



ABSTRAK AGRICULTURE AND EXTENSION BERSUMBER DARI PANGKALAN DATA SCIENDIRECT

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BADAN PENYULUHAN DAN PENGEMBANGAN SUMBER DAYA MANUSIA PERTANIAN
BALAI BESAR PELATIHAN KESEHATAN HEWAN

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1. Influence of animal glue on mineralogy, strength and weathering resistance of lime plasters / Elert, Kerstin; García Sánchez, Rosa Maria; Benavides-Reyes, Cristina; Linares Ordóñez, Fátima. Construction and Building Materials. ISSN: 0950-0618 (2019) v.226 p.625-635

DOI: 10.1016/j.conbuildmat.2019.07.261

Abstrak: In order to optimize lime plasters for conservation purposes, the influence of animal glue on the mineralogical evolution, mechanical properties, and weathering resistance was studied. The organic additive caused a decrease in carbonation rate and affected mechanical properties negatively, facilitating the formation of large air bubbles in the plaster matrix. However, the weathering resistance (water spraying/SO₂ exposure) improved significantly. The organic additive also reduced crack formation and formed a physical barrier around the calcite crystals, which delayed sulfation. Lime-based composite materials are a valuable alternative to conventional lime plasters, showing improved adherence to the substrate and no significant color changes.

Keyword: Animal glue; Heritage conservation; Lime plaster; Mineralogy; Strength; Weathering resistance

2. Hepatoprotective and antioxidant activity of hydroalcoholic extract of *Stachys pilifera*. Benth on acetaminophen-induced liver toxicity in male rats /Mansourian, Mahboubeh; Mirzaei, Ali; Azarmehr, Nahid; Vakilpour, Hossein; Kokhdan, Esmaeel Panahi; Doustimotlagh, Amir Hossein. Heliyon. ISSN: 2405-8440 (2019) v. 5 p.e03029

DOI: 10.1016/j.heliyon.2019.e03029

Abstrak: Background Acetaminophen (APAP) at high doses causes adverse side effects such as hepatotoxicity. The aim of the current study was to investigate the hepatoprotective and antioxidant effects of hydroalcoholic extract of *Stachys pilifera*. Benth (SP) on hepatotoxicity induced by APAP in male rats. Methods Adult male Wistar rats were allocated into four groups: control (C), APAP (2 g/kg), APAP + SP (500 mg/kg), and APAP + Silymarin (SM, 100 mg/kg) as positive control group. On the seventh day, the rats were sacrificed after taking blood samples. Then levels of biochemical parameters, oxidative stress markers and activity of antioxidant enzymes were measured. Results In the APAP group, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) enzymes activity was significantly increased and the level of protein carbonyl (PCO) was insignificantly increased as compared to control group. In addition, the activity of glutathione peroxidase (GPX) and total thiol in the APAP group was significantly decreased compared to the normal rats. *Stachys pilifera*. Benth extract administration significantly reduced the activity of AST and ALT enzymes and the level of PCO compared to the APAP group, while significantly elevated the activity of GPX enzyme. Conclusion Hydroalcoholic extract of SP diminishes hepatotoxicity induced by APAP by reducing the amount of liver function indicators (AST and ALT). Furthermore, the hydroalcoholic extract of SP is capable of reducing oxidative stress through inhibiting protein oxidation as well as boosting the activity of GPX enzyme. In this respect, the hepatoprotective impact induced by the SP extract may possibly be attributable to its reactive oxygen species scavenging and antioxidant properties.

Keyword: Acetaminophen; Animal science; Biological sciences; Food science; Health sciences; Hepatobiliary system; Hepatotoxicity; Oxidative stress; Pharmacology; Toxicology

3. Rapid and efficient production of genome-edited animals by electroporation into oocytes injected with frozen or freeze-dried sperm / Nakagawa, Yuki; Kaneko, Takehito. Cryobiology. ISSN: 0011-2240 (2019) v.90 p.71-74

DOI: 10.1016/j.cryobiol.2019.08.004

Abstrak: Sperm preservation is a useful technique for maintaining valuable animal strains. Rat sperm could be frozen or freeze-dried in a simple Tris-EDTA solution (TE buffer), and oocytes that were fertilized with these sperm by intracytoplasmic sperm injection (ICSI) developed into offspring. Genome editing with the clustered regularly interspaced short palindromic repeat (CRISPR) and CRISPR-associated protein 9 (Cas9) system enables the rapid production of genetically modified rats. The recent innovative method, named the TAKE method, could easily produce genome edited rats by electroporation of endonucleases into embryos. Although various rat strains have been applied for genome editing, genome editing using strains that were preserved as sperm took longer because it required collecting embryos after maturation of animals regenerated from sperm. To reduce the production period, we directly electroporated Cas9 protein and gRNA into oocytes that were injected with frozen or freeze-dried sperm in TE buffer. No effect of electroporation until 30 V to ICSI-embryos derived from frozen or freeze-dried sperm were shown in the development of offspring. Furthermore, the rate of genome editing in offspring was high (56% for frozen and 50% for freeze-dried sperm). These results concluded that the combination of ICSI and the TAKE method was useful for the rapid production of genome-edited animals from sperm that have been preserved as genetic resources.

Keyword: Embryo; ICSI; Rat; Freezing; Preservation; CRISPR/Cas9; Electroporation; Freeze-dry; Genome editing; Sperm

4. Variation in *Rhyzopertha dominica* (F.) (Coleoptera: Bostrychidae) progeny adult emergence in different animal feed stored under ventilated and non-ventilated conditions /Wijayaratne, L.K.W.; Dissanayaka, D.M.S.K.; Sammani, A.M.P.. Journal of Stored Products Research. ISSN: 0022-474X (2019) v. 84 p.101516

DOI: 10.1016/j.jspr.2019.101516

Abstrak: In contrast to the traditional practices of using naturally-available food materials for livestock production, multiplicity types of animal feed are currently available at the market. Prolonged storage of animal feed concurrently with human food items is practiced, and niche users experience the deterioration and possible risk of contamination of animal feed by insects. This study was conducted to determine the infestation of eleven types of animal feed commonly used in Sri Lanka by *Rhyzopertha dominica* (F.) (Coleoptera: Bostrychidae), a major granivorous insect species. Twenty adults of one-month-old *R. dominica* were introduced to 20 g of different animal feed: fish feed, rabbit feed, dog feed, cat feed, chick mash, grower mash, layer mash, broiler starter, broiler finisher, bird feed (Bajiri) and rice polish. Each animal feed was maintained either ventilated or non-ventilated. From each animal feed, four replicates were tested. The parent adults were maintained in animal feed for 21 days under ambient environmental conditions (30 °C, 60% relative humidity, continuous darkness), and then sifted out. The progeny adults emerged in each animal feed were determined at monthly intervals for 5 months. In general, fish feed, rabbit feed, layer mash and bird feed ('bajiri') were more infested by *R. dominica* than other animal feed tested. Furthermore, progeny adults emerged in animal feeds differed with the status of ventilation and the duration of storage. The study

reveals that the status of ventilation has mixed effects on the infestation of different animal feeds by *R. dominica*.

Keyword: Animal feed; Non-ventilated; Progeny adults; Ventilated

5. Proximate Analysis of Animal Feed Pellet Formulated from Sunflower Shell Waste / Surayah Osman, Nor; Ayuna Mohamed Khamil, Izume; Sapawe, Norzahir. Materials Today: Proceedings. ISSN: 2214-7853 (2019) v.19 p.1796-1802

DOI: 10.1016/j.matpr.2019.11.218

Abstrak: Proximate analysis based on AOAC analytical standard for animal feed has been performed on animal feed pellet that contain 35% of sunflower shell waste. This pellet which formulated with the additional of other ingredient aim to increase the percentage of crude protein required by animal feed as well as reduced the too high fibre and lignin content which reported in sunflower shell waste from earlier study. From the results obtained, this sunflower shell waste-based pellet (PI2019002187) contains approximately 16.8% crude protein, 14.5% crude fibre and 12.25% lignin respectively. Other results including ash analysis (1.59%), moisture content (9.7%) and lipid content (5.65%). The proximate analysis performed on the formulated pellet depicting encouraging potential for its application as animal feed as it meets nutrient requirement for pet animal such as rabbit and hamster.

Keyword: animal feed pellet; formulation; hamster; Proximate analysis; sunflower shell waste

6. Positive effects of compost and vermicompost produced from tannery waste-animal fleshing on the growth and yield of commercial crop-tomato (*Lycopersicon esculentum* L.) plant /Ravindran, Balasubramani; Lee, Sang Ryong; Chang, Soon Woong; Nguyen, Dinh Duc; Chung, Woo Jin; Balasubramanian, Balamuralikrishnan; Mupambwa, Hupenyu Allan; Arasu, Mariadhas Valan; Al-Dhabi, Naif Abdullah; Sekaran, Ganesan. Journal of Environmental Management. ISSN: 0301-4797 (2019) v. 234 p.154-158

DOI: 10.1016/j.jenvman.2018.12.100

Abstrak: Accumulation of solid waste has intensified with the increase in world population and industrialization. Most importantly, wastes of animal origin such as animal manures and tannery wastes are a major under-utilized resource in most countries with potential for utilization in crop production. This study evaluated the potential of solid state hydrolyzed tannery animal fleshing (SSF-ANFL) and submerged state hydrolyzed tannery ANFL (SmF-ANFL) vermicompost and compost amended soils on the growth, yield and chemical characteristics of tomatoes. It was interesting to observe that of most measured parameters, the SSF amended treatments resulted in significantly ($P < 0.05$) the highest measurements compared to the SmF amended treatments. On average, the SSF vermicompost resulted in a 10%, 8.9% and 14% higher plant height, stem girth and leaf numbers, respectively, compared to other treatments combined. It was also noteworthy that, for the same parameters, the SSF-ANFL based treatments resulted in a 7.7%, 10.1% and 7.4% higher plant height, stem girth and leaf numbers, respectively, relative to the SmF-ANFL based treatments. The study demonstrates the potential of animal fleshing based vermicomposts as nutrient sources in crop production.

