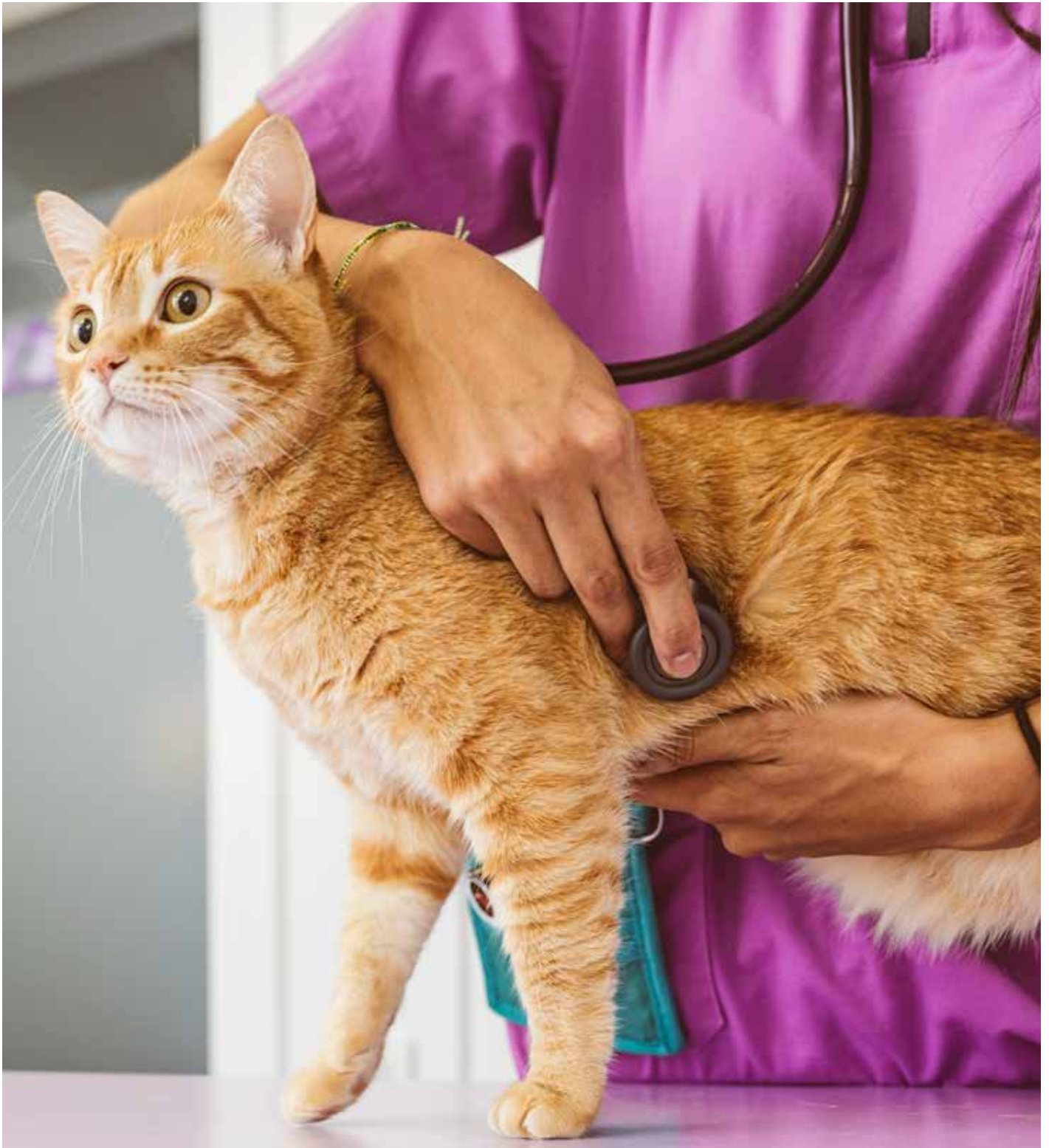


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# VETS WOULD NOT MANAGE COVID-19 THIS WAY

BY DICK SIBLEY AND JOE BROWNLIE

**VETERINARY SURGEONS WITH ANY EXPERIENCE IN DEALING WITH INFECTIOUS DISEASE AND POPULATION MEDICINE WILL BE LOOKING AT THE GOVERNMENT'S CURRENT MANAGEMENT OF THE COVID-19 EPIDEMIC WITH DISMAY.**

The current approach is to manage the epidemic to fit the critical care capacity of the NHS - something that has been under-resourced over many years. It is a strategy not so much to save lives but to delay deaths.

But this policy could also wreck our economy and drive many businesses (including veterinary practices) into financial ruin. Livestock vets have experience of successfully managing national disease outbreaks. They understand the confounding factors that are important when determining strategies for delivering disease prevention and control on a major scale, including health, welfare, economics and political palatability: issues that are perplexing current policymakers.

The mathematical models that are driving current policy have a poor record of credibility; they predicted over 500,000 deaths and nearly 200,000 sick people requiring critical care at the peak of the epidemic. Understandably, the prospect of people dying in corridors and ambulance car parks is politically unacceptable, so the government was keen to find other ways to flatten the predicted epidemic curve. They opted to reduce overall transmission and spread the epidemic over a longer period - more of a system of delaying deaths than saving lives.

It is unfortunate that the medical world has historically invested in therapeutics, diagnostics, technologies and even bigger hospitals to treat the sick rather than the preventive medicine that has become the cornerstone of the veterinary world. The predict-and-prevent strategies that are familiar to any livestock vet seem to be alien to the medical policymakers who choose to expand treatment centres rather than invest in prevention programmes.

Most of us accept that this disease is not going to go away. We have written an accompanying Research Comment in this issue of *Vet Record* (see p 446-448), which reviews the emergence and characteristics of coronaviruses, including Covid-19. This very successful virus will circulate in world populations for years to come. The only effective long-term control to minimise new infections will be through developing immunity, either by managed exposure or vaccination, while at the same time accepting that there will always be vulnerable individuals requiring intensive treatment and support.

Those vulnerable individuals that would require hospital admission through being severely affected by the virus can be

predicted and protected, enabling the NHS to cope, while the more resilient are exposed and become immune in a controlled way. The government's strategy of spreading the number of inevitable deaths over a longer time frame - in order to make the death rate more palatable to a figure-hungry news media and confused public - seems an odd way to go about controlling a disease, and unacceptable to any livestock vet. Imagine explaining to a farmer during a major bovine respiratory disease outbreak that the best solution would be to accept the mortalities, but spread them over a longer period so they don't seem so bad.

If this was an animal disease outbreak, with similar infectivity, economic connotations and variable clinical outcomes, vets would apply the four pillars of disease control to manage it: biosecurity, biocontainment, surveillance and resilience.

Biosecurity protects a population by managing the risks of disease entering that population, while biocontainment manages the risks of the disease spreading within a population. When we as vets approach an infectious disease outbreak, whatever the cause and whatever the scale, we use these principles to devise strategy options and select the most appropriate for the situation at the time.

Biosecurity is second nature to any livestock vet: most of us in livestock practice are educated, examined and even audited in biosecurity theory and practice as part of our official veterinarian validation. Our clients run livestock units with absolute adherence to biosecurity as a norm.

Biosecurity against Covid-19 has been lamentable, with known focuses of infection in specific areas of the world being allowed to widely disseminate the disease into numerous new infection sites. Coincidentally, China is undergoing an epidemic of African swine fever that has decimated its pig population. We have extraordinary systems to keep the disease out of the UK - try carrying a pig in your hand luggage through Heathrow. But we happily accepted human traffic from known Covid-19-infected areas without any effective biosecurity, other than a polite request to individuals to voluntarily isolate themselves for a few days on arrival.

Once a disease is endemic in a population, biocontainment (the multiplier of disease) must be effectively managed. Probably the most familiar disease that we see in veterinary practice that emulates the Covid-19 epidemic is the large-scale outbreaks



of respiratory disease in intensive livestock units, a day-to-day experience in our normal working lives when working in commercial livestock veterinary practice.

Bovine respiratory disease is a common syndrome affecting numerous cattle populations every winter. It is caused by a complex of respiratory pathogens, but like Covid-19, they have high infectivity with variable clinical outcomes due to differences in susceptibility, resilience and doses of pathogenic exposure.

Control in the first instance is by rigorous and robust biocontainment: isolating the infected animals from the susceptible, improving air space and air quality for the whole population and protecting the most vulnerable. The idea of mixing the infected, infectious and vulnerable, packing them tightly into concentrated air spaces with noxious air quality, and then moving them over large distances to seed the infection to other susceptible populations would be regarded as foolhardy, if not negligent. It may be no coincidence that the major Covid-19 hotspots have been in cities with underground mass transport systems. Moving animals in such conditions would be illegal in the UK.

As livestock vets, we understand the principles of surveillance, and how testing plays an important part in managing and monitoring disease. However, we also understand the limitations of laboratory tests, their sensitivities, specificities, the need for active and passive surveillance and the use of surveillance to identify and categorise the disease status of populations and individuals.

We also understand the difference between disease prevalence and incidence, and test prevalence and incidence. Our extensive experience with mass testing programmes, such as currently being conducted on the majority of our cattle farms for John's disease, bovine viral diarrhoea virus, bovine TB and other problematical infections, allows us to understand that tests are rarely totally sensitive and specific, always require careful and skilled interpretation and need strategic use to be useful.

However, vets have the big advantage of having major databases and individual animal identification, introduced after difficult disease experiences such as the management, control and eradication of bovine spongiform encephalopathy. Privacy laws, the antagonisms towards identification cards and a political aversion to national databases will stifle effective systems for surveillance and disease categorisation. The current surveillance

strategies for Covid-19 appear confused, inappropriate and undeliverable.

Any vet will understand that resilience is essential to manage long-term disease control, whether that be by a managed, controlled exposure and immunity, or by vaccination or by a combination of both. No single infectious disease has ever decimated a population: there is always a natural variation in resilience that may reflect an evolutionary safeguard to ensure survival.

In any managed exposure, we can usually predict the particularly vulnerable (eg, breeds, age cohorts, those with concomitant infections etc) and protect them, while the most resilient are exposed and become immune. Vaccination allows us to improve resilience, but it has its limitations. Only two viral diseases have ever been eradicated from the world: our own veterinary heroes, Walter Plowright and Peter Roeder oversaw the eradication of rinderpest from the world's cattle population using an effective vaccination, and the infamous Edward Jenner started the control and eventual eradication of smallpox using a vaccine derived from a cow disease - although it took 200 years.

The key to managing Covid-19, if it were a disease in a veterinary context, would be to apply the key four pillars of control concurrently. In practical terms, that would mean managing the exposure of at least 60 per cent of the population who could be identified as being resilient to severe clinical outcomes, while protecting the 40 per cent who could be defined as vulnerable, if necessary by creating biosecure Covid-19-free zones. That would allow releasing the 60 per cent from lockdown while ensuring the vulnerable robustly restrict their exposure to infection.

