tongue and oesophagus and, rarely, the crop. During its life cycle, eggs are first shed in faeces, then embryonate under suitable temperature and humidity conditions. Birds become infected by ingesting soil containing the eggs or contaminated feed.

The parasite occurs in Eurasian sparrowhawks (*Accipiter nisus*), common buzzards (*Buteo buteo*), short-toed snake eagles (*Circaetus gallicus*), common kestrels (*Falco tinnunuscul*) and peregrine falcons (*Falco peregrinus*). *Eucoleus dispar* can inhabit its avian definitive hosts without causing health problems.

However, under conditions such as stress or immunosuppression, it can become pathogenic, causing severe disease and death. The parasite produces soft, yellowish or whitish diphtheritic plaques in the upper digestive tract of birds. These lesions and the resulting inflammatory reaction render birds unable to feed. Birds that are unable to feed become debilitated, develop

gastrointestinal haemorrhage and ultimately die. Clinical signs include reduced feed intake, weight loss, dysphagia, difficulty moving the neck, lethargy and growth retardation.

On gross examination, lesions in the upper digestive tract resemble those caused by trichomoniasis, herpesvirus infection and avian poxvirus infection.

Diagnosis is based on faecal examination, necropsy and histopathology. During faecal examination, eggs with polar plugs are observed microscopically. Opening the oesophagus at necropsy reveals the parasite. On histopathological examination, microscopic findings include parasite sections within the mucosa, mucosal erythema and thickening, and increased mucus production.

Antiparasitic treatments include fenbendazole (20–25 mg/kg), ivermectin (2 mg/kg) and levamisole (10–20 mg/kg).

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Keywords: anthelmintics, Capillariidae, diphtheritic plaques, raptor, upper digestive tract

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