Keyword: Animal fleshing (ANFL); Compost; Tannery waste; Tomato plant growth; Vermicompost; Yield attributes

7. Feeling for textual animals: Narrative empathy across species lines / Małecki, Wojciech; Pawłowski, Bogusław; Sorokowski, Piotr; Oleszkiewicz, Anna. *Poetics*. ISSN: 0304-422X (2019) v.74 p.101334

DOI: 10.1016/j.poetic.2018.11.003

Abstrak: Throughout history, it has been often claimed by activists, writers, and scholars that narrative empathy for animals influences social attitudes toward other species. The problem is that there are no experimental data to support this opinion. Our study aimed to address this limitation. Involving 209 participants and three different narratives, it sought to experimentally establish whether narrative empathy for animals can improve attitudes toward animals and their welfare. The results were positive, and in the conclusion we discuss their implications, situating them in the context of research on the prosocial effects of narrative empathy.

Keyword: **Animal ethics; Animal stories; Empathic concern; Empathy for animals; Narrative empathy, ambassadorial strategic empathy; Prosocial effects of narratives**

8. Opportunity for a Dietary Win-Win-Win in Nutrition, Environment, and Animal Welfare /Scherer, Laura; Behrens, Paul; Tukker, Arnold. *One Earth*. ISSN: 2590-3322 (2019) v. 1 p.349-360

DOI: 10.1016/j.oneear.2019.10.020

Abstrak: Summary Sustainable food systems are essential for meeting nutritional requirements, limiting environmental impacts, and reducing animal welfare loss. Although current dietary trends in many regions rather go in the opposite direction, the adequacy of dietary guidelines is unknown, and the three sustainability dimensions are generally not assessed simultaneously. Here, we assessed nation-specific recommended diets for these impacts compared with the average diet. We assessed the trade-offs between nutritional quality, environmental sustainability (carbon, land, and water footprints), and animal welfare. Most countries reduce their animal product consumption in terms of food calories when switching to the nationally recommended diet. Recommended diets have the potential for “win-win-wins” in all three categories when compared with the current average diet, such as that shown in Brazil. However, South Korea loses in all three regards, and many other countries face trade-offs. This highlights the scope for the optimization of dietary guidelines to minimize such trade-offs.

Keyword: **climate change; farm animals; food; footprint; human health; impact assessment; input-output analysis; land use; sustainability; water scarcity**

9. Not all rotten fish stink: Microbial changes in decaying carcasses increase cytotoxicity and potential risks to animal scavengers / Blandford, Makeely I.; Katouli, Mohammad; Gilby, Ben L.; O'Dea, Christian; Olds, Andrew D.; Schlacher, Thomas A.. *Estuarine, Coastal and Shelf Science*. ISSN: 0272-7714 (2019) v.227 p.106350

DOI: 10.1016/j.ecss.2019.106350

Abstrak: Dead animal bodies occur naturally in ecosystems, are regularly washed up along ocean beaches, and are a key component of many coastal food webs where scavenging animals consume

carcasses. Microbes that decompose carcasses can, however, produce toxic chemicals during putrefaction. This is frequently assumed to have negative consequences for scavengers in the wild, but has been rarely quantified. In this study, we measured how changes in the microbial assemblages of decaying fish affect the toxicity of carcasses. We did this by allowing fish carcasses to decompose in the field for up to 31 days in the dunes of a sandy beach; an ecosystem where scavenging animals are common. Carcasses were sampled daily and the tissues tested for changes in culturable microbial communities using 100 µL samples of whole carcass homogenates on marine and sheep blood agar, and changes in cytotoxicity using Vero cell assays. Cytotoxicity peaked 11 days after deployment showing 95% rounded and detached cells. Cytotoxicity was lower in the early phases of decay as microbial communities developed and after approximately two weeks when carcasses dried. The peak in toxicity correlated with peaks in the abundance of *Acinetobacter*, and *Vibrio* and *Alivibrio*; microbes known to produce toxins. This trajectory of toxicity suggests an ecological model where microbes may predictably determine the palatability of carrion in food webs, making both fresh and aged carcasses the least risky proposition for scavenging animals. This 'fresh and aged carcasses are best' model is highly amenable to testing in the context of carrion-centred food webs in multiple systems, and it has practical applications in conservation where animal carcasses are provided to threatened, and often iconic, scavenger species.

Keyword: Toxicity; fish; Food web; Microbes; Necrobiome; Sandy beach; Scavenger

10. Animal welfare considerations for using large carnivores and guardian dogs as vertebrate biocontrol tools against other animals /Allen, Benjamin L.; Allen, Lee R.; Ballard, Guy; Drouilly, Marine; Fleming, Peter J.S.; Hampton, Jordan O.; Hayward, Matthew W.; Kerley, Graham I.H.; Meek, Paul D.; Minnie, Liaan; O'Riain, M. Justin; Parker, Daniel M.; Somers, Michael J.. *Biological Conservation*. ISSN: 0006-3207 (2019) v. 232 p.258-270

DOI: 10.1016/j.biocon.2019.02.019

Abstrak: Introducing consumptive and non-consumptive effects into food webs can have profound effects on individuals, populations and communities. This knowledge has led to the deliberate use of predation and/or fear of predation as an emerging technique for controlling wildlife. Many now advocate for the intentional use of large carnivores and livestock guardian dogs as more desirable alternatives to traditional wildlife control approaches like fencing, shooting, trapping, or poisoning. However, there has been very little consideration of the animal welfare implications of deliberately using predation as a wildlife management tool. We assess the animal welfare impacts of using dingoes, leopards and guardian dogs as biocontrol tools against wildlife in Australia and South Africa following the 'Five Domains' model commonly used to assess other wildlife management tools. Application of this model indicates that large carnivores and guardian dogs cause considerable lethal and non-lethal animal welfare impacts to the individual animals they are intended to control. These impacts are likely similar across different predator-prey systems, but are dependent on specific predator-prey combinations; combinations that result in short chases and quick kills will be rated as less harmful than those that result in long chases and protracted kills. Moreover, these impacts are typically rated greater than those caused by traditional wildlife control techniques. The intentional lethal and non-lethal harms caused by large carnivores and guardian dogs should not be ignored or dismissively assumed to be negligible. A greater understanding of the impacts they impose would benefit from empirical studies of the animal welfare outcomes arising from their use in different contexts.

Keyword: Animal ethics; Animal welfare; Biocontrol; Decision matrix; Dingo; Fear effects; Guardian dog; Humaneness; Landscape of fear; Leopard; Predator-prey relationships

11. A novel S1P1 modulator IMM002 ameliorates psoriasis in multiple animal models / Jin, Jing; Xue, Nina; Liu, Yuan; Fu, Rong; Wang, Mingjin; Ji, Ming; Lai, Fangfang; Hu, Jinping; Wang, Xiaojian; Xiao, Qiong; Zhang, Xiaoying; Yin, Dali; Bai, Liping; Chen, Xiaoguang; Rao, Shuan. *Acta Pharmaceutica Sinica B*. ISSN: 2211-3835 (2019) v. p.

DOI: 10.1016/j.apsb.2019.11.006

Abstrak: Psoriasis is characterized by abnormal proliferation of keratinocytes, as well as infiltration of immune cells into the dermis and epidermis, causing itchy, scaly and erythematous plaques of skin. The understanding of this chronic inflammatory skin disease remains unclear and all available treatments have their limitations currently. Here, we showed that IMM002, a novel orally active S1P1 modulator, desensitized peripheral pathogenic lymphocytes to egress signal from secondary lymphoid organs and thymus. Using different psoriasis animal models, we demonstrated that IMM002 could significantly relieve skin damage as revealed by PASI score and pathological injury evaluation. Mechanistically, IMM002 regulated CD3+ T lymphocytes re-distribution by inducing lymphocytes' homing, thus decreased T lymphocytes allocation in the peripheral blood and skin but increased in the thymus. Our results suggest that the novel S1P1 agonist, IMM002, exert extraordinary capacity to rapidly modulate T lymphocytes distribution, representing a promising drug candidate for psoriasis treatment.

Keyword: IMM002; Lymphocyte; Psoriasis; S1P; S1P agonist

12. Advanced Animal Track-&-Trace Supply-Chain Conceptual Framework: An Internet of Things Approach /Addo-Tenkorang, Richard; Gwangwava, Norman; Ogunmuyiwa, Enoch N.; Ude, Albert U.. *Procedia Manufacturing*. ISSN: 2351-9789 (2019) v. 30 p.56-63

DOI: 10.1016/j.promfg.2019.02.009

Abstrak: Information and data transmission, as well as total visibility in terms of supply chain track-&-trace, is seriously lacking in current industrial logistics-&-supply-chain management activities. This paper proposes the application of RFIDs and the Internet of things' enterprise systems architecture to, propose a low-cost feasible cloud solution. This solution would keep track of health history, birth records, ownership history and track location of each animal by using an electronic solar-powered tag instead of the current passive ear tags. This paper employs GPRS, GSM and the Google Earth function along with RFIDs to design an enhanced proposed enterprise system-architecture framework in the form of a business process model. Various areas such as e-health, e-commerce, and cloud-based manufacturing have been revolutionized by discoveries in digitized practices. Advancements in the Internet of things led to the advent of asset tracking systems, condition monitoring and various intelligent systems that exchange data over the cloud. Farmers are very vulnerable to stock theft, straying animals and high business risks due to poor animal health management practices. Existing tracking systems have high ownership costs since some of them rely on GSM network providers whose services are costly for farmers. Innovations in digitized systems continue to add more value to businesses and individuals across broad range sectors. Authors of this paper propose a low-cost intelligent animal tracking system for an African free-ranging environment. Economies worldwide are ever becoming digital and animal husbandry practices stand to benefit from this digitisation approach.