If there is anything fortunate in this ghastly experience, it is that most of the vulnerable can be readily identified, protected and kept out of the intensive care units; they are generally not the economic generators within the population. The young, fit, slim, non-smokers could be left to get on with creating the wealth that we are going to need to secure our futures, instead of being locked away waiting for the inevitable.

Dick Sibley is the director and principal of West Ridge Veterinary Practice in Devon.

Joe Brownlie is an honorary research fellow at the University of Bristol and an emeritus professor of veterinary pathology at the Royal Veterinary College, London.

# PACE YOURSELF

BY SIMON PALMER

When my grandfather was in his early 80s, he was driving back from his regular morning swim at a friend's pool at 630am when the police pulled him over. They said that he had been driving erratically and they had been trying to get his attention with their sirens for a few blocks. The police took him home in the back of the police car and that was the end of his driving career. Looking back at the situation, I think the whole family was aware of the incremental degradation of his faculties over the previous few years, and perhaps there should have been an earlier intervention. It was lucky, under the circumstances, that no one was hurt by his poor driving skills in his last few years behind the wheel.

Fortunately, in Australia we don't rely solely on self-regulation when it comes to driving. Once you reach a senior age (it varies in different states), it is mandatory that you take a regular test to ensure that you are fit to drive. It is the same with commercial airline pilots, at a much younger age. Federal Judges, firefighters and policemen don't have such a test. They have a mandatory retirement age that differs from state to state.

Why do we do this to experienced, senior professionals...? Surely, with their extra years of experience in their field comes more knowledge, insight, diagnostic ability and muscle memory, which younger professionals don't have?

I think the answer is obvious. We, as a society, recognise that with age comes compromises to our physical and mental aptitude. Vision, hearing, agility, dexterity and stamina all become compromised at some point as we age, and degradation in processing speed and decision-making is inevitable. If your profession comes with the ability to impact on the wellbeing of other people's lives (like a judge or commercial pilot), Australia (and other countries) has enforced age limits, to ensure that people are protected from professionals whose age could physically or mentally compromise them...

Somehow, there is no mandatory testing of physical or mental aptitude for surgeons, dentists or Vets at any age, in order to remain registered and practicing. Doctors, dentists and vets are lucky to be able to rely on self-regulation to determine when it is time to hang up the tools.

With that lack of regulatory oversight comes a huge burden of responsibility and obligation that vets and their families owe the public, to keep an eye on their own fatigue and faculties. Vets need to be able to look beyond their own financial, lifestyle and identity preferences and recognise when it is time to retire. While there will always be a few who will hang in there too long, the vast majority of the profession has a high level of professional integrity and retires long before compromises to their faculties ever impact on their clinical abilities.

If you are a vet who can see that a gradual degradation in vision, back/neck pain or fatigue is beginning to creep in and dictate your clinical choices, it might be time to start thinking about an exit plan. It doesn't need to be an all-or-nothing decision. If you aren't ready to retire, many find that by cutting down their clinical hours to part-time (fewer weeks per year, fewer days per week, fewer hours per day), their chronic pain and fatigue is much more manageable, and that they are able to keep practicing quality, uncompromised for longer.

If you are a practice owner, this scale-back will need to be done carefully, so as to not compromise the revenue, profit and underlying sale value of the practice. The senior vet either has to replace themselves in the practice as they scale down, or sell before they scale down, and work in the practice as an employee/contractor in their last years in practice.

When you have a fixed date of retirement, you can and should sprint to the finish and work hard to the end. When you want to keep working as long as possible, you need to pace yourself. All vets owe it to their patients, community and their own legacy to ensure that the reputation they built through the provision of many years of proud, high-calibre veterinary service is not undermined by compromises in their final years of practice.

Simon Palmer is the Founder and Managing Director of Practice Sale Search, the leading practice brokerage in Australia, with the region's largest database of registered buyers and practices for sale. **For more information, call 1300 282 042 or email [info@practicesalesearch.com.au](mailto:info@practicesalesearch.com.au).**





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# HOW OLD ARE DOGS IN HUMAN YEARS? NEW METHOD BETTER THAN ‘MULTIPLY BY 7’

How old is your tail-wagging bundle of joy in human years? According to the well-known “rule of paw,” one dog year is the equivalent of 7 years. Now, in a study published in July, in the journal *Cell Systems*, scientists say it’s wrong. Dogs are much older than we think, and researchers devised a more accurate formula to calculate a dog’s age based on the chemical changes in the DNA as organisms grow old.

Dogs share the same environment as their owners and receive almost the same standard of health care as humans, providing a unique opportunity for scientists to understand ageing across species. Like humans, dogs follow similar developmental trajectories that lead them to grey and become more susceptible to age-related diseases over time. However, how they age on a molecular level is more complicated - ageing rapidly at first and slowing down later in life.

**“In terms of how physiologically mature a 1-year-old dog is, a 9-month-old dog can have puppies. Right away, you know that if you do the math, you don’t just times seven,” says senior author Trey Ideker of the University of California, San Diego. “What’s surprising is exactly how old that one-year-old dog is - it’s like a 30-year old human.”**

Human and dog DNA, which codes who we are, doesn’t change much throughout the course of life, but chemical marks on the DNA, called methylation marks, do. Ideker considers these marks like wrinkles in the genome. “I tend to think of it very much like when you look at someone’s face and guess their age based on their wrinkles, grey hair, and other features,” he says. “These are

just similar kinds of features on the molecular level.”

The researchers studied 104 Labrador retrievers spanning from few-week-old puppies to 16-year-old dogs with the help of two canine experts, Danika Bannasch of the University of California, Davis, and Elaine Ostrander of the National Institutes of Health. They compared the changes in the methylation pattern to humans.

The comparison revealed a new formula that better matches the canine-human life stages:  $\text{human age} = 16 \ln(\text{dog age}) + 31$ . Based on the new function, an 8-week-old dog is approximately the age of a 9-month-old baby, both being in the infant stage where puppies and babies develop teeth. The average 12-year lifespan of Labrador retrievers also corresponds to the worldwide life expectancy of humans, 70 years.

“I like to take my dogs on runs, and so I’m a little bit more sympathetic to the 6-year-old now,” says Ideker, who realised that his dog is pushing 60 according to the new calculation.

In both species, they found that the age-driven methylation largely happens in developmental genes that are hotly fired up to create body plans in utero and regulating childhood development. By the time one becomes an adult and stops growing, “you’ve largely shut off these genes, but they’re still smouldering,” says Ideker. “If you look at the methylation marks on those developmental genes, they’re still changing.”

Focusing on the smouldering developmental genes, the team developed a clock that can measure age and physiological states across different species, while other methylation-quantifying age-predicting methods only do well in one species. Ideker also noted that future investigation in different dog breeds with various lifespans could provide more insight into the new clock. The clock may not only serve as a tool to understand cross-species ageing but also apply as clinical practice for veterinarians to take proactive steps to treat animals.



#### Journal Reference:

Tina Wang, Jianzhu Ma, Andrew N. Hogan, Samson Fong, Katherine Licon, Brian Tsui, Jason F. Kreisberg, Peter D. Adams, Anne-Ruxandra Carvunis, Danika L. Bannasch, Elaine A. Ostrander, Trey Ideker. Quantitative Translation of Dog-to-Human Aging by Conserved Remodeling of the DNA Methylome. *Cell Systems*, 2020; DOI: 10.1016/j.cels.2020.06.006



# SLEDGE DOGS ARE CLOSELY RELATED TO 9,500-YEAR-OLD 'ANCIENT DOG'

Sledge dogs are much older and have adapted to Arctic conditions much earlier than previously thought. In a new study from the QIMMEQ project, researchers from the University of Copenhagen show that ancestors of modern sledge dogs have worked and lived with humans for over 9,500 years.

Dogs play an important role in human life all over the world - whether as a family member or as a working animal. But where the dog comes from and how old various groups of dogs are is still a bit of a mystery.

Now, light has been shed on the origin of the sledge dog. In a new study published in SCIENCE, researchers from the Faculty of Health and Medical Sciences, University of Copenhagen, show that the sledge dog is both older and has adapted to the Arctic much earlier than thought. The research was conducted in collaboration with the University of Greenland and the Institute of Evolutionary Biology, Barcelona.

"We have extracted DNA from a 9,500-year-old dog from the Siberian island of Zhokhov, which the dog is named after. Based on that DNA we have sequenced the oldest complete dog genome to date, and the results show an extremely early diversification of dogs into types of sledge dogs," says one of the two first authors of the study, PhD student Mikkel Sinding, the Globe Institute.

Until now, it has been the common belief that the 9,500-year-old Siberian dog, Zhokhov, was a kind of ancient dog - one of the earliest domesticated dogs and a version of the common origin of all dogs. But according to the new study, modern sledge dogs such as the Siberian Husky, the Alaskan Malamute and the Greenland sledge dog share the major part of their genome with Zhokhov.

"This means that modern sledge dogs and Zhokhov had the same common origin in Siberia more than 9,500 years ago. Until now, we have thought that sledge dogs were only 2-3,000 years old," says the other first author, Associate Professor Shyam Gopalakrishnan, Globe Institute.

## The Original Sledge Dog

To learn more about the origins of the sledge dog, researchers have further sequenced genomes of a 33,000-year-old Siberian wolf and ten modern Greenlandic sledge dogs. They have compared these genomes to genomes of dogs and wolves from around the world.

"We can see that the modern sledge dogs have most of their genomes in common with Zhokhov. So, they are more closely related to this ancient dog than to other dogs and wolves. But not just that - we can see traces of crossbreeding with wolves such as the 33,000-year-old Siberian wolf - but not with modern wolves. It further emphasises that the origin of the modern sledge dog goes back much further than we had thought," says Mikkel Sinding.

The modern sledge dogs have more genetic overlap with other modern dog breeds than Zhokhov has, but the studies do not show us where or when this occurred. Nevertheless, among

modern sledge dogs, the Greenland sledge dogs stands out and has the least overlap with other dogs, meaning that the Greenland sledge dog is probably the most original sledge dog in the world.

## Common Features with Inuit and Polar Bears

In addition to advancing the common understanding of the origin of sledge dogs, the new study also teaches the researchers more about the differences between sledge dogs and other dogs. Sledge dogs do not have the same genetic adaptations to a sugar and starch rich diet that other dogs have. On the other hand, they have adaptations to high-fat diets, with mechanisms that are similar to those described for polar bears and Arctic people.