Keyword: Animal Identification; Cloud/Virtual Network; Digital manufacturing –3D Printing; Google Earth; Supply Chain Management; The Internet of things; Tracking

13. Reducing the need for animal testing while increasing efficiency in a pesticide regulatory setting: Lessons from the EPA Office of Pesticide Programs' Hazard and Science Policy Council / Craig, Evisabel; Lowe, Kelly; Akerman, Gregory; Dawson, Jeffrey; May, Brenda; Reaves, Elissa; Lowit, Anna. Regulatory Toxicology and Pharmacology. ISSN: 0273-2300 (2019) v.108 p.104481

DOI: 10.1016/j.yrtph.2019.104481

Abstrak: As part of EPA's commitment to reducing animal testing, the Office of Pesticide Programs (OPP) created the Hazard and Science Policy Council (HASPOC). This group considers requests for waiving animal study requirements for human health risk assessments and makes recommendations based on a weight-of-the-evidence approach. Since its inception in 2012, the HASPOC has evaluated over one thousand requests to waive animal studies required by default for pesticide evaluation. Here, the number of studies waived, and the types of studies represented were analyzed to determine the impact of the HASPOC decisions in terms of animal and monetary savings. Overall, the waiving of studies by HASPOC resulted in over 200 thousand animals saved. There were also savings of over \$300 million in study costs and over \$6 million in study review costs as well as less time spent in study processing and review by EPA staff. Thus, the HASPOC has built significant efficiencies into the risk assessment process while continuing to protect human health.

Keyword: 3Rs; HASPOC; Pesticides; Risk assessment

14. Use of a Bayesian model including QTL markers increases prediction reliability when test animals are distant from the reference population /Ma, Peipei; Lund, Mogens S.; Aamand, Gert P.; Su, Guosheng. Journal of Dairy Science. ISSN: 0022-0302 (2019) v. 102 p.7237-7247

DOI: 10.3168/jds.2018-15815

Abstrak: ABSTRACT Relatedness between reference and test animals has an important effect on the reliability of genomic prediction for test animals. Because genomic prediction has been widely applied in practical cattle breeding and bulls have been selected according to genomic breeding value without progeny testing, the sires or grandsires of candidates might not have phenotypic information and might not be in the reference population when the candidates are selected. The objective of this study was to investigate the decreasing trend of the reliability of genomic prediction given distant reference populations, using genomic best linear unbiased prediction (GBLUP) and Bayesian variable selection models with or without including the quantitative trait locus (QTL) markers detected from sequencing data. The data used in this study consisted of 22,242 bulls genotyped using the 54K SNP array from EuroGenomics. Among them, 1,444 Danish bulls born from 2006 to 2010 were selected as test animals. Different reference populations with varying relationships to test animals were created according to pedigree-based relationships. The reference individuals having a relationship with one or more test animals higher than 0.4 (scenario $p < 0.4$), 0.2 ($p < 0.2$), or 0.1 ($p < 0.1$, where p = relationship coefficient) were removed from reference sets; these represented the distance between reference and test animals being 2 generations, 3 generations, and 4 generations, respectively. Imputed whole-genome sequencing data of bulls from Denmark were used to conduct a genome-wide association study (GWAS). A small number of significant variants (QTL markers) from the GWAS were added to the array data. To compare the effects of different models, the basic GBLUP model, a Bayesian selection variable model, a GBLUP model with 2 components of genetic effects, and a Bayesian model

with pooled array data and QTL markers were used for estimating genomic estimated breeding values (GEBV) of test animals. The reliability of genomic prediction decreased when the test animals were more generations away from the reference population. The reliability of genomic prediction was 0.461 for 1 generation away and 0.396 for 3 generations away, with the same number of individuals in the reference set, using a GBLUP model with chip markers only. The results showed that using the Bayesian method and QTL markers improved the reliability of genomic prediction in all scenarios of relationship between test and reference animals, in a range of 1.3% and 65.1% (4 generations away with only 841 individuals in the reference set). However, most gains were for predictions of milk yield and fat yield. There was little improvement for predictions of protein yield and mastitis, and no improvement for prediction of fertility, except for scenario $p < 0.1$, in which there was a large improvement for predictions of all traits. On the other hand, models including more than 10% polygenic effect decreased prediction reliability when the relationship between test and reference animals was distant.

Keyword: Bayesian model; distant relationship; genomic prediction; QTL markers

15. Length-specific occurrence and profile of perfluoroalkyl acids (PFAAs) in animal protein feeds / Li, Xiaomin; Gao, Ke; Dong, Shujun; Liu, Xian; Fu, Kehan; Wang, Peilong; Zhang, Aiqian; Su, Xiaoou; Fu, Jianjie. *Journal of Hazardous Materials*. ISSN: 0304-3894 (2019) v.373 p.224-231

DOI: 10.1016/j.jhazmat.2019.03.074

Abstrak: Animal protein supplement feeds (APFs) are susceptible to perfluoroalkyl acids (PFAAs) and could be the main sources for raised animals, thereafter causing further human exposure through the farm-to-fork pathway. However, the occurrence of PFAAs has been rarely evaluated in various APFs, especially for emerging short-chain PFAAs. In the present study, we collected the most prevalent APFs (blood meal, meat meal, feather meal, soybean meal and DDGS) and found that $\Sigma 16$ PFAAs ranged from undetectable to 37.1 ng/g dry weight (dw) (average: 7.23 ng/g dw). Blood meal contained the highest PFAA levels, and results revealed that some terrestrial-derived APFs might be present at levels on par with the marine-derived feed. Animal-derived APFs (mean 10.9 ng/g dw) possessed higher Σ PFAAs than plant-derived APFs (0.75 ng/g dw). Length-specific PFAA profiles were specified between terrestrial-origin and marine-origin feeds in addition to animal-derived and plant-derived feeds. Short-chain PFAAs (PFBA, PFBS and PFHxS) were primarily found in blood meal, meat meal, soybean meal and DDGS, while the long-chain counterparts dominated in feather meal. It is of great concern that feed exposure to emerging contaminants has not drawn enough attention.

Keyword: Animal-derived feed; Marine-origin feed; Perfluoroalkyl acids; Plant-derived feed; Terrestrial-origin feed

16. Symposium review: Omics in dairy and animal science—Promise, potential, and pitfalls* /Lippolis, J.D.; Powell, E.J.; Reinhardt, T.A.; Thacker, T.C.; Casas, E.. *Journal of Dairy Science*. ISSN: 0022-0302 (2019) v. 102 p.4741-4754

DOI: 10.3168/jds.2018-15267

Abstrak: ABSTRACT Sequencing the first genome took 15 yr and \$3 billion to complete. Currently, a genome can be sequenced in a day for a few thousand dollars. Comparing the relative abundance of nearly every mRNA transcript and small RNAs from cells and tissues from different experimental

conditions has become so easy that it can take longer to transfer the data between computers than to perform the experiment. Nucleotide sequencing techniques have become so sensitive that the greatest concern is not detecting a gene or transcript but rather, falsely identifying one. Better genome sequencing has led to more complete transcriptomic and proteomic databases and, combined with more sensitive instrumentation and separation techniques, is bringing us closer to detecting complete transcriptomes and proteomes. The promise of these powerful omics techniques is to lead us to new and unexpected connections between molecular processes in the context of animal health. This promise cannot be achieved without hypothesis-driven research that connects omics data with animal health experiments. Any researcher who wishes to invest the time and resources in omics experiments should be aware of the common pitfalls and limitations of these techniques so they can avoid these issues and maximize the use of these research tools. Several important questions must be asked: What is the quality of the databases and how they are annotated? Are the annotations based on experimental results or computational predictions? What assumptions are made by the analysis algorithms, and how will this affect the result? Finally, how can the research community use the vast amount of data being generated by omics experiments in ways to achieve the goals of better animal health and production (which is the promise of omics technologies)? Until the observations shown in omics data sets are used to achieve the goals of better animal health and production, the potential of omics technology will not be fully realized.

Keyword: genome-wide association study (GWAS); omics technology; proteomics; sequencing; transcriptomics

17. Oregano: A potential prophylactic treatment for the intestinal microbiota / Bauer, Benjamin W.; Radovanovic, Anita; Willson, Nicky-Lee; Bajagai, Yadav Sharma; Hao Van, Thi Thu; Moore, Robert J.; Stanley, Dragana. *Heliyon*. ISSN: 2405-8440 (2019) v.5 p.e02625

DOI: 10.1016/j.heliyon.2019.e02625

Abstrak: Prophylactic use of antibiotics in poultry diets has been identified as a problematic practice because of its potential to exacerbate the spread of antibiotic resistance to human pathogens. A range of countries have opted to completely ban the use of antibiotics in animal feed. The animal production industries are looking for alternative ways to effectively control pathogens while providing the performance benefits previously secured by antibiotics in feed. Here, we present evidence that oregano (*Origanum vulgare*) could be a potential alternative for pathogen control in the poultry industry. Broiler diets were supplemented with oregano powder (0%, 0.5%, 1%, and 2%) for six weeks. The capacity for pathogen control was estimated by microbiota profiling of the jejunum, ileum, and caecum content, and in the faeces, by 16S rRNA gene amplicon sequencing. The concentrations of short-chain fatty acids in the caecal content were also measured, as were villus/crypt parameters in the ileum. There were no differences among treatments in weight gain, feed intake, or the concentration of short-chain fatty acids. The height, width, and the surface area of villi in the ileum were not influenced by oregano addition. However, 1% and 2% of oregano produced a significant increase in the villus height to crypt depth ratio. There were no visible histopathological changes in the liver in control and treated groups. Although oregano had no significant effect on overall microbial diversity and gross composition, some specific genera, like *Proteus*, *Klebsiella* and *Staphylococcus*, which include known pathogens, were reduced in relative abundance by oregano treatment. *Bifidobacterium*, recognized as a beneficial and probiotic genus, was also suppressed by the oregano treatment.

Keyword: Chicken; Animal science; Antibiotic alternative; Food microbiology; Gastrointestinal system; Microbiology; Microbiota; Oregano; Public health

18. Time trends, seasonal differences and determinants of systemic antimicrobial use in companion animal clinics (2012-2015) /Hopman, Nonke E.M.; Portengen, Lützen; Heederik, Dick J.J.; Wagenaar, Jaap A.; Van Geijlswijk, Ingeborg M.; Broens, Els M.. *Veterinary Microbiology*. ISSN: 0378-1135 (2019) v. 235 p.289-294

DOI: 10.1016/j.vetmic.2019.07.016

Abstrak: Any antimicrobial use (AMU) in humans and animals selects for antimicrobial resistance (AMR) and responsible AMU should therefore be promoted both in human and veterinary medicine. Insight into current AMU in companion animal clinics is necessary to be able to optimise antimicrobial (AM) prescribing behaviour. The objective of this study was to describe systemic AMU in 44 Dutch companion animal clinics over a 3-year time period (2012–2015), using retrospectively collected data. The number of Defined Daily Doses for Animals (DDDA) per month and per clinic were calculated from prescription data for total, 1st, 2nd and 3rd choice AMU (classification according to Dutch policy on veterinary AMU). Time trends, seasonality and the influence of potential determinants (e.g., the number of dogs, cats and rabbits per clinic and other clinic characteristics) were explored using statistical modelling. Overall, the findings show that total AMU decreased over time and a shift in used classes of antimicrobials towards more 1st choice AMs was visible. Mean total AMU decreased from 1.82 DDDA/year in 2012–2013 to 1.56 DDDA/year in 2014–2015. Aminopenicillins, with and without clavulanic acid, accounted for the largest group of antimicrobials used; 38.7% (2012–2013), 40.2% (2013–2014) and 39.3% (2014–2015) of total AMU, respectively. Strong seasonal differences in AMU were found, with highest AMU in July–August and lowest in February–March. The distribution of different animal species per clinic appeared to affect AMU as well. In clinics with a larger proportion of dogs, 2nd choice AMU was significantly higher, whereas in clinics with a larger proportion of rabbits, 2nd choice AMU was significantly lower. Despite the decrease of AMU during the study period, there is still room for improvement left, especially with regard to the antimicrobial classes prescribed. According to Dutch classification of veterinary AMU, 1st choice AMs should be used as empirical therapy. A decrease in 2nd (might select for ESBL-producing bacteria) and 3rd choice AMU (i.e. fluoroquinolones and 3rd generation cephalosporins) should be aimed for.

Keyword: Antimicrobial use; Companion animal; Determinant; Seasonality; Time trend; Veterinary medicine

19. Impact of environmental pollution on PCDD/F and PCB bioaccumulation in game animals / Warenik-Bany, Malgorzata; Maszewski, Sebastian; Mikolajczyk, Szczepan; Piskorska-Pliszczynska, Jadwiga. *Environmental Pollution*. ISSN: 0269-7491 (2019) v.255 p.113159

DOI: 10.1016/j.envpol.2019.113159

Abstrak: Elucidation of the relationship between the levels of 35 individual dioxins and polychlorinated biphenyl congeners in environmental samples (pine needles, leaves, grass and soil), and their bioaccumulation in the muscles of two game animal families (Cervidae and Suidae) was the aim of the research. Comparative studies were performed in four industrially degraded regions with various types of heavy industry and in an agricultural region with a tourism industry. The content of pollutants was determined by the isotopic dilution method using high resolution gas chromatography coupled with high resolution mass spectrometry. The polychlorinated dibenzodioxins/furan and PCB

profiles in plants, soil and animal tissues varied by region and were related to the indigenous industry. The presence of characteristic congeners of particular industrial sectors was found. The animal tissue congeners were a reflection of the types and levels found in soil and plants. Independently of the region, deer tissue had almost twice the concentration of PCDD/F/DL-PCBs compared to boars, but the converse was true for NDL-PCBs. Spearman's statistical test showed strong correlations between pine needle, leaf, grass and soil dioxin and dioxin-like PCB levels and concentrations of these in the tissues of both species. Coefficients of bioaccumulation in deer muscles (BAF) calculated for all regions varied considerably and they were significantly higher for wild boars. BAF decreased with increasing number of chlorine atoms in the dioxin and furan molecule. The highest congener values were for 2,3,7,8-tetrachlorodibenzodioxin, 1,2,3,7,8-pentachlorodibenzodioxin, 2,3,7,8-tetrachlorodibenzofuran and 2,3,4,7,8-pentachlorodibenzofuran in both kinds of muscle regardless of the region. The levels of pollutants, types of pollutants, and their relative abundance in tissues of deer and boar reflected their surrounding environment and local pollutant emitters.

Keyword: Bioaccumulation; Dioxins; Environmental pollution; Game animals; PCBs

20. Measurements of radiocesium in animals, plants and fungi in Svalbard after the Fukushima Daiichi nuclear power plant disaster /Mezaki, Yoshihiro; Kato, Shigeaki; Nishikawa, Osamu; Takashima, Isao; Tsubokura, Masaharu; Minowa, Haruka; Asakura, Tadashi; Matsuura, Tomokazu; Senoo, Haruki. *Heliyon*. ISSN: 2405-8440 (2019) v. 5 p.e03051

DOI: 10.1016/j.heliyon.2019.e03051

Abstrak: An earthquake struck the eastern part of Japan on March 11, 2011. The Fukushima Daiichi nuclear power plant was severely damaged by the earthquake and subsequent tsunami, leading to the emission of large amounts of radioactive pollutants, including ¹³⁴Cs and ¹³⁷Cs, into the environment. From August 23 to September 1 in 2011, and from August 27 to September 4 in 2013, we collected samples of animals, plants, fungi and lichens from Svalbard, Norway and measured the radioactivity of ¹³⁴Cs and ¹³⁷Cs contained in the samples. Though no radioactivity of ¹³⁴Cs, which has a half-life of approximately 2 years, was observed, radioactivity of ¹³⁷Cs, which has a half-life of approximately 30 years, was observed in some samples of lichens and fungi. We failed to detect the radioactivity of ¹³⁴Cs in any of the samples we collected, therefore, it was impossible to say clearly that the radioactivity is derived from Fukushima or not. Nevertheless, the radioactivity data documented in this report are a useful reference for the future surveys of radioactivity within the Arctic.

Keyword: Bioaccumulation; Aquatic biology; Arctic; Cesium; Environmental radioactivity; Environmental science; Fukushima Daiichi nuclear power plant; Quality of life; Radioactivity; Svalbard; Water pollution

21. Reduced rates of antimicrobial resistance in *Staphylococcus intermedius* group and *Escherichia coli* isolated from diseased companion animals in an animal hospital after restriction of antimicrobial use / Kurita, Goro; Tsuyuki, Yuzo; Murata, Yoshiteru; Takahashi, Takashi. *Journal of Infection and Chemotherapy*. ISSN: 1341-321X (2019) v.25 p.531-536

DOI: 10.1016/j.jiac.2019.02.017

Abstrak: The 2016 National Action Plan aims for reduction in antimicrobial resistance (AMR) to tetracyclines, third-generation cephalosporins, and fluoroquinolones in *Escherichia coli* isolates from livestock: to lower the tetracycline resistance of *E. coli* to 33% or less; to maintain the third-generation

cephalosporin resistance of *E. coli* at the same level as in the other G7 countries as of 2020; and to maintain the fluoroquinolone resistance of *E. coli* at the same level as in the other G7 countries as of 2020. A relatively unexplored facet of reducing AMR is the impact of minimizing transmission of AMR strains by companion animals. In this study we compared AMR rates in *Staphylococcus intermedius* group (SIG) and *E. coli* isolated from diseased companion animals in an animal hospital before and after restriction of antimicrobial use. Our study spanned a 4.5-year period from 2014 to June 2018 during which antimicrobial use was restricted in 2016. During this period, abundance of methicillin-resistant SIG isolates from the hospital dropped from 41.5% to 9.3%, and that of extended-spectrum β -lactamase (ESBL)-producing *E. coli* isolates dropped from 29.5% to 9.5%. Tests for antimicrobial susceptibility revealed significantly reduced rates of AMR to enrofloxacin and levofloxacin in SIG isolates, and to cefazolin in *E. coli* isolates after antimicrobial use was restricted. Our observations suggest that restriction of antimicrobial use, especially that of third-generation cephalosporins and fluoroquinolones, is an effective method for reducing AMR rates. These findings will be relevant in guiding antimicrobial restriction approaches in other animal hospitals and clinics.

Keyword: Antimicrobial resistance; Companion animals; group; Restriction of antimicrobial use

22. Establishing a health-based recommended occupational exposure limit for nitrous oxide using experimental animal data – A systematic review protocol /van Luijk, Judith A.K.R.; Popa, Madalina; Swinkels, Janne; Menon, Julia M.L.; Alkema, Wynand; Roeleveld, Nel; Hoffmann, Sebastian E.; Schlünssen, Vivi; Mandrioli, Daniele; Ritskes-Hoitinga, Merel; Scheepers, Paul T.J.. Environmental Research. ISSN: 0013-9351 (2019) v. 178 p.108711

DOI: 10.1016/j.envres.2019.108711

Abstrak: Nitrous oxide (N₂O) is widely used as inhalation analgesic and anaesthetic in medical, paramedical, and veterinary practice. Previous evaluations resulted in classification of N₂O as a possible risk factor for adverse reproductive health outcomes based on evidence from animal data. Available human data were considered inadequate, partly due to the possibility that other risk factors, such as co-exposures to other inhalation anaesthetics may have contributed to the adverse outcomes. As no substantial new human evidence has emerged since previous evaluations, this protocol describes a planned systematic review of the evidence obtained from animal studies. The aim is to assess the available evidence on the effects of N₂O on reproductive and developmental outcomes in animals to inform a health-based recommended occupational exposure limit (OEL) for N₂O. Comprehensive search strategies were designed to retrieve animal studies addressing N₂O exposure from PubMed, EMBASE, and Web of Science. Screening of the studies retrieved will be performed by at least two independent reviewers, while discrepancies will be resolved by reaching consensus through repeated review and discussions. Articles will be included according to criteria specified in this protocol. Outcome data relevant for reproduction and development will be extracted and risk of bias will be assessed by two independent reviewers using the SYRCLE's risk of bias tool. Primary reproductive and developmental outcomes of interest will be the number of resorptions, malformations, and birth weight. We will focus on dose-response studies that allow to derive an OEL with the benchmark dose (BMD) approach. Adverse outcomes occurring at doses that are equivalent to the exposures occurring in human occupational settings will be particularly relevant for dose-response modelling. The proposed review has not been performed before. We will follow the procedures specified in this protocol. We will adhere to guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), adapted for animal studies. Ethical approval will not be required, as the review will use existing data available in the public domain.

Keyword: Animal experimentation; Nitrous oxide; Occupational exposure; OEL; Reproductive and developmental toxicity; Systematic review

23. Perception, knowledge and attitudes of small animal practitioners regarding animal abuse and interpersonal violence in Brazil and Colombia / Monsalve, Stefany; Pereira, Érika Leitão; Leite, Luana Oliveira; Polo, Gina; Garcia, Rita. Research in Veterinary Science. ISSN: 0034-5288 (2019) v.124 p.61-69

DOI: 10.1016/j.rvsc.2019.03.002

Abstrak: Identification and report of animal abuse by veterinarians are fundamental to the promotion of animal welfare and the prosecution of this crime. Likewise, these professionals have an important responsibility to cope with the cycle of violence. This study aims to characterize the perception, knowledge, and attitudes of small animal practitioners regarding animal abuse and interpersonal violence in Brazil and Colombia. An online survey containing 27 questions was distributed to small animal practitioners of both countries. Multiple correspondence analysis (MCA) was employed to construct relationships among categorical variables and the chi-square statistic was used for testing these relationships. An important number of respondents had suspected that their patients could be victims of animal abuse (Brazil 48.1%; Colombia 64.5%). However, only a minority reported this situation to competent authorities (Brazil 32.7%; Colombia 10.8%). To receive training about veterinary forensics and/or animal welfare sciences in veterinary college was associated with identifying and denouncing animal abuse ($p < .05$). Deficiency in training received by veterinarians on veterinary forensic and animal welfare science in veterinary college was evident. Despite this, small animal practitioners recognize the existence of an association between animal abuse and interpersonal violence (Brazil 94.2%; Colombia 96.8%). The results highlight the need to strengthen education on animal abuse and promote the participation of veterinarians in the prosecution of this crime in Latin America.

Keyword: Animal cruelty; Companion animal maltreatment; Human-animal relationship; Link theory; Veterinary education

24. A novel luciferase immunosorbent assay performs better than a commercial enzyme-linked immunosorbent assay to detect MERS-CoV specific IgG in humans and animals /Wang, Wenling; Wang, Tianyu; Deng, Yao; Niu, Peihua; A, Ruhan; Zhao, Jincun; Peiris, Malik; Tang, Shixing; Tan, Wenjie. Biosafety and Health. ISSN: 2590-0536 (2019) v. p.

DOI: 10.1016/j.bsheal.2019.12.006

Abstrak: The Middle East respiratory syndrome (MERS) is a lethal zoonosis caused by MERS coronavirus (MERS-CoV) and poses a significant threat to public health worldwide. Therefore, a rapid, sensitive, and specific serologic test for detecting anti-MERS-CoV antibodies in both humans and animals is urgently needed for the successful management of this illness. Here, we evaluated various novel luciferase immunosorbent assays (LISA) based on nucleocapsid protein (NP) as well as fragments derived from spike protein (S) including subunit 1 (S1), N terminal domain (NTD), receptor-binding domain (RBD) and subunit 2 (S2) of S for the detection of MERS-CoV-specific IgG. Fusion proteins, including nanoluciferase (NLuc) and various fragments derived from the NP or S protein of MERS-CoV, were expressed in human embryonic kidney 293 T cells. LISAs that detected anti-MERS-CoV IgG were further developed using cell lysates expressing various fusion proteins. Panels of human or animal samples infected with MERS-CoV were used to analyze the sensitivity and specificity of various LISAs

in reference to a MERS-CoV RT-PCR, commercial S1-based ELISA, and pseudovirus particle neutralization test (ppNT). Our results showed that the S1-, RBD-, and NP-LISAs were more sensitive than the NTD- and S2-LISAs for the detection of anti-MERS-CoV IgG. Furthermore, the S1-, RBD-, and NP-LISAs were more sensitive (by at least 16-fold) than the commercially available S1-ELISA. Moreover, the S1-, RBD-, and NP-LISA specifically recognized anti-MERS-CoV IgG and did not cross-react with samples derived from other human CoV (OC43, 229E, HKU1, NL63)-infected patients. More importantly, these LISAs proved their applicability and reliability for detecting anti-MERS-CoV IgG in samples from camels, monkeys, and mice, among which the RBD-LISA exhibited excellent performance. The results of this study suggest that the novel MERS-CoV RBD- and S1- LISAs are highly effective platforms for the rapid and sensitive detection of anti-MERS-CoV IgG in human and animal samples. These assays have the potential to be used as serologic tests for the management and control of MERS-CoV infection.

Keyword: Luciferase immunosorbent assay (LISA); MERS-CoV; Samples of humans and animals; Serological IgG detection

25. Animal production, insecticide use and self-reported symptoms and diagnoses of COPD, including chronic bronchitis, in the Agricultural Health Study / Rinsky, Jessica L.; Richardson, David B.; Kreiss, Kathleen; Nylander-French, Leena; Beane Freeman, Laura E.; London, Stephanie J.; Henneberger, Paul K.; Hoppin, Jane A.. Environment International. ISSN: 0160-4120 (2019) v.127 p.764-772

DOI: 10.1016/j.envint.2019.02.049

Abstrak: Background Occupational exposure to animal production is associated with chronic bronchitis symptoms; however, few studies consider associations with chronic obstructive pulmonary disease (COPD). We estimated associations between animal production activities and prevalence of self-reported COPD among farmers in the Agricultural Health Study. Methods During a 2005–2010 interview, farmers self-reported information about: their operations (i.e., size, type, number of animals, insecticide use), respiratory symptoms, and COPD diagnoses (i.e., COPD, chronic bronchitis, emphysema). Operations were classified as small or medium/large based on regulatory definitions. Farmers were classified as having a COPD diagnosis, chronic bronchitis symptoms (cough and phlegm for ≥ 3 months during 2 consecutive years), or both. Polytomous logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI). Results Of 22,491 participating farmers (median age: 59 years), 922 (4%) reported a COPD diagnosis only, 254 (1%) reported a diagnosis and symptoms, and 962 (4%) reported symptoms only. Compared to raising no commercial animals, raising animals on a medium/large operation was positively associated with chronic bronchitis symptoms with (OR: 1.59; 95% CI: 1.16, 2.18) and without a diagnosis (OR: 1.69; 95% CI: 1.42, 2.01). Ever use of multiple organophosphates, carbaryl, lindane, and permethrin were positively associated with chronic bronchitis symptoms. Conclusion Animal production work, including insecticide use, was positively associated with chronic bronchitis symptoms; but not consistently with COPD diagnosis alone. Our results support the need for further investigation into the role of animal production-related exposures in the etiology of COPD and better respiratory protection for agricultural workers.

Keyword: Pesticide; Environmental health; Epidemiology; Occupational health

26. Propagating wave based on transition of interaction within animal group /Sonoda, Kohei; Murakami, Hisashi; Niizato, Takayuki; Tomaru, Takenori; Nishiyama, Yuta; Gunji, Yukio-Pegio. Biosystems. ISSN: 0303-2647 (2019) v. 185 p.104019

DOI: 10.1016/j.biosystems.2019.104019

Abstrak: Propagating waves, information transfers of direction of travel in collective groups, have been observed in animal groups of insects, birds, fish, and mammals. Nevertheless, although many previously proposed models of group behaviors have elucidated various aspects of collective motion, none has directly shown the propagating wave constructively. These models consisted of flocking algorithms in which individuals modify their positions or velocities through average responses to their neighbors. The algorithms involve the function of diluting local fluctuations, individual motions, or social cues that initiate coherent decision-making of where to travel and which spread through a group in the form of a wave. The present study challenged physics-inspired models based solely on average interaction and instead proposed a combination with pair interaction: the 'copy' mechanism. By the mechanism, individuals specially attend and mimic the motion of the largest turning neighbor. The model comprises three modes (base, copy, and align modes) that sequentially switch among themselves, depending on the degree of variance in direction. The model therefore involves propagating waves that produce rapid collective responses and quick turning motions of a group. This proposal is an attempt to uncover the mechanisms of self-organized waves in simulation studies of coordinated groups, without explicit signals such as alarm calls. Understanding such mechanisms is expected to contribute to the 'collective mind' metaphor, answering the question of how animal groups obtain higher-order computational capabilities from local inter-individual interactions.

Keyword: Animal behavior; Animal group; Self-organization; Self-propelled particles

27. Design of an Animal Detection System for Motor Vehicle Drivers / Sibanda, Vennan; Mpofu, Khumbulani; Trimble, John; Zengeni, Noreen. *Procedia CIRP*. ISSN: 2212-8271 (2019) v.84 p.755-760

DOI: 10.1016/j.procir.2019.04.175

Abstrak: Wildlife-vehicle accidents result in substantial personal, environmental and economic losses, including human injuries, fatalities, loss of wildlife, and vehicle damage. When driving on the highway wild and domestic animals pose dangers to road users. In most cases when the drivers notice an animal on their path, it will be too late to stop the vehicle in time to avoid an accident. This has prompted research into possible ways of developing an animal detection system that gives warning to the drivers and thus enabling them to take precautionary measures. This research is therefore aimed at developing an animal detection system that warns drivers of a possible collision with an animal. Research was carried out using various methods including looking at Literature on ultrasound hooting frequency, and other available warning systems. Questionnaires were also used to gather information from drivers on their experiences and needs to develop the safety measures. Experiments were carried out using Arduino UNO R3 to illustrate the image visibility on an infrared camera and the effect of infrared illumination on the camera system. Calculations were done to achieve the desired number of Infrared LEDs to be used on the camera. An ultrasound circuit and entire system circuitry was developed and simulated using proteus 8 professional to achieve the preferred response mechanism for the system. The system therefore can capture an image of the animal and retrieve its similarity from the animal system database. The results provide a developed animal detection and warning system that can be used by motorists any time of the day while driving.

Keyword: Animal detection system; Infrared; Thermal detection; Ultrasound

28. Pots, plants and animals: Broad-spectrum subsistence strategies in the Early Neolithic of the Moroccan Rif region /Dunne, J.; Manning, K.; Linstädter, J.; Mikdad, A.; Breeze, P.; Hutterer, R.; Lehnig, S.; Morales, J.; Gillard, T.; Drake, N.; Evershed, R.P.. Quaternary International. ISSN: 1040-6182 (2019) v. p.

DOI: 10.1016/j.quaint.2019.12.009

Abstrak: The transition from hunter-gathering to food-producing societies in the Mediterranean zone of north Africa was complex and variable, likely influenced by local ecological conditions as well as the socio-economic origins of the population. The adoption of domestic plants and animals was piecemeal, with hunting and gathering continuing as an important part of local subsistence strategies. Here, we investigate the timing and extent of the adoption of agricultural practices, namely herding and cultivation, in three diverse coastal and inland Early Neolithic sites in the Mediterranean Maghreb region, namely Ifri Oudadane, Ifri n'Etsedda and Hassi Ouenzga. Results from absorbed lipid residues extracted from 306 potsherds from these sites are correlated with information from faunal and archaeobotanical assemblages. Our findings suggest that agricultural practices, regarded as being of Neolithic origin, were never fully adopted in the Maghreb but rather that these farmer/foragers adopted a range of strategies including low-level food production (exploiting cereals and animal products, including meat and milk), gathering of wild plants and marine shellfish, and hunting both small and large sized game. These broad-spectrum farmer/foragers were clearly both flexible and resourceful and likely adapted their subsistence practices to maximise resource availability in an increasingly unpredictable environment.

Keyword: Animal management; Dairying; Eastern Rif; Epipalaeolithic; Fauna; Morocco; Neolithic; Organic residue analyses

29. Progress in farm animal proteomics: The contribution of combinatorial peptide ligand libraries / Boschetti, Egisto; Hernández-Castellano, Lorenzo E.; Righetti, Pier Giorgio. Journal of Proteomics. ISSN: 1874-3919 (2019) v.197 p.1-13

DOI: 10.1016/j.jprot.2019.02.005

Abstrak: The present review covers proteomics discoveries in farm animals using combinatorial peptide ligand libraries (CPLLs). These libraries enhance the identification of low-abundance proteins by compressing the dynamic range of the protein concentration. This technology can be applied in multiple biological fluids, such as plasma or serum, follicular and cerebrospinal fluids, urine, saliva, tears seminal fluid, milk whey and even lymph. The discovery of low-abundance proteins contributes to the continuous monitoring for animal pathologies, which allows early treatment and disease prevention. Additionally, evidencing rare proteins in animal products used for human consumption can help in assessing their nutritional properties and their positive or negative effects on human health. Significance Many investigations are made on the identification of proteins of farm animals. Protein concentration changes under abnormal stressful conditions as a sign of a first physiological reaction. Many of these protein changes are of low-abundance and their detection is dependent on enrichment technologies. These changes are potentially correlated with the type of stressor and may determine actions to preserve the animal welfare.

Keyword: Animal health; Animal proteomes; Combinatorial peptide ligand libraries; Low-abundance proteins

30. Phylogenetic grouping and biofilm formation of multidrug resistant *Escherichia coli* isolates from humans, animals and food products in South-West Nigeria /Olowe, Olugbenga Adekunle; Adefioye, Olusolabomi J.; Ajayeoba, Titilayo A.; Schiebel, Juliane; Weinreich, Jörg; Ali, Aamir; Burdukiewicz, Michał; Rödiger, Stefan; Schierack, Peter. *Scientific African*. ISSN: 2468-2276 (2019) v. 6 p.e00158

DOI: 10.1016/j.sciaf.2019.e00158

Abstrak: We evaluated prevalence and distribution of antibiotic resistant *E. coli* in three categories: animals (goats, pigs, poultry, cattle, sheep), humans (butchers, meat sellers, animal farm workers, buyers) and animal food products (milk, cheese, beef, chicken, yoghurt) from selected animal farms in South-West Nigeria. The biofilm formation, phylogrouping and detection of biofilm-associated genes were further analyzed. Out of a total number of 280 samples that were collected, 216 *E. coli* strains were isolated. The prevalence of isolating *E. coli* from humans (96%) was higher than from animals (89%) and about 38.8% were isolated from animal food products. Out of these 216 *E. coli* isolates that were tested for antibiotic sensitivity, 37 were multidrug-resistant. The prevalence of isolating these multi-resistant strains was highest in the animal category (23.6%) followed by the animal food products (16.1%) and the human category (11.5%). All the multidrug-resistant isolates were capable of forming biofilm, which varied significantly with each isolate. The majority of isolates belonged to phylogroup B1. All biofilm-associated genes were detected in the antibiotic resistant isolates. The results suggest the need for continuous surveillance of antibiotic resistance, biofilm formation and virulence determinants in *E. coli* in the whole food chain.

Keyword: Animals; Antibiotic resistance; Food products; Human; Multidrug resistance; Nigeria

31. Using artificial intelligence for modeling of the realistic animal behaviors in a virtual island / Turan, Erta; Çetin, Gürca. *Computer Standards & Interfaces*. ISSN: 0920-5489 (2019) v.66 p.103361

DOI: 10.1016/j.csi.2019.103361

Abstrak: The remarkable development of the computer graphic techniques enables the creation and management of more realistic games and virtual environments. However, placing the Artificial Intelligence (AI) in a virtual world get making these environments both more interactive and more believable. One of the most ambitious goals of the AI is to create virtual worlds in which a big number of virtual characters or humans being interacted and behave in an autonomous way. For this purpose, placing embodied intelligence characters in a virtual world offers a unique opportunity to evaluate the AI concept. This paper introduces a Virtual Island developed in an innovative way based on fuzzy rules at the user interaction mechanism. We have used fuzzy tactics to create AI-based animals having various behavior types from an eagles' perspective which called 'Flight Simulation'. The simulation utilizes an eagle flying over the airspace of the Island of Chios. The AI on the ground is triggered by other animals when they enter a radius area with a certain speed defined in the software. It then decides how to behave according to health, behavior type and confidence level. Also, there is non-AI sparrow herd placed over the island to make user understand how fast he is and give the user sense of speed what can be called as an in-project feature. Consequently, the used Fuzzy Tactics have been tested in realized Unity 3D simulation. The results of the study have proven that the virtual

environment consisting AI-based animals has a good performance in terms of animal-user interactions and provided satisfactory results in run time.

Keyword: **Animal behaviors; Artificial intelligence; Fuzzy logic; Unity 3D modeling; Virtual environment**

32. Development of an animal-assisted activity program on a pediatric behavioral health unit /Fodstad, Jill C.; Bauers, Jodi; Sexton, Melissa; Butler, Melissa; Karlsson, Cassie; Neff, Mallory. *Complementary Therapies in Clinical Practice*. ISSN: 1744-3881 (2019) v. 36 p.153-157

DOI: 10.1016/j.ctcp.2019.07.001

Abstrak: Animal-assisted activities (AAA), a form of animal-assisted interaction, have the potential to improve positive coping for youth with significant psychiatric symptoms admitted to acute behavioral health units. However, little is known regarding the appropriateness of an AAA program in short-term mental health hospital settings. The goal of this investigation is to describe and report on the feasibility and acceptability of embedding a canine-AAA program within the therapeutic programming of a pediatric behavioral health unit. Both patient participants and unit staff completed quantitative and qualitative measures. Outcomes yielded preliminary data suggesting AAA was feasible and acceptable to patients and unit staff. Initial efficacy outcomes demonstrated decreases in subjective distress. Qualitative data provided areas for further refinement of the AAA program.

Keyword: **Canine; Animal assisted activities; Behavioral health; Children's hospitals; Pediatric; Pet therapy**

33. Which animal type contributes the most to the emission of antibiotic resistance genes in large-scale swine farms in China? / Zhang, Junya; Lu, Tiedong; Chai, Yufeng; Sui, Qianwen; Shen, Peihong; Wei, Yuansong. *Science of The Total Environment*. ISSN: 0048-9697 (2019) v.658 p.152-159

DOI: 10.1016/j.scitotenv.2018.12.175

Abstrak: Modern swine farms generally contain several animal types and rely extensively on the feed additives, including antibiotics and heavy metals, to augment animal growth. Nonetheless, as an important reservoir of antibiotic resistance genes (ARGs) in the environment, the ARGs emission of each animal type from swine farms has not been characterized. The goal of this study is to determine which animal type contributes the most to the ARGs emission into the environment in typical swine farms of China. Results showed that chlortetracycline (CTC), Cu and Zn were the typical feed additives, and the concentrations of antibiotics and heavy metals in the feed and swine manure were generally higher in nursery pigs (NP) than other animal types, while the gene copies of ARGs from gestation sows (GS) were the most abundant. GS released the most of antibiotics, ARGs and mobile genetic elements (MGEs) per head per day compared to other animal types. A typical swine farms with the feedstock of 10,000 pigs could release about $4.0 \pm 1.3 \times 10^{17}$ gene copies of ARGs per day, and concerning the breeding ratio and manure production coefficient, growing and fattening pigs (GFP) released the most of ARGs and antibiotics, whereas gestation sows (GS) released the most of MGEs. The different distribution of ARGs in different animal types was mainly determined by the discrepancy of microbial community composition reflected by mantel test and partial redundancy analysis (pRDA). The dominant phylum in swine manure were Firmicutes and Bacteroidetes, but Proteobacteria, Bacteroidetes and Spirochaetae played the dominant role in shaping the ARGs profiles. Antibiotics and heavy metals could have generated and maintained the ARGs profiles, whereas the proliferation and spread of ARGs could be mainly attributed to microbial community in swine manure.

Keyword: Animal types; Antibiotic resistance genes; Large-scale swine farms; Microbial community; Swine manure

34. Distinct Roles of GluA2-lacking AMPA Receptor Expression in Dopamine D1 or D2 Receptor Neurons in Animal Behavior /Shou, Jiayi; Tran, Angelica; Snyder, Natasha; Bleem, Eric; Kim, Seonil. Neuroscience. ISSN: 0306-4522 (2019) v. 398 p.102-112

DOI: 10.1016/j.neuroscience.2018.12.002

Abstrak: Dopaminergic signaling in the central nervous system regulates several aspects of animal behavior. In the dopaminergic circuits, there are two classes of neurons that can be differentiated by their expression of dopamine receptors, D1 or D2 receptors (D1Rs or D2Rs). Notably, Ca²⁺-permeable GluA2-lacking glutamate AMPA receptors (CP-AMPA) are important for gating synaptic plasticity and gene expression in neurons, and their expression particularly in the striatum affects various forms of animal behavior. However, differential effects of GluA2-lacking AMPARs in D1R or D2R neurons on animal behavior have not been addressed. Here, we employed the Cre-Lox recombination system to remove GluA2 selectively in D1R or D2R neurons to express CP-AMPA and carried out multiple behavior assays. First, the open-field assay revealed that D2R GluA2 knockout (KO) mice showed hypoactivity, while GluA2 KO in D1R neurons had no effect on locomotor activity. We also revealed that D1R GluA2 KO mice showed delayed learning in the accelerating rotarod test compared with control animals, whereas D2R GluA2 KO animals exhibited complete loss of motor learning. In the sociability test, GluA2-lacking AMPAR expression in D1R neurons induced hypersociability, whereas D2R GluA2 KO mice elicited loss of sociability. Both D1R and D2R GluA2 KO mice consumed less food compared with control animals, while D1R GluA2 KO animals showed significantly more weight gain. Finally, D1R GluA2 KO induced anti-depressant effects, while GluA2-lacking AMPAR expression in D2R neurons promoted depression-like behavior. Taken together, GluA2-lacking CP-AMPA expression in D1R and D2R neurons differentially affects animal behavior.

Keyword: animal behavior; calcium-permeable AMPA receptor; D1 receptor; D2 receptor

35. Does animal manure application improve soil aggregation? Insights from nine long-term fertilization experiments / Guo, Zichun; Zhang, Jiabao; Fan, Jun; Yang, Xueyun; Yi, Yanli; Han, Xiaori; Wang, Daozhong; Zhu, Ping; Peng, Xinhua. Science of The Total Environment. ISSN: 0048-9697 (2019) v.660 p.1029-1037

DOI: 10.1016/j.scitotenv.2019.01.051

Abstrak: Manure application is widely recognized as a method of improving soil structure and soil fertility due to additional organic matter and nutrient inputs. However, the salinity of animal manure may have a detrimental effect on soil aggregation. The objective of this study was to determine the effects of long-term animal manure application on soil aggregation, binding agents (soil organic carbon, SOC and glomalin-related soil protein, GRSP), and dispersing agents (e.g., Na⁺) and their relationships based on nine long-term fertilization experiments (12 to 39 yr) across China. The two red soil experiments (Qiyang, QY and Jinxian, JX) and one paddy soil experiment in Jinxian (JX-P) were conducted in southern China (precipitation above 1200 mm yr⁻¹), whereas the other six experiments were established in semi-humid or arid regions in China with precipitation in the range of 500–900 mm yr⁻¹. Each experiment included three treatments as follows: no fertilization (Control), inorganic fertilizer (NP or NPK), and a combination of inorganic fertilizer and animal manure (NPM or

NPKM). Long-term animal manure application not only significantly increased the biological binding agents (i.e., SOC and GRSP) in the nine experiments but also considerably increased the dispersing agents (i.e., exchangeable Na⁺) ($P < 0.05$), except for the paddy soil experiment. Consequently, soil aggregate stability increased after animal manure application in three experimental sites in southern China but not in the experimental sites in northern China. Aggregate stability had a positive relationship with SOC and GRSP in the experimental sites in southern China ($P < 0.01$) but a negative relationship with exchangeable Na⁺ in the experimental sites in northern China ($P < 0.05$). The Na⁺ accumulation in soils was negatively related to mean annual precipitation ($P < 0.001$). Our study demonstrates that the long-term application of animal manure may degrade soil structure via the Na⁺ accumulation.

Keyword: Animal manure; Binding agents; Dispersing agents; Glomalin; Soil aggregate stability; Soil aggregation

36. Effects of plant and animal high protein diets on immune-inflammatory biomarkers: A 6-week intervention trial /Markova, Mariya; Koelman, Liselot; Hornemann, Silke; Pivovarova, Olga; Sucher, Stephanie; Machann, Juergen; Rudovich, Natalia; Thomann, Ralph; Schneeweiss, Rosemarie; Rohn, Sascha; Pfeiffer, Andreas F.H.; Aleksandrova, Krasimira. Clinical Nutrition. ISSN: 0261-5614 (2019) v. p.

DOI: 10.1016/j.clnu.2019.03.019

Abstrak: Summary Background & aims Pro-inflammatory biomarkers are well-established contributors to insulin resistance and represent valid targets for diabetes management and prevention. Yet, little is known whether nutrition could play a role in modulating various aspects of immune-inflammatory responses. Our aim is to assess the effect of isocaloric animal and plant protein dietary interventions on selected biomarkers representing various immune-inflammatory pathways. Methods We enrolled 37 participants with type 2 diabetes (age 64 ± 6 years, body mass index 30.2 ± 3.6 kg/m², glycated hemoglobin $7.0 \pm 0.6\%$) who underwent an either high-animal protein (AP) or high-plant protein (PP) diet (30 E% protein, 40 E% carbohydrates, 30 E% fat) for 6-weeks. Clinical examinations were performed at beginning and end of the study. Levels of pro-inflammatory adipokines [chemerin, progranulin], cytokines [tumor necrosis factor α (TNF- α), interleukin 6 (IL-6), soluble urokinase-type plasminogen activator receptor (suPAR), transforming growth factor beta 1 (TGF- β 1)], and proteins [calprotectin, lactoferrin and growth differentiation factor 15 (GDF-15)] were determined in blood serum using enzyme-linked immunosorbent assay. Results Chemerin and progranulin concentrations decreased following AP and PP diets. TGF- β 1 increased in AP and decreased in PP, whereas calprotectin increased in PP and decreased in AP. No statistically significant differences in the concentrations of IL-6, TNF- α , suPAR, lactoferrin and GDF-15 could be seen in either of the protein diet arms. Conclusions These results suggest that both AP and PP diets may effectively reduce the levels of the pro-inflammatory adipokines chemerin and progranulin. The effects on the additional immune-inflammatory biomarkers seem to be more complex. Clinical trial registry number NCT02402985 (www.clinicaltrials.gov).

Keyword: Animal; Animal diet; Dietary protein; Inflammation; Legumes; Plant diet

37. New Large Animal Model for Aortic Aneurysms in the Viscerorenal Segment / Kalder, Johannes; Isfort, Peter; Reinartz, Sebastian Daniel; Gremse, Felix; Yamoah, Grace Gyamfuah; Gesche, Valentine; Kotelis, Drosos; Tolba, Rene; Jacobs, Michael Johan; Jalaie, Houman. *Journal of Surgical Research*. ISSN: 0022-4804 (2019) v.240 p.156-164

DOI: 10.1016/j.jss.2019.02.054

Abstrak: Background Aortic aneurysms in the viscerorenal-segment are nowadays treatable by endovascular means. Previously, new endograft techniques were only tested in healthy animals. We aimed to establish a new large animal model for testing complex endovascular stent techniques preclinically. Methods In sheep, four juxtarenal and two type IV thoracoabdominal aortic aneurysms were surgically created via a retroperitoneal approach. Two pieces out of a 10 × 15-cm bovine pericardial patch were sewn with the healthy aorta longitudinally. The viscerorenal segment was clamped, and the aorta was incised longitudinally. Then, the patches were longitudinally sewn together. In the meantime, antegrade flow through the native part of the aorta was already established by tangential clamping. Computed tomography angiography was performed after 4, 8, and 52 wk. Results Technical success was 100%. The median surgical procedure time was 3 h, the median blood loss was 210 mL, and the viscerorenal-segment clamping time was 2-4 min. The animals started drinking 1 h after arousal from anesthesia. One animal died after 1 wk because of delayed bleeding and another died after 1 y because of aneurysm rupture by a secondary bacterial infection. Four animals survived. The proximal landing zone diameter and the clock position of the vessel were stable over 52 wk. Conclusions Surgical creation of an aortic aneurysm in the viscerorenal-segment in sheep was successful, without an ischemia/reperfusion injury. This animal model offers a new platform for evaluating innovative endovascular therapy options in vivo.

Keyword: **Animal; Aorta; Aortic aneurysm; Endovascular procedures; Models**

38. Effects of lithium and valproate on ERK/JNK signaling pathway in an animal model of mania induced by amphetamine /Valvassori, Samira S.; Gava, Fernanda F.; Dal-Pont, Gustavo C.; Simões, Henio Leonardo; Damiani-Neves, Marcela; Andersen, Monica Levy; Boeck, Carina Rodrigues; Quevedo, João. *Heliyon*. ISSN: 2405-8440 (2019) v. 5 p.e01541

DOI: 10.1016/j.heliyon.2019.e01541

Abstrak: Bipolar disorder (BD) is a severe and chronic psychiatric disorder, characterized by recurrent mood episodes of depression and mania. Some studies have indicated that there are ERK and JNK pathways alterations in the brain from bipolar patients. The animal model of mania induced by dextroamphetamine (d-AMPH) has been considered an excellent model to study intracellular alterations related to BD. The present study aimed to evaluate the effects of lithium (Li) and valproate (VPA) on the behavioral and ERK1/2/JNK1/2 signaling pathway in an animal model of mania induced by d-AMPH. Wistar rats were first given d-AMPH or saline (Sal) for 14 days, and then, between the 8th and 14th days, the rats were treated with Li, VPA, or Sal. The open-field test was used to evaluate the locomotion and exploration behaviors of rats. The levels of phosphorylated ERK1/2 and JNK1/2 were assessed in the hippocampus and frontal cortex of the rats. Li and VPA reversed the increased of locomotion and exploration induced by d-AMPH. The treatment with VPA or AMPH per se decreased the levels of pERK1 in the hippocampus. The treatment with VPA in the animals submitted to the administration of d-AMPH decreased the levels of ERK1, JNK-1, and JNK-2 phosphorylated in the

hippocampus of the animals. The treatment with Li decreased the JNK-1 phosphorylated in the hippocampus of the animals submitted to the animal model of mania induced by d-AMPH. Although the association of VPA plus amphetamine alters some proteins involved in the JNK pathway in the hippocampus, these alterations were very random and seemed that were not related to the d-AMPH-induced manic-like behavior. These results suggest that the manic-like effects induced by d-AMPH and the antimanic effects of mood stabilizers, Li and VPA, are not related to the alteration on ERK1/2 and JNK1/2 pathways.

Keyword: Molecular biology; Neuroscience

39. Modelling animal health as a production factor in dairy production- a case of low somatic cell counts in Swedish dairy agriculture / Telldahl, C.; Hansson, H.; Emanuelson, U.. *Livestock Science*. ISSN: 1871-1413 (2019) v.230 p.103840

DOI: 10.1016/j.livsci.2019.103840

Abstrak: Disease in livestock is an undesirable factor in the production process. It lowers the profit margins of the producers and causes unnecessary suffering to the animals. For dairy production, mastitis is the most common disease, which negatively affects animal welfare, increases production costs, and reduces milk yield. The purpose of this study was to estimate the impact of animal health on dairy production and to introduce a model that can be generally used to assess the effect of animal health on production. Empirical data were obtained from farm-level accounting data of a sample of 99 Swedish dairy producers combined with biological information of the dairy herds. A multiple regression analysis, applying both a Cobb-Douglas and a Translog functional form, was used to investigate how animal health affects production. Animal health was proxied by the inverse of the bulk tank somatic cell count, which is taken to reflect higher levels of animal health. The results suggest that animal health plays a significant role in the production process of dairy farming. The study illustrates how the production output may change when animal health is improved, through its impact on production function. The model developed in this study can be a useful tool for evidence-based counselling in order to help dairy farms become more efficient in their mastitis management process. The model and the approach taken here can also be useful for other livestock production systems to investigate how animal health affects production.

Keyword: Dairy cows; Economic consequences; Mastitis; Sweden

40. Probiotic treatment improves the impaired spatial cognitive performance and restores synaptic plasticity in an animal model of Alzheimer's disease / Rezaei Asl, Zahra; Sepehri, Gholamreza; Salami, Mahmoud. *Behavioural Brain Research*. ISSN: 0166-4328 (2019) v. 376 p.112183

DOI: 10.1016/j.bbr.2019.112183

Abstrak: Studies demonstrate that damage to gut microbiota is associated with some brain disorders including neurodegenerative diseases such as Alzheimer's disease (AD). Accordingly, supporting gut microbiota has been considered as a possible strategy for AD treatment. We evaluated behavioral and electrophysiological aspects of the brain function in an animal model of AD made by intracerebroventricular injection of β -amyloid. Two groups of control rats received either water as vehicle (Con) or probiotics (Pro + Con). Also two groups of Alzheimeric animals were treated by either vehicle (Alz) or probiotics (Pro + Alz). Sham group was only subjected to surgical procedure and

received the vehicle. Spatial learning and memory was assessed in Morris water maze. Also, basic synaptic transmission and long-term potentiation (LTP) were assessed by recording field excitatory postsynaptic potentials (fEPSPs) in hippocampus. Change in anti-oxidant/oxidant factors was assessed via measuring plasma level of total anti-oxidant capacity (TAC) and malondialdehyde (MDA). Brain staining was done to confirm β -amyloid accumulation. Fecal bacteria quantification was accomplished to find how probiotic supplement affected gut microbiota. We found that while the Alz animals displayed a weak spatial performance, probiotic treatment improved the maze navigation in the Pro + Alz rats. Whereas basic synaptic transmission remained unchanged in the Alz rats, LTP was suppressed in this group. Probiotic treatment significantly restored LTP in the Pro + Alz group and further enhanced it in the Pro + Con rats. The intervention also showed a favorable effect on balance of the anti-oxidant/oxidant biomarkers in the Pro + Alz rats. This study provides the first proof on positive effect of probiotics on synaptic plasticity in an animal model of AD.

Keyword: Probiotics; Alzheimer's disease; Animal model; Long- term potentiation; Spatial memory

41. The use of animal-borne cameras to video-track the behaviour of domestic cats / Huck, Maren; Watson, Samantha. *Applied Animal Behaviour Science*. ISSN: 0168-1591 (2019) v.217 p.63-72

DOI: 10.1016/j.applanim.2019.04.016

Abstrak: Free roaming domestic animals can have a profound effect on wildlife. To better understand and mitigate any impact, it is important to understand the behaviour patterns of the domestic animals, and how other variables might influence their behaviour. Direct observation is not always feasible and bears the potential risk of observer effects. The use of animal-borne small video-cameras provides the opportunity to study behaviour from the animal's point of view. While video-tracking has been used previously to study specific aspects of the behaviour of a species, it has not been used so far to determine detailed time-budgets. The aim of this study was to provide and validate an ethogram based on cat-camera footage collected from 16 cats (*Felis catus*). The methodology was validated comparing films recorded simultaneously, from both collar-mounted video recorders and hand-held video recorders. Additionally, the inter-observer reliability of scorers was measured. Continuous and instantaneous recording regimes were compared, and behavioural accumulation curves were evaluated to provide further technique recommendations for video-tracking cats. Video-tracking allows scoring of behaviour as reliably as direct observation (linear mixed effects model: $t < 0.001$, $P = 0.99$; $df = 14$ in 7 cats; Cohen's $\kappa = 0.88$). Furthermore, inter-observer reliability was high (Cohen's $\kappa = 0.72$) and was not significantly different from 0.8 (one-sample t -test: $t = 1.15$, $df = 5$, $P = 0.30$), indicating that the method is not subject to bias in observers. Recommendations are given for the most efficient scoring protocol to reliably record feline behaviour. While the validation was concerned with cat behaviour, the approach can be easily adapted for a variety of domestic species, as well as some captive animals. Video-tracking offers a new avenue to investigate both general time-budgets and more specific behaviours such as foraging or space use from the animal's point of view and in its normal environment, without restrictions to movement. Insights gained through video-tracking will be relevant to various conservation and animal welfare issues.

Keyword: Ethogram; Inter-observer reliability; Recording rules; Time-budget; Video-tracking