**"This emphasises that sledge dogs and Arctic people have worked and adapted together for more than 9,500 years. We can also see that they have adaptations that are probably linked to improved oxygen uptake, which makes sense in relation to sledding and give the sledding tradition ancient roots," says Shyam Gopalakrishnan.**



## Journal Reference:

Mikkel-Holger S. Sinding, Shyam Gopalakrishnan, Jazmin Ramos-Madrigal, Marc De Manuel, Vladimir V. Pitulko, Lukas Kuderna, Tatiana R. Feuerborn, Laurent A. F. Frantz, Filipe G. Vieira, Jonas Niemann, Jose A. Samaniogo Castruita, Christian Carøe, Emilie U. Andersen-Ranberg, Peter D. Jordan, Elena Y. Pavlova, Pavel A. Nikolskiy, Aleksei K. Kasparov, Varvara V. Ivanova, Eske Willerlev, Pontus Skoglund, Merete Fredholm, Sanne Eline Wennerberg, Mads Peter Heide-Jørgensen, Rune Dietz, Christian Sonne, Morten Meldgaard, Love Dalén, Greger Larson, Bent Petersen, Thomas Sicheritz-Pontén, Lutz Bachmann, Øystein Wiig, Tomas Marques-Bonet, Anders J. Hansen, M. Thomas P. Gilbert. Arctic-adapted dogs emerged at the Pleistocene-Holocene transition. *Science*, 2020; 368 (6498): 1495-1499  
DOI: 10.1126/science.aaz8599

# RESEARCHERS BOOST KOALA SPOTTING SYSTEM

Queensland University of Technology researchers have published an improved and innovative method for estimating the number of koalas in an area detected by using drones and an artificial intelligent algorithm as they continue the quest of identifying surviving koala populations in bushfire areas.

In an article published in the journal *Ecology and Evolution*, the researchers led by Associate Professor Grant Hamilton detail the statistical method that uses the number of koalas automatically detected in infrared images of bushland as a starting point.

Their previous research, published in the *Nature* journal *Scientific Reports*, showed their system was more reliable and less invasive than traditional animal population monitoring techniques.

Professor Hamilton, who co-authored the latest study with PhD student Evangeline Corcoran and Dr Simon Denman, said all methods for spotting koalas in heavy bushland faced challenges, whether spotters used traditional methods such as people looking up at the trees, dogs brought in to sniff out the koalas or high-tech tools such as infrared drones.

“All abundance estimation methods are at least a bit wrong - that’s why they’re called estimates,” Professor Hamilton said.

The lead author on the article, Evangeline Corcoran, said that finding wildlife in a complex environment could be very challenging.

“We never have perfect knowledge, so we never know exactly how many koalas were there when we do a count,” Ms Corcoran said.

**“No matter how accurate the drone cameras, a koala could be hiding behind a branch when the drone flies over the area or perhaps one koala is counted twice in an aerial survey.**

“That’s why we generally have a margin of error. We use different terminology, but for example in general terms our current count might have an error margin of plus or minus ten per cent. That means we’re confident that the true number of koalas is somewhere within the margin of error

“By accounting for different factors about the site that can impact on how many koalas we detect, we’re making the margin of error smaller and so making our estimates more accurate.

“In this way, we are deriving a count figure that accounts for more factors such as temperature, which is an important consideration because our thermal cameras give a more accurate estimate when its colder, and the density of the forest canopy.”

Professor Hamilton is currently involved in a project in which he is using his artificial intelligence (AI) system that uses drones and infrared imaging in a collaborative project to count Kangaroo Island’s surviving koala population after the recent devastating bushfires.

Professor Hamilton’s system for detecting koalas in bushland begins with drones fitted infrared cameras covering an area in a “lawnmower” pattern at early morning and during the colder months so that the heat of the koalas better stands out.



Associate Professor Grant Hamilton is using AI to find koalas in areas hit by bushfires. Photo credit: Queensland University of Technology

## Journal Reference:

Evangeline Corcoran, Simon Denman, Grant Hamilton. New technologies in the mix: Assessing N-mixture models for abundance estimation using automated detection data from drone surveys. *Ecology and Evolution*, 2020; DOI: 10.1002/ece3.6522



# GENETIC STUDY OF ARABIAN HORSES CHALLENGES SOME COMMON BELIEFS ABOUT THE ANCIENT BREED

A study involving Arabian horses from 12 countries found that some populations maintained a larger degree of genetic diversity and that the breed did not contribute genetically to the modern-day Thoroughbred, contrary to popular thought.

An international team of scientists was led by the University of Florida's Samantha Brooks, a UF/IFAS assistant professor of animal sciences; Cornell University's Doug Antczak, the Dorothy Havemeyer McConville Professor of Equine Medicine at the Baker Institute for Animal Health; and Andy Clark, the Jacob Gould Schurman Professor in Cornell's department of molecular biology and genetics.

The group collected and examined DNA samples from 378 Arabian horses from Qatar, Iran, UAE, Poland, USA, Egypt, Jordan, Kuwait, United Kingdom, Australia, Denmark and Canada. The research, published in June in the journal *Scientific Reports*, was conducted over an 8-year period, beginning in 2014 before Brooks made the move from Cornell to UF. The process was a lot of effort, she said, in part due to traveling to collect the Arabians' blood and hair samples, as well as natural delays in working with international colleagues to collect and ship other samples.

The samples were anonymised for data analysis purposes, except to note the horse's location and categorising them as endurance competition, flat course racing or show horses. The data set was also expanded using information from past studies on other breeds, which included Thoroughbreds, Persian Arabian, Turkemen and Straight Egyptians.

"The Arabian horse has a special mystique due to the long recorded history of the breed," Brooks said. "Arabian horse breeders, in particular, know their horse's bloodlines many generations back. What we found was that in the area where this breed originates - likely the near East region, but we don't know exactly - there's a healthy level of diversity. This is particularly evident in populations from Bahrain and Syria, which suggests these are some pretty old populations."

The horse is prized for characteristics like heat tolerance and endurance, as well as its unique appearance, with a dish-shaped facial profile, wide-set eyes, an arched neck and a high tail carriage. It has been exported from its ancestral homeland for centuries, with some modern lineages drawn strictly from these smaller genetic pools, giving the breed a reputation for inbred disorders. While this was true for some groups they tested, Brooks noted, they also found remarkable diversity when considering the breed as a whole.

Brooks contrasted the discovery of more diverse populations with the samples they received from racing Arabians. Another longstanding myth says that the Arabian contributed genetically to the modern Thoroughbred, but the racing Arabians' DNA told a different story.

**"What we found in these samples was not that much Arabian ancestry was part of the Thoroughbred line, but the opposite: that Thoroughbred DNA exists in most of the modern racing Arabian lines, indicating a more recent interbreeding within this**

**group," Brooks said. "I can't speculate on the how or why, but this is clearly the story the DNA is telling us."**

Another implication of this study, Brooks said, is the potential to identify the genetic regions that determine some of the Arabian's unique traits, like their facial profile. This could be expanded to identify the marker for other horse breeds' head shapes, for example.

The study has a long list of co-authors, with contributors from the University of Tehran, Iran; Weill Cornell Medical College in Qatar; the University of Kentucky; the University of Agriculture in Kraków, Poland; the Hong Kong Jockey Club; the Equine Veterinary Medical Center in Doha, Qatar; and the University of Veterinary Medicine Vienna, Austria. Elissa Cosgrove from the Clark lab and Raheleh Sadeghi, a visiting scientist from Iran in the Antczak lab, shared first co-authorship of the study.

"An exceptional aspect of this project was the wonderful level of open collaboration and sharing of resources by veterinary geneticists, equine scientists, and horsemen from around the world," Antczak said. "It was a great pleasure to conduct this global study for the benefit of the horse."

#### Journal Reference:

Cosgrove, E.J., Sadeghi, R., Schlamp, F. et al. Genome Diversity and the Origin of the Arabian Horse. *Sci Rep* 10, 9702 (2020). <https://doi.org/10.1038/s41598-020-66232-1>





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# WHAT CAN ANIMAL CORONAVIRUSES TELL US ABOUT EMERGING HUMAN CORONAVIRUSES?

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BY JOE BROWNLIE, EMERITUS PROFESSOR AND DICK SIBLEY

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**DISEASES ARE CONTINUALLY EMERGING. A CONSERVATIVE ESTIMATE IS THAT THERE IS ONE NEW HUMAN DISEASE EVERY EIGHT MONTHS, WITH EVEN MORE EMERGING IN ANIMALS.**

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In 2008, the UK Government's Foresight programme investigated the potential threat of new and emerging diseases.<sup>1,2</sup> Of the eight categories of diseases that were considered to be particularly important, three were prescient of the present severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. These were novel diseases, zoonotic infections and acute respiratory diseases.<sup>1</sup>

The successful control of global diseases is dependent on a number of factors. The most common natural control comes from sufficient members of the population having immunity to the infection (ie, herd immunity). However, this can break down when either the pathogen mutates, as we regularly see with influenza viruses, or the host becomes immunosuppressed.

Herd immunity can be enhanced by vaccination, but with newly emerging diseases there is insufficient time to develop, test, regulate and produce effective vaccines to influence the first 'wave' of an epidemic. So, as we are now with the present SARS-CoV-2 pandemic, we need to understand the pathology, epidemiology, viral shedding patterns and survival outside of the host to make informed but intuitive decisions for disease control.

## Coronaviruses

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Coronaviruses are enveloped, single-stranded, positive-sense RNA viruses that infect a wide variety of species, including people, livestock and companion animals. These viruses display exceptional genetic plasticity, driven by the accumulation of point mutations and recombination events. This genetic variation is responsible for the emergence of viral strains with increased virulence, different tissue tropism and/or an expanded host range.

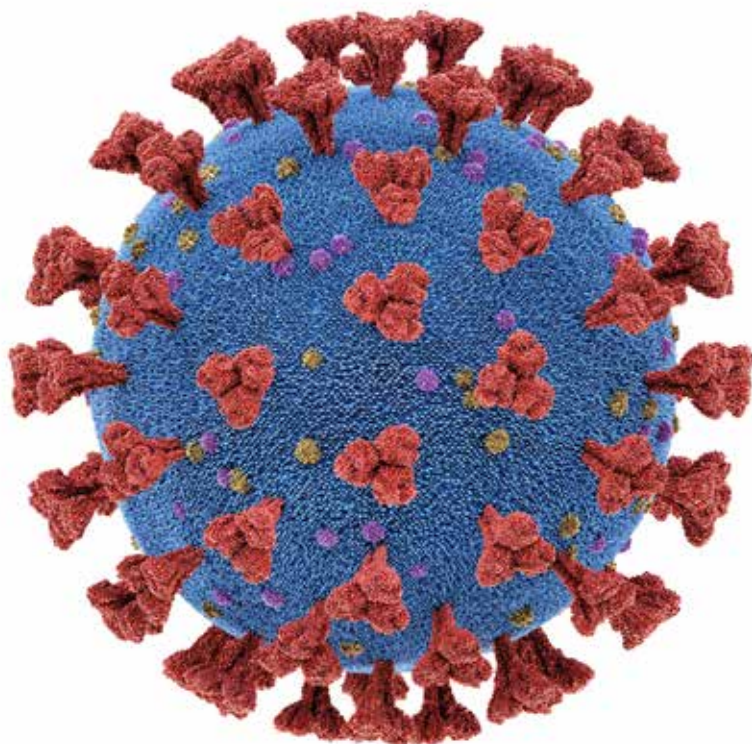
Coronaviruses are currently classified within four genera, Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus (*Box 1*). Many alphacoronaviruses and betacoronaviruses have their origin in bats, while gammacoronaviruses and deltacoronaviruses tend to have their origin in birds.

### Box 1: Representative viruses within the four coronavirus genera

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- Alphacoronaviruses: human coronavirus 229E, human coronavirus NL63, bat coronavirus HKU8, porcine epidemic diarrhoea virus, porcine respiratory coronavirus, transmissible gastroenteritis virus, bat coronavirus HKU2, canine [enteric] coronavirus, feline coronavirus
  - Betacoronaviruses: human coronavirus OC43, human coronavirus HKU1, murine coronavirus, bat coronavirus HKU5, bat coronavirus HKU9, severe acute respiratory syndrome-related coronaviruses (SARS-CoV and SARS-CoV-2), bat coronavirus HKU4, Middle East respiratory syndrome-related coronavirus, hedgehog coronavirus, bovine coronavirus, canine respiratory coronavirus, equine coronavirus, porcine haemagglutinating encephalomyelitis virus
  - Gammacoronaviruses: infectious bronchitis virus, cetacean coronavirus
  - Deltacoronaviruses: bulbul coronavirus HKU11, porcine coronavirus HKU15
- 

One estimate for the first emergence of coronaviruses is about



8000 BC, although some models place the common ancestor as far back as 55 million years ago, implying long-term coevolution with bat and avian species.<sup>3</sup> New coronaviruses have regularly emerged since then, with many emerging within the last hundred years. For example, bovine coronavirus and canine respiratory coronavirus are likely to have diverged from a common ancestor in the 1950s,<sup>4</sup> and SARS-CoV may have diverged from a bat coronavirus in 1986.<sup>5</sup>

### Canine respiratory coronavirus (CRCoV)

Like SARS-CoV-2, CRCoV is a betacoronavirus, and, to some degree, the story of its discovery has parallels with the current SARS-CoV-2 pandemic. In the early 2000s, a dog re-homing centre in London was experiencing acute, and sometimes peracute, outbreaks of respiratory diseases that resulted in a number of deaths. This led to an investigation to find out why the outbreak should be so rapid, so widespread and apparently so refractory to the established 'kennel cough' vaccines. During the investigation, a novel coronavirus (CRCoV) was discovered that was genetically distinct from the enteric canine coronavirus - which is an alphacoronavirus.<sup>6</sup>

Rapid diagnostic tests for both the virus and antibodies to the virus were established using PCR and ELISA techniques, respectively. These tests allowed us to understand the epidemiology both in the kennel and in those entering the kennel. Furthermore, we were able to investigate other kennels and validate the occurrence and clinical importance of CRCoV.<sup>7</sup>

CRCoV was found both in air samples and on water troughs and toys left in the pens. This surface maintenance of virus was unexpected, so cleaning routines were incorporated into new biosecurity measures to reduce the infectious load of the virus within the kennels.<sup>8</sup>

The pathology of CRCoV infections in dogs shows mild inflammatory changes in both the nares and the trachea.<sup>9</sup> There is also damage to the surface cilia, which was confirmed by the failure of latex clearance in tracheal organ cultures that were infected with CRCoV.<sup>10</sup> This damage to the cilia is a common

finding with respiratory coronavirus infections that results in mild upper respiratory disease. However, such damage does allow deeper penetration of the airways by secondary microbial infections with, in the more severe clinical cases, the development of pneumonia.

For example, studies have shown that dogs infected with CRCoV have significantly more severe clinical disease when subsequently challenged with either *Bordetella bronchiseptica* or canine mycoplasmas. It was these secondary infections that exacerbated the clinical disease seen in the original outbreak, with most uncomplicated CRCoV infections being mild and quickly resolved. This may also be the case with the current SARS-CoV-2 pandemic.

### Other coronaviruses of animals

In addition to the contribution that research on CRCoV can make to our understanding of emerging coronaviruses such as SARS-CoV-2, research on other animal coronaviruses may also be relevant:

- Infectious bronchitis virus of poultry was the first coronavirus to be described,<sup>11</sup> and it has considerable genetic diversity with many strains circulating concurrently. As with other coronaviruses, it is rapidly spread by aerosol and, depending on the strain, can cause high mortality (more than 60 per cent) in unvaccinated flocks. Vaccines are available, and these may form a basis for the development of a vaccine to SARS-CoV-2.
- It has recently become apparent that porcine haemagglutinating encephalomyelitis virus and porcine epidemic diarrhoea virus are circulating silently within Italian pig herds.<sup>12</sup> There has even been evidence of recombination of these viruses with another coronavirus of pigs - transmissible gastroenteritis virus. This suggests that new viruses may be emerging and circulating in pig populations and that surveillance is warranted.

### Diagnosing SARS-CoV-2 in people

The human coronaviruses 229E, NL63, OC43 and HKU1 are associated with mild cold-like symptoms. These viruses are constantly circulating within the population and may go largely undetected. As such, any diagnostic tests developed for SARS-CoV-2 must be able to accurately distinguish SARS-CoV-2 from these other coronaviruses. Only with accurate testing can you plan a controlled strategy to allow the free movement of the non-vulnerable people again.

The present delay in developing a specific antibody test in people with SARS-CoV-2 could be cross-reactivity to other human coronaviruses. It is also possible that these closely related viruses may give some cross-protection, which might explain some of the variability in individuals' susceptibilities to SARS-CoV-2.

### SARS-CoV-2 infection of animals

SARS-CoV-2 was only identified at the end of 2019, and information about its animal reservoirs is as yet unconfirmed. Although a number of species have been suggested, the designation of an animal as a reservoir for human infections needs both considerable caution and verifiable proof before any strategic action is taken.<sup>13</sup>

There is limited proof that pangolins may be an intermediate host but not a reservoir - the pangolin beta coronavirus has some similarities to SARS-CoV-2 but this is insufficient to make the pangolin the missing animal reservoir. However, the demonstration of a 96 per cent homology between SARS-CoV-2 and the bat

SARS-like coronavirus (BAT-CoV RATG13) is convincing evidence of a bat reservoir.<sup>14</sup>

Of possibly greater significance is the recent report from the Harbin Veterinary Research Institute in China of experimental infection of cats and ferrets with SARS-CoV-2 and the onward transmission of the virus from inoculated cats to uninoculated cats.<sup>15</sup> However, the inoculation was given intranasally at a high dose (105 plaque-forming units), and it is unclear whether similar results would be seen under natural infection conditions. Both cats and ferrets had viral replication only in their upper airways, not in the lower airways or in other organ systems.

Experimental intranasal infection of dogs showed poor establishment of the virus, and there was no evidence of susceptibility in pigs, chickens or ducks.

It is interesting to note that there have been recent reports of SARS-CoV-2 infection of a tiger and five lions in the Bronx zoo, USA. These reports highlight that the Harbin research demonstrating that cats can be infected by SARS-CoV-2 and

transmit it to other cats needs to be taken seriously, not only in relation to its importance for cats but also because it raises the possibility that cats may transmit the virus to people. Therefore, further experimental and field epidemiological studies to investigate this possibility need to be supported urgently.

## Conclusion

Coronaviruses circulate widely in most animal species, including people. They can transmit rapidly - mainly by aerosol transmission - and can cause severe disease. Being RNA viruses, they readily mutate and can even recombine with other coronaviruses, which can lead to the emergence of new viruses. They can also spread silently among populations, as observed with the pig coronaviruses and, to some extent, SARS-CoV-2.

Considering their long-term experience gained with animal coronaviruses, vets are in a unique position to help forge a better understanding of the origin and spread of SARS-CoV-2 and guide future research towards the development of effective vaccines and antiviral drugs.

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# HOW WHAT WE FEED DOGS CAN HELP CHANGE THE WORLD

Frontier Pets, is an Australian company founded 5 years ago by ex Shark Tank contestant, and disruptor of the Australian Factory Farming industry, Diana Scott. Trailblazing a new way forward for the Australian pet food industry and ruffling a few feathers along the way, Frontier Pets have made it their mission to put an end to the 500 million Australian animals currently stuck in the vortex of animal cruelty which is Factory Farming, and they others to join them in the battle.

Frontier Pets founder, Diana Scott, is a strong believer in organic and free range produce, however, she saw a gap in the market for ethical food options available for her pets. Through research Scott came to realise that the Australian pet food industry is essentially propping up the Factory Farming industry in Australia. Frontier Pets have produced a range of superior pet products using only high welfare and organic ingredients while also supporting ethical Australian producers. By supporting ethical meat suppliers, and bringing awareness to the unethical and inhumane practices of Factory Farming, Frontier Pets hopes to have these methods shut down once and for all.

"In our desire to produce cost effective meat, we've created concentration camps for animals. And the pet food manufacturing industry is supporting this by using the off-cuts of Factory Farmed animals in their pet food. It's not acceptable and it's not necessary." explains Frontier Pets founder, Diana Scott.

With a purpose to provide superior nutrition that doesn't cost the earth, Frontier Pet food contains all natural, free-range, organic and human-quality ingredients. Developed alongside one of

Australia's leading dog nutritionists, Dr Kathy Cornack, Frontier Pets spent two years perfecting the recipe to include all nutrients dogs should be eating based on their natural ecology. Processed using a cutting edge freeze-drying technology ensures that colours, flavours, and most importantly, the nutritional content remain intact. Frontier Pet food ensures your dog will be healthier, have more vitality and be more likely to maintain a healthy weight.

Frontier Pets works closely with organic and free range farmers throughout Australia to source quality cuts of beef, chicken, pork and eggs, to not only create one of the most nutrient rich pet foods on the market, but also to create partnerships and support ethical farming practices across Australia. Together, with their growing customer base, Frontier Pets have contributed \$1,314,200 towards ethical farming. Founder, Diana Scott explains, "We only purchase produce from free-range meat farmers and organic fruit & veg producers. The partnership works because farmers have a new income stream and we get the very best produce on the market. Australian free-range farmers really care about their animals and they know that we care, so they're delighted to be working with us".

Paving the way for the pet food industry, Frontier Pets isn't focused on competitors, but instead focused on encouraging other pet brands to join them in the fight against ending Factory Farming, and prove that dogs really can really help change the world.

**For more information on Frontier Pets please visit [www.frontierpets.com.au/](http://www.frontierpets.com.au/)**



# ANIMAL EMERGENCY AUSTRALIA EXPANDS INTO CANBERRA MARKET

Animal Emergency Australia (AEA) has expanded its group of after-hours emergency hospitals by purchasing a 50% share of Canberra Veterinary Emergency Service (CVES) in the suburb of Gungahlin.

CVES will be the seventh emergency and critical care practice to join the AEA group alongside Queensland based Animal Emergency Service hospitals at Tanawha, Jindalee, Carrara, Underwood, Logan based Pet ICU, and Perth Vet Emergency in Yokine Western Australia.

CVES Founder and Co-Owner Dr Tracy Hughes has welcomed teaming up with AEA, seeing the move as an opportunity to access first class support services for her veterinary team, and a partner to facilitate the expansion of her business.

"CVES always strives to provide the best level of care possible for our patients and we see the AEA group as leaders in the field of small animal emergency and critical care medicine," Dr Hughes said.

"Each practice that AEA is part of operate uniquely. This is important to us because

CVES already has a well established, dedicated team with many systems in place, but AEA brings with them support services that will help us reach the next stage of our development, these same services have seen AEA succeed in growing their brands across Queensland and Perth," she continued.

AEA provides centrally coordinated marketing, human resources and financial management but each practice is locally lead by their own leadership teams.

**"CVES is a special veterinary service because of their people and culture," said CEO of AEA, Dr Rob Webster.**

"Our strategy is to build homes for veterinary professionals. Working with Dr Tracy and the CVES team is a milestone extension for our business, and we are looking forward to the challenges of building a future together."

## About Animal Emergency Australia

Animal Emergency Australia is a specialised veterinary clinic support network. Established in 2005, the company provides centralised marketing, human resource and financial management for hospitals in Queensland, Western Australia and Canberra. There are seven after hours emergency hospitals within the network, including Animal Emergency Service hospitals, Pet ICU, Perth Vet Emergency, and Canberra Veterinary Emergency Services.



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# KEY TO HARMONIOUS PET RELATIONSHIPS: PHEROMONES

**ANIMAL BEHAVIOUR SCIENTISTS FROM THE UNIVERSITY OF LINCOLN, UK, HAVE DISCOVERED THAT FILLING HOMES WITH APPEASING PHEROMONES COULD BE THE KEY TO A HAPPY HOUSEHOLD WHERE BOTH DOGS AND CATS ARE LIVING UNDER THE SAME ROOF.**

The new research, led by Professor Daniel Mills and Dr Miriam Prior, explored the effects of two different pheromone products on cat-dog interactions in homes where owners could see room for improvement in their pets' relationships.

Their new scientific paper is now available to read online via the journal *Frontiers in Veterinary Science*.

The results show that both products used - Feliway Friends, which emits pheromones that are calming for cats, and Adaptil, which does the same for dogs - both had a positive impact on the interactions between cats and dogs living in the same home.

Over a six week period, both products led to a notable decrease in undesirable interactions - such as dog chasing cat, cat hiding from dog, cat and dog staring at each other, and dog barking at cat. Users of Adaptil even observed a significant increase in some desirable behaviours - friendly greetings between cat and dog, and time spent relaxing in the same room.

"Although we are all aware of the perceived tensions between cats and dogs, we believe this is the first study of its kind to explore the use of pheromone products to improve the relationship when the two species are living in the same household," explained Professor Mills, Professor of Veterinary Behavioural Medicine in Lincoln's School of Life Sciences.

"Seven per cent of households in the UK own both a cat and a dog, which represents a large number of pet owners and their animals living with potentially stressful animal relationships on a day-to-day basis. Many cat and dog owners report that their animals are comfortable in each other's' company, but where this isn't the case, a poor relationship between a resident cat and dog can have serious consequences for the welfare of individual animals. There may be an unacceptable level of social stress or restricted access to key resources such as food, water or suitable toilet areas. There will also be increased stress for the remainder of the family (both human and animal), and potential risks of injury due to conflict."

It has also been reported that a problematic relationship between a new pet and an existing pet is one of the main reasons for cats and dogs being taken to shelters for rehoming.

The pet owners involved in this new scientific trial reported weekly on the frequency of 10 specific undesirable interactions and seven specific desirable interactions between their cats and dogs. They were split into two groups; one group using Feliway Friends and the other using Adaptil, with the pheromones supplied in unlabelled packaging and randomly assigned by an independent staff member such that neither the participants nor the researchers knew which product was being trialled in each household until after the statistics had been collected.

The researchers were aware that in many households, the comfortability of the cat seems to have a stronger influence over the quality of the cat-dog relationship. It could therefore be seen as surprising that it was the product releasing dog pheromones which was seen to increase specific desirable interactions.

Miriam, a Lincoln-based vet who undertook the work as part of her postgraduate degree in Clinical Animal Behaviour at the University of Lincoln, said "While it might be expected that Feliway Friends would be more effective in multi-species homes given the apparently stronger contribution of the cat's comfortability to the quality of the cat-dog relationship, this did not appear to be the case. Our results might be explained by the behaviour of the dog being the primary determinant of the cat's quality of interaction with it.

"We would like to investigate this further to really tease out the effects of these pheromone products individually and also to investigate their use in combination with each other. We suggest that Adaptil may have had such a beneficial effect because a more relaxed dog may be less likely to disturb the cat (e.g. by chasing it), resulting in a cat that is less stressed and more willing to form some form of social bond with the dog."

#### Journal Reference:

Miriam Rebecca Prior, Daniel Simon Mills. Cats vs. Dogs: The Efficacy of Feliway Friends™ and Adaptil™ Products in Multispecies Homes. *Frontiers in Veterinary Science*, 2020; 7 DOI: 10.3389/fvets.2020.00399



**“Although we are all aware of the perceived tensions between cats and dogs, we believe this is the first study of its kind to explore the use of pheromone products to improve the relationship when the two species are living in the same household”**

**Professor Daniel Mills**





# ORIGINS OF THE BELOVED GUINEA PIG

New University of Otago research sheds light on guinea pig domestication and how and why the small, furry animals became distributed around the world.

Published in June in the international science journal, *Scientific Reports*, the researchers use ancient DNA from archaeological guinea pig remains which reveals the transition from the animals being used as a wild food source 10,000 years ago to their domestication and later role as beloved pets and medical animal models.

It builds on previous research over many years by Professor of Biological Anthropology, Lisa Matisoo-Smith, tracing the DNA from plants and animals that Pacific settlers carried in their canoes and using that as a proxy for identifying human population origins and tracking their movement around the Pacific.

As part of her Otago Master's thesis research in Professor Matisoo-Smith's lab, Edana Lord, now at Stockholm University, Sweden and Dr Catherine Collins from Otago's Department of Anatomy and other international researchers, set about finding out where the guinea pigs that were introduced to the islands of the Caribbean came from.

Professor Matisoo-Smith explains it is generally accepted that modern guinea pigs were domesticated in the Andes region of what is now Peru. As an important food item that was also included in religious ceremonies, they were transported and traded around South America.

Sometime around AD500, guinea pigs were taken out to the islands of the Caribbean, through at least one of several established trade networks.

The researchers expected that the guinea pigs found in the Caribbean would have come from Colombia, one of the closer locations in South America to the Caribbean.

Using ancient DNA of guinea pig remains excavated from several sites in the Caribbean, Peru, Colombia, Bolivia, Europe and North America, they found the guinea pigs on the islands did not originate in Colombia, but most likely originated in Peru.

What was a bigger surprise to the team was that the guinea pig remains found in the Colombian Highlands appeared to be from a totally different species. This suggests that guinea pig domestication likely took place independently in both Peru and Colombia.

The genetic information, along with archaeological contexts, also shows how the guinea pigs had different roles through time.

"They were and still are important food item in many parts of South America and cultures that derived from South America - people took them live to introduce to new islands where they were not native or they traded them for other goods," Professor Matisoo-Smith explains.

"The guinea pig was brought to Europe in the late 1500s or early 1600s by the Spanish and to North America in the early 1800s as part of the exotic pet trade. In the 18th century guinea pigs began to be used by medical researchers as laboratory animals because they have many biological similarities to humans, thus the origin of the phrase 'being a guinea pig' in research.

**"All guinea pigs today - pets, those that are sold for meat in South America and Puerto Rico, and those used in medical research - are derived from the Peruvian domesticated guinea pigs."**

Why the guinea pig was viewed as a pet in some cultures and a food source in others can likely be attributed to long-established cultural notions of what is acceptable as food.

Professor Matisoo-Smith says the research demonstrates that the history of guinea pigs is more complex than previously known and has implications for other studies regarding mammal domestication, translocation and distribution.

"Identifying the origins of the guinea pig remains from the Caribbean helps us to understand how the human trade networks in the region moved in the past 1000 years or so.

"Through this analysis of ancient guinea pig DNA, we better understand the history of human social interactions over thousands of years and across three continents. It also provides a critical historical perspective of the genetic diversity in guinea pigs and the relationship humans have had with this important domestic animals."



## Journal Reference:

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## FIGHTING PARASITES WITH POO

Sheep poo could hold the key to developing the next generation of antiparasitic treatments that could protect Australian livestock and save the industry millions of dollars a year.

University of Queensland researchers will study the bacteria and fungi present in infected sheep faeces and pastures in a bid to discover new natural antiparasitics that could also prevent multi-drug resistance.

Professor Robert Capon and Dr Zeinab Khalil from UQ's Institute for Molecular Bioscience have been awarded a \$700,000 Australian Research Council Linkage Grant to partner with Boehringer Ingelheim Animal Health Australia, a world-leader in the research and development of antiparasitics, who will provide funding and in-kind support totalling \$1.5 million.

"We are targeting nematodes - microscopic worm-like parasites - which infect the gut of sheep and cattle, causing illness and reduced productivity," Professor Capon said.

"An outbreak of nematodes can lead to the quarantining of livestock and pastures, increasing costs for farmers, jeopardising Australian food security and leaving the export trade vulnerable.

**"While farmers now use a combination of existing chemicals as antiparasitics, many nematodes have become multi-drug resistant."**

The issue for the livestock industry has been compounded by the slow discovery rate of new antiparasitics.

Dr Khalil said they would collect samples of infected sheep faeces and pasture soil from commercial sheep stations across Australia.

"Taking these samples back to the lab, we will assemble a library of bacteria and fungi that we can manipulate to discover new classes of natural antiparasitics," Dr Khalil said.

"Microbes like fungi and bacteria can have silent or switched off gene clusters with antiparasitic properties."

The researchers aim to activate these 'silent' genes by changing the conditions in which the microbes grow.

"We can use various chemical and physical stimuli on the microbes to trick them into revealing the natural chemical defences they normally keep hidden deep in their DNA," Dr Khalil said.

"We will thoroughly investigate the antiparasitics that we find and fast-track the ones with the most potential."

Professor Capon said the aim was to discover new classes of natural antiparasitic with different modes of action which will safeguard livestock and sidestep multi-drug resistance.

"New antiparasitics will have a radical effect on farming - allowing less frequent application of chemicals, less chemical stress on the environment, and an ability to rehabilitate infected pastures previously deemed uneconomic," he said.

## OOSHIE ALMOST COSTS COCO HER LIFE

Coco is feeling very sorry for herself following emergency life-saving surgery at Lort Smith Animal Hospital.

The two-year-old Pinscher cross Doberman had a lion Ooshie and another plastic object removed from her bowel during emergency surgery.

Coco's carer Troy Collins had noticed something was not right after his beloved pet began vomiting a lot of plant matter. However it was her loss of appetite that really caught his attention.

"She refused to eat, which is not like her," said Mr Collins adding she then "went down really quickly".

The family rushed her to a local vet, where x-rays suggested a foreign object was blocking her bowel. She was referred to Lort Smith for emergency enterotomy surgery.

Mr Collins was surprised to hear it was two pieces of plastic including a lion Ooshie that was causing Coco's internal damage, suspecting it might have otherwise been Lego.

"Coco is lucky she made it to us in time. If she had been left in this state much

longer the situation could have been dire," said Lort Smith Head of Hospital Dr David Cunliffe.

Foreign body surgeries increased by 75% in comparison to last year over the April-May period.

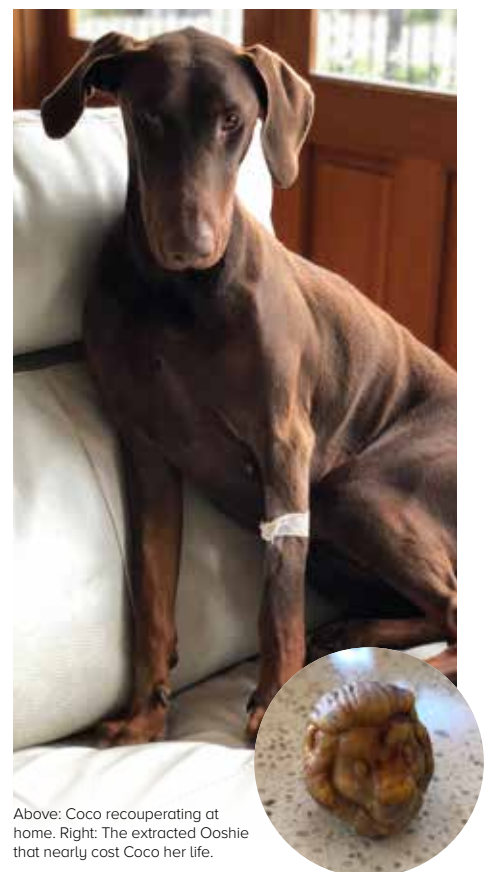
Lort Smith understands pets are curious, and can easily ingest things while we are not looking. However, it is important to minimise potential hazards by keeping keep enticing objects out of reach.

Creating physical boundaries around certain activities can help to minimise these unfortunate but increasingly common instances.

"Most importantly always keep an eye on your dog; and if you are concerned about your pet, please see your vet," added Dr Cunliffe.

Coco spent a total of four days at Lort Smith, and is now back at home with her beloved family, feeling rather sorry for herself.

Lort Smith continues to offer emergency, urgent and essential care to animals.



Above: Coco recuperating at home. Right: The extracted Ooshie that nearly cost Coco her life.

# PROTEIN DERIVED FROM TICK SALIVA PROVES EFFECTIVE IN THE TREATMENT OF EQUINE SKIN CANCER

**EXPERIMENTS WERE CONDUCTED BY SCIENTISTS AFFILIATED WITH THE CENTRE OF EXCELLENCE IN NEW TARGET DISCOVERY, A RESEARCH CENTRE SUPPORTED BY FAPESP, INVOLVING FIVE ANIMALS WITH SPONTANEOUS SKIN TUMOURS.**

A protein derived from the saliva of the tick *Amblyomma sculptum* has been successfully used by researchers at the Butantan Institute in São Paulo, Brazil, to treat skin cancer (melanoma) in horses. The results of the study are described in the journal *Scientific Reports*.

The principal investigator for the project is Ana Marisa Chudzinski-Tavassi, who leads the Centre of Excellence in New Target Discovery (CENTD), an Engineering Research Centre (ERC) established at the Butantan Institute by São Paulo Research Foundation - FAPESP and GlaxoSmithKline.

CENTD's mission is to discover and validate molecular targets to treat inflammatory diseases for the purpose of developing new drugs.

The protein is Amblyomin-X, which has been studied at the Butantan Institute for more than ten years and evidences significant anti-tumour potential in the laboratory and in vivo and has already been approved in preclinical toxicity testing.

The researchers used "omics" tools (genomics, transcriptomics, proteomics and metabolomics) to analyse the signalling pathways and proteins affected by the treatment of horse melanoma with Amblyomin-X.

Roger Chammas, a researcher at the São Paulo State Cancer Institute (ICESP), collaborated with CENTD scientists on the project.

## **Immune mechanisms**

Equine melanomas are spontaneous tumours. Unlike cutaneous melanomas in humans, in horses, they are encapsulated and



Experiments were conducted by scientists affiliated with the Center of Excellence in New Target Discovery, a research center supported by FAPESP, involving five animals with spontaneous skin tumours. Photo credit: Daniel Souza Wikimedia Commons





locally confined, rarely giving rise to metastasis. However, in both humans and horses, these tumours are potentially immunogenic, i.e., capable of producing an immune response, and can serve as a model for the investigation of the immune mechanisms involved in tumour regression induced by therapeutic molecules.

In the first phase of the study, spontaneous tumours in five horses were treated for 30 days with intratumoural injections of Amblyomin-X. The treatment took place at the Butantan Institute's farm in Araçariçuama, state of São Paulo. The animals were monitored throughout the period by means of clinical examinations, blood work, and biochemical laboratory tests.

The results were promising. Control tumours (not treated with the compound) maintained their shape and grew in size, whereas tumours treated with Amblyomin-X shrank and, in some cases, even reached remission up to two months after the treatment ended.

None of the five treated animals developed any adverse reactions. At the end of the treatment, the tumours were surgically removed for histopathological analysis. The researchers found no trace of tumoural characteristics.

The second phase of the study consisted of experiments in transcriptomics (analysing messenger RNA expression) and interactomics (analysing the interaction between tumour cell

proteins and Amblyomin-X) to see how signalling pathways were modulated by the treatment and, especially, to obtain molecular confirmation of previous findings from *in vitro* and *in vivo* experiments conducted by Chudzinski-Tavassi and her team. The results published by the group between 2010 and 2017 suggested that the antitumour action of Amblyomin-X occurred via the modulation of the endoplasmic reticulum and mitochondrial stress and apoptotic and proteasomic pathways, among others.

The transcriptome study was expected to confirm activation of these pathways and show whether others were affected by the treatment. The researchers also deployed next-generation sequencing and analysis based on bioinformatics and systems biology to map the initial mechanisms of the response triggered by Amblyomin-X, which culminated in tumour regression.

Among the findings of the transcriptomic analysis was the discovery that the innate immune system's rapid response (six hours after the injections) involved the modulation of four different pathways: TLR (toll-like receptor), RIG-I (viral invasion sensors), OAS (2',5'- oligoadenylate synthetase and RNase L) and oncostatin-M (corresponding to the interleukin-6 family inflammation pathway). These findings described the first steps in the activation of a defence response that culminated in tumour regression, pointing to potential candidate targets for adjuvant therapies against tumours.

#### Journal Reference:

Lichtenstein, F., Iqbal, A., de Lima Will, S.E.A. et al. Modulation of stress and immune response by Amblyomin-X results in tumor cell death in a horse melanoma model. *Sci Rep* 10, 6388 (2020). <https://doi.org/10.1038/s41598-020-63275-2>

# ALIEN FROG INVASION WREAKS HAVOC ON NATURAL HABITAT

Indiscriminate feeding by an alien population of the carnivorous spotted-thighed frog - could severely affect the native biodiversity of southern Australia according to a new study by the University of South Australia.

The invasive amphibian - *Litoria cyclorhyncha* - which has hitchhiked across the Nullarbor from Western Australia - has now established a community of 1000-plus in Streaky Bay, South Australia, with sightings also confirmed on the Eyre Peninsula and at the Adelaide airport.

This is the first study of the spotted-thighed frog's diet in its invaded range with the findings providing important biological information about the impact of the alien species on natural ecosystems.

Ecology experts, UniSA's Associate Professor Gunnar Keppel and Christine Taylor, say the potential of the spotted-thighed frog spreading to other parts of Australia is very concerning given its destructive eating patterns.

"This frog is an indiscriminate eating machine that will devour just about anything it can fit into its mouth," Taylor says.

"We're talking about a relatively large, predatory tree frog that, as a species is alien to South Australia, and it could have devastating impact on invaded habitats.

**"As it eats away at local species, it's impacting the natural ecosystem, which can displace or destroy local food webs, outcompete native birds, reptiles and mammals for resources, and potentially change natural biodiversity."**

Biodiversity was the theme of this year's United Nations World Environment Day.

Published in the Australian Journal of Zoology, the study examined the stomach contents of 76 spotted-thighed frogs across three habitats - an artificial wetland, seminatural bushland and an urban setting.

On average, each frog had at least six prey items in its stomach, with prey estimated to include 200 different species, 60 per cent of which were beetles, spiders and insects. Native geckos, young frogs and mice were also identified as prey.

Introduced species can have terrible outcomes for Australia, if not understood well. The infamous introduction of the cane toad in the 1930s as a mechanism to control sugar cane beetles, is just one example. The failure of that initiative continues to ravage Australia's ecology, with the cane toad now listed as a threatening pest under the Environment Protection and Biodiversity Conservation Act.

Assoc Prof Keppel says it is important that people understand how detrimental introduced species can be for whole environments. He warns that if the spread of the spotted-thighed frog is not kept under control they could dominate many ecosystems in south-east Australia, at the expense of the local flora and fauna.



The spotted-thighed frog is native to southwestern Australia. Photo credit: Christine Taylor



The carnivorous spotted-thighed frog will indiscriminately devour just about anything it can fit into its mouth. Photo credit: UniSA/Christine Taylor



The spotted-thighed frog is easily identified by the distinct spots on its thighs. Photo credit: Christine Taylor

"The spotted-thighed frog is obviously very mobile. Already it's managed to travel more than 2000 kilometres and set up a colony in Streaky Bay. But its considerable tolerance of salinity and potential ability to withstand high temperatures could lead to further geographic spread, and if not controlled, it could extend further eastward into the Murray-Darling Basin," Assoc Prof Keppel says.

"It's vital that we continue to protect Australia's biodiversity. Preventing further dispersal of the spotted-thighed frog is a high conservation priority.

"The state government should consider managing the invasive population of spotted-thighed frogs at Streaky Bay. This should include education programs to inform people about what to do if they find a frog, as well as the feasibility of exterminating the population in South Australia.

"Importantly, if you do see one of these critters in your travels - leave it be. We don't want it hitchhiking any further."

## Journal Reference:

Christine M. Taylor, Gunnar Keppel, Shaun O'Sullivan, Stefan Peters, Gregory D. Kerr, Craig R. Williams. Indiscriminate feeding by an alien population of the spotted-thighed frog (*Litoria cyclorhyncha*) in southern Australia and potential impacts on native biodiversity. Australian Journal of Zoology, 2020; DOI: 10.1071/ZO19042

# PROTECTED AREAS WORLDWIDE AT RISK OF INVASIVE SPECIES

Protected areas across the globe are effectively keeping invasive animals at bay, but the large majority of them are at risk of invasions, finds a China-UK research team involving UCL.

The research, led by the Chinese Academy of Science and published in *Nature Communications*, show that for most protected areas, there is an invasive animal species living less than 10km away that is well suited to the protected area's environment.

Co-author Professor Tim Blackburn (UCL Genetics, Evolution & Environment and the Institute of Zoology, ZSL) said "One of the most harmful ways that people are impacting the natural environment is through the introduction of 'aliens' - species that do not occur naturally in an area, but have been taken there by human activities.

"These species may kill or compete with native species, or destroy habitats, amongst other impacts. Invasions by alien species are regarded as one of the top five direct drivers of global biodiversity loss, and aliens are establishing themselves in new areas at ever increasing rates. Protected areas are a cornerstone of biodiversity conservation, but aliens don't know where their boundaries lie. It's important to know whether these areas might protect against the spread of invasive species."

The researchers investigated 894 terrestrial animal species (including mammals, birds, reptiles and invertebrates) that are known to have established alien populations somewhere in the world.

They then assessed whether these species occurred within, or near, the boundaries of 199,957 protected areas across the globe, as defined by the International Union for Conservation of Nature (IUCN), including wilderness areas, national parks, and natural monuments or features.

The team found that less than 10% of the protected areas are currently home to any of the invasive species surveyed, suggesting that protected areas are generally effective in protecting against invasive species.

But almost all of those areas may be at risk of invasion, as an invasive species was found within 100km of the boundaries of 99% of the protected areas. For 89% of the protected areas, there was an alien species resident within 10km of the boundaries.

More than 95% of the protected areas were deemed to be environmentally suitable for the establishment of at least some of the alien species under investigation.

The researchers also investigated common factors among the protected areas that are already home to alien species. They found that protected areas tend to have more alien animal species if they have a larger human footprint index, due to factors such as transport links and large human populations nearby.

The researchers also found that larger, and more recently established protected areas, tend to have more alien species. Older protected areas tend to be in more remote areas, so they are less exposed to human impacts.

Senior author Dr Li Yiming (Institute of Zoology, Chinese Academy of Sciences) said: "At the moment most protected areas are still free of most animal invaders, but this might not last. Areas readily accessible to large numbers of people are the most vulnerable."

"We need to increase efforts to monitor and record invasive alien species that people may bring into protected areas, deliberately

or by accident, especially damaging species like the American bullfrog, brown rat and wild boar."

The findings do not suggest that the rich existing biodiversity in protected areas acts as a barrier to invasions, as they found mixed evidence on the relationships between existing native biodiversity and presence of invasive species.

Professor Blackburn concluded "If alien species continue to spread - and we would expect many to do that - many more protected areas will have their boundaries reached, and potentially breached, by these alien species."

The research was supported by the Second Tibetan Plateau Scientific Expedition and Research (STEP) Programme, National Science Foundation of China and Youth Innovation Promotion Association of Chinese Academy of Sciences. Alien species commonly found in protected areas include:

- Rock dove (*Columba livia*): in 6,450 PAs such as Yosemite National Park, USA
- Ring-necked pheasant (*Phasianus colchicus*): in 4,822 PAs including UK sites such as Minsmere
- House sparrow (*Passer domesticus*): in 3,972 PAs such as Kruger National Park, South Africa
- Wild rabbit (*Oryctolagus cuniculus*) in 1,673 PAs including much of Australia and UK, such as Uluru-Kata Tjuta National Park and Cairngorms National Park
- American mink (*Neovison vison*) in 1,251 PAs such as Cairngorms National Park
- Brown rat, such as in Fiordland National Park, New Zealand
- Stoat, such as in Fiordland National Park
- Red-eared Slider (*Trachemys scripta*) in 164 PAs such as Singapore nature reserves
- Cane toad (*Rhinella marina*) in 265 PAs such as Kakadu National Park, Australia
- Harlequin ladybird (*Harmonia axyridis*) in 2,686 PAs including in Southern UK

The most invaded parks were all found in Hawaii: Volcanoes National Park (80 species); Hakalau Forest National Wildlife Refuge (63 species) and Kipuka Ainahou (62 species)



American mink (*Neovison vison*) was found in 1,251 protected areas such as Cairngorms National Park in the UK, where this photo was taken. Photo credit: Professor Tim Blackburn, UCL

#### Journal Reference:

Liu, X., Blackburn, T.M., Song, T. et al. Animal invaders threaten protected areas worldwide. *Nat Commun* 11, 2892 (2020). <https://doi.org/10.1038/s41467-020-16719-2>



# Zinc: Plaque's natural enemy



BRUCE ADDISON, Veterinary Microbiologist • Addison Biological Laboratory, Inc.



*"Plaque forms within 24 hours, calculus within 3 days and gingivitis begins as early as 2 weeks."*

— WSAVA.org

Pet oral health care is an ongoing challenge for pet owners and veterinary teams. Periodontal disease is the number one health problem in small animal patients, according to the American Kennel Club. By age 3, more than 80 percent of dogs and cats have some form of periodontal, or gum disease. Pet owner resistance to in-clinic dental procedures that involve x-rays and anesthesia is well known.

To optimize pet health, **the starting point for comprehensive oral care must be in the home** where bad breath is the primary warning sign. Most veterinary clinic personnel miss the opportunity to educate pet owners about daily oral care and promote in-home solutions for their pets.

*Quite simply,  
"a chew alone  
won't do."*



Working with natural zinc compounds, Addison Biological Laboratory pioneered the use of a natural, zinc-based compound that is safe for daily use, inexpensive, taste-free and provides excellent pet acceptance. The unique formula works to break down plaque on contact and can be used daily without brushing.

Addison's neutralized zinc is a combination of select amino acids and zinc. Taurine and zinc gluconate form a complex bond that inhibits the precipitation of zinc in the neutral pH (6.7 – 7.0) range. In this narrow pH range, an oral zinc preparation delivers increased bioavailability that ensures its duration of effect and efficacy.

*"Zinc is well documented to tie up sulfur compounds in the oral cavity which are a primary cause of bad breath, the first signal of impending dental disease."* — Bruce Addison, Veterinary Microbiologist, President and Founder

## Putting zinc to work

New to the MAXI/GUARD® product family are MAXI/GUARD® Oral Cleansing Wipes. They provide a proprietary neutralized zinc oral care compound on a textured applicator wipe. They are recommended for daily in-home use.

### MAXI/GUARD® Oral Cleansing Wipes

#### Features / Functions

- Taste free
- Oral product and applicator all-in-one
- Neutralized zinc formulation
- Quick and easy wipe application
- 100 textured wipes per large container

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- Removes plaque; resolves offensive mouth odors
- Supports pet owner compliance
- Up to 100 days of effective daily oral care

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[www.k9gums.com.au](http://www.k9gums.com.au)



## Customer feedback

*"For nearly 30 years, we've promoted dental care, brushing at home and yet still only get around 2 percent compliance. We no longer carry paste and brushes. Oral Cleansing Wipes are our home care focus for every dog and cat. Demonstrating the quick, easy wipe method gives clients confidence to do it at home. Wiping during an exam also shows clients the amount of plaque and oral debris resident in their pet's mouth." JB, DVM*



*"We keep a jar in every exam room and at the front desk. Everyone in the practice is trained to demonstrate and actively promote home dental care." TLP, RVT, VTS (DENTISTRY)*

*"Our nurses and DVMs get face to face with pets in every exam. This gives us a chance to smell pets' breath and begin screening for oral health issues. To help pet owners understand, we talk about the smell of the breath as we raise the cheek to examine the teeth and gums." JMC, LVT*

## Resources available on K9 Gums website, [www.k9gums.com.au](http://www.k9gums.com.au)

### MAXI/GUARD® Oral Cleansing Wipes demonstration videos

Click on photos to view demonstrations.



### Addison MAXI/GUARD® Oral Cleansing Wipes resources and printable materials

[MAXI/GUARD Oral Cleansing Wipes Detail](#)

[MAXI/GUARD Oral Cleansing Wipes Practice Tips](#)

[MAXI/GUARD Dental Client Educational Brochure](#)

Easy, quick, sanitary oral health care for pets.

## Related animal health industry materials and references

- [PetHealthNetwork](#). Did you know that 4 out of 5 dogs over the age of 3 years have some sort of periodontal disease?
- [Dentistry for dogs, FETCH by WebMD](#). "...periodontal disease (i.e. gum disease) occurs 5 times as often in pets as it does in people."
- [AVMA](#). Periodontal disease is the most common dental condition in dogs and cats. By the time a pet is 3 years old, it will very likely have some early evidence of periodontal disease. If preventative measures are not taken, it will worsen as the pet grows older.
- [2019 AAHA Dental Care Guidelines for Dogs and Cats](#). The guidelines are intended primarily for general practitioners and veterinary team members without advanced dental training. The dental task force encourages all veterinary professionals to continuously improve their veterinary dentistry knowledge, skills, and treatment capabilities and to recognize cases needing referral.
- [World Small Animal Veterinary Association Global Dental Guidelines](#). Despite its prevalence, periodontal disease is grossly underdiagnosed... Periodontal disease is generally described in two stages: gingivitis and periodontitis.
- [Veterinary Oral Health Council](#). Studies have shown that dogs with severe periodontal disease have more severe microscopic damage in their kidneys, heart muscle and liver than do dogs with less severe periodontal disease.
- Source: [Today's Veterinary Practice](#). Periodontal disease has been called the "silent killer."<sup>50</sup> Periodontal disease is lurking in patients' mouths whether or not a veterinarian chooses to recognize it.
  - By 2 years of age, 80% of dogs and 70% of cats have some form of periodontal disease.<sup>3</sup> Small and toy breed dogs are particularly susceptible.<sup>4</sup>
  - Even after teeth are completely cleaned, plaque forms on the tooth surfaces within 24 hours.<sup>3,5</sup>
  - Lack of homecare for 1 week can result in gingivitis in some patients; for 3 weeks, in all patients.<sup>6</sup>
  - One veterinary study found that pockets became re-infected within 2 weeks of a dental cleaning if homecare was not performed.<sup>7</sup>





# PARASITE INFESTATIONS REVEALED BY TINY CHICKEN BACKPACKS

Blood-feeding livestock mites can be detected with wearable sensor technology nicknamed “Fitbits for chickens.”

To help farmers detect mite infestations, a team of entomologists, computer scientists, and biologists led by UC Riverside entomologist Amy Murillo has created a new insect detection system. The team’s work is detailed in the journal *Scientific Reports*.

In recent years, concern for the well-being of livestock has given rise to more farms where poultry are allowed to roam. Though this freedom improves the quality of chickens’ lives, free-range chickens are still subject to insect infestations.

“The trend in egg sales is ‘cage free,’ but that doesn’t necessarily mean the chickens are insect free,” Murillo said.

Of particular concern to scientists is the northern fowl mite, which Murillo said feeds on chicken blood and lives on hens in feathers surrounding “the butt area of the chicken.”

In addition to the economic consequences of infected hens laying fewer eggs, mites can make the chickens sick and cause lesions to develop on their skin.

“Fowl mites are very unpleasant for the birds being fed upon and cause an itchy immune response,” Murillo said.

To devise their detection system, Murillo’s team first identified three key chicken pastimes linked to chickens’ well-being: pecking, preening, and dustbathing. The team hypothesised they would see a big increase in preening and dustbathing among infected chickens because these activities keep feathers clean.

The team placed motion sensors into tiny backpacks the chickens could wear without discomfort. The next challenge was translating data from these sensors into algorithms that could be detected as behaviours.

Alireza Abdoli, a doctoral student in computer science at UCR, explained that quantifying fowl behaviour isn’t as simple as working with human behaviours like walking, because it isn’t as regular.

In order to train a computer to recognise chicken behaviours, Abdoli had to take an unusual approach. He created an algorithm, or set of instructions, for the computer that considers the shape that the backpack sensor data makes on a graph, as well as features of the data such as mean and max.

“Most algorithms use either shape or features, but not both,” Abdoli said. “Our approach is exciting because it increases the accuracy of the data so much and is key to making good decisions about the chickens’ health.”

Traditional animal behaviour studies have had to rely on video or visual observations, which can be both time consuming and prone to errors. Murillo did some flock observations at the beginning of the project to make sure the computer’s conclusions about behaviours were accurate. Once they were certain, observations were no longer necessary, and the computer could take over.

Not only does this new approach increase the reliability of

scientists’ observations, it also increases the number of animals and length of time they can be tracked.

The flock in this study did suffer from a mite infestation, which the team related to an increase in cleaning behaviours. Once the birds were treated and healed, the data showed preening and dust baths went back to normal levels.

Far more than farm fashion, these “Fitbits for chickens” offer valuable information for livestock farmers.

**“These results could let farmers know it’s time to examine their birds for parasites,” Murillo said. “And the tools we developed can also be used examine the effects of any change in a bird’s environment or diet.”**



Chicken wearing a behavior sensor meant to detect the presence of blood-feeding mites. Photo credit: Amy Murillo/UCR

## Journal Reference:

Amy C. Murillo, Alireza Abdoli, Richard A. Blatchford, Eamonn J. Keogh, Alec C. Gerry. Parasitic mites alter chicken behaviour and negatively impact animal welfare. *Scientific Reports*, 2020; 10 (1) DOI: 10.1038/s41598-020-65021-0



# SIMPLE WAY OF 'LISTENING' TO CHICKS COULD DRAMATICALLY IMPROVE WELFARE

A simple and low-cost method of 'listening' to chicks may allow welfare issues to be picked up at the earliest possible opportunity, according to new research.

In commercial chicken farming, thousands of newly-hatched chicks are reared in batches. A team of animal welfare and behaviour scientists from across the UK collected acoustic recordings in 12 typical such flocks of 25,000 chicks.

In nature, when uncomfortable or uncertain of their surroundings, chicks would attract the hen with a loud and distinctive distress call.

In this study, the researchers demonstrated that these calls could be clearly picked up above other noises such as regular calling and farm machinery.

But where previous research has linked distress calling to stress and anxiety-like states in chicks, this study also shows it could predict flock-level behaviour, future growth and mortality rate.

That suggests distress calling may be an 'iceberg indicator' - a single measure that captures a range of welfare information at once.

The study, published in the *Journal of the Royal Society Interface*, involved researchers from the University of Plymouth, University of Roehampton, SRUC, and Newcastle University. It was funded by the Biotechnology and Biological Sciences Research Council in an Innovate UK partnership with Greengage Lighting Ltd.

Lead author Dr Katherine Herborn, Lecturer in Physiology and Behaviour at the University of Plymouth, said "On their first day in a barn, all chicks are going to call because they are in strange surroundings. But after that they learn where to find food and water and settle into that new world, so if you are still hearing a lot of distress calling after a few days it could be a sign there is something wrong. With over 50 billion birds being produced each year, tools to support simple interventions at the right time could potentially have big impacts on welfare and quality of life for these birds."

Lucy Asher, Professor in Animal Behaviour Informatics at Newcastle University and Principal Investigator on the BBSRC project, added "By analysing the calls chicks make in their first few days of life, it seems we are able to predict weight gained and the number of deaths in the whole flock for the whole life. This means we could have a very powerful tool to help chicken welfare. What is particularly useful is that this welfare indicator can be used early on in life, whereas most chicken welfare indicators are taken later in their life when it is too late to make major improvements. As an added benefit this study shows how we can measure chick calls automatically, meaning no extra work for farmers, but more information to help them improve chicken welfare."

The method used in the research involved measuring the 'spectral entropy' of the soundscape - a value that describes how sound can vary from a clear, tonal note up to white noise.

As increasing numbers of chicks call in unison, the usual background noise of the farm becomes overall more tonal. This

computationally simple way of counting distress calls could act as an early-warning signal to farm staff that chicks require attention and ultimately improve chick welfare across their lifetimes.

The findings support previous studies on the benefits of automated monitoring of livestock for real-time warnings of emerging welfare concerns. They also emphasise the importance of using animal-centred behavioural and emotional welfare indicators alongside traditional environment and productivity monitoring on poultry farms, to improve conditions from the birds' own perspective.

**Dr Alan McElligott, Reader in Animal Behaviour at the University of Roehampton, added "The results of this research show how useful vocalisations can be for monitoring welfare, and especially in an age when animal welfare needs should be central to progress in precision livestock farming."**



#### Journal Reference:

Katherine A. Herborn, Alan G. McElligott, Malcolm A. Mitchell, Victoria Sandilands, Brett Bradshaw, Lucy Asher. Spectral entropy of early-life distress calls as an iceberg indicator of chicken welfare. *Journal of The Royal Society Interface*, 2020; 17 (167): 20200086 DOI: 10.1098/rsif.2020.0086

# RESEARCHERS CAST DOUBT ON EARLIER COVID-19 ORIGINS STUDY CITING DOGS AS POSSIBLE HOSTS

A study published earlier this year claiming the coronavirus may have jumped from dogs to humans is scientifically flawed, offering no direct evidence to support its conclusions, according to a collaborative group of international researchers, including scientists at the University of Colorado Anschutz Medical Campus.

“During this time of Covid-19 we are seeing people publish things that make wild leaps to conclusions that are not justified by the evidence,” said David Pollock, PhD, professor of biochemistry and molecular genetics at the University of Colorado School of Medicine. “And this seems to be one of them.”

Pollock and CU Anschutz alumnus Todd Castoe, an associate professor of biology at the University of Texas Arlington, are lead authors of an academic letter published this recently in *Molecular Biology and Evolution* aimed at refuting the earlier study published in the same journal.

Pollock and his co-authors, including PhD student Kristen Wade and colleague Elizabeth Carlton, PhD, MPH, an assistant professor at the Colorado School of Public Health at CU Anschutz, took issue with the April 2020 study by biology Professor Xuhua Xia of the University of Ottawa in Canada.

Many scientists are interested in the origins of the novel coronavirus. The want to know which host the SARS-CoV-2 virus, responsible for Covid-19, came from before making the leap from animal to human.

The classic way to address this is by finding viruses with similar genome sequences in a particular animal host. Xia, however, focused on a feature of the coronavirus genome known as CpG content, and found that a distantly-related dog coronavirus had similar CpG content as SARS-CoV-2. Because this distant virus replicated well in the dog’s digestive tract, he concluded that a dog’s intestines were the ideal place to have affected the ancestral SARS-CoV-2’s CpG content.

“However, there is no evidence for the logical premise of Xia’s argument, considering that all mammals have digestive tracts,” the researchers wrote.

They showed that dogs aren’t special in their content of ZAP and ABOBEC3G proteins, which help safeguard humans from viruses and can interact with viral CpG content.

“Additionally, a recent inoculation study found that while other domesticated mammalian hosts are highly susceptible to SARS-CoV-2, canines exhibited low susceptibility, and no traces of viral RNA were detectable in any dog organs,” the scientists wrote.

Pollock and his colleagues said that although the recent origin of SARS-CoV-2 is uncertain, the best current evidence makes it likely that it was passed to humans by horseshoe bats or possibly pangolins, a kind of spiny anteater in China. There is strong evidence that the virus has recently jumped between humans and these animals or other intermediate hosts.

Bat and pangolin viruses also have CpG content similar to human SARS-CoV-2, so the environment that affected viral CpGs must have happened long ago and possibly in one of these two mammals. They noted that there are signs of prior recombination events among divergent viruses. That suggests that over the years relatives of coronaviruses found in bats and pangolins mixed and mutated to give rise to SARS-CoV-2.

The proposition that dogs were likely recent ancestors of SARS-CoV-2 is not justified by the available evidence, the researchers concluded.

“Xia did not demonstrate that the low CpG frequency in the SARS-CoV-2 genome was driven by a unique selective environment in dog digestive tracts,” the authors wrote. “Dogs are not more plausible than most other potential host species, and based on current data, far less plausible than bats or pangolins.”

Pollock said determining how the virus jumped from animals to humans is critical in preparing for the next pandemic.

Even so, he said, in the midst of a pandemic scientific results can be over-interpreted and misused, leading to misappropriation of resources and effort. Rather than promote the speculations of a study based on weak evidence, he noted, it is better to admit uncertainty. If not, the scientific community has an obligation to respond.

**“Considering the ramifications, scientists need to be particularly careful in interpreting findings, and avoid rushing to conclusions that are not well supported by solid evidence” co-lead author Castoe said. “We need to get this right.”**

#### Journal Reference:

Richard A Goldstein, Pleuni S Pennings, James L N Wood, Elizabeth J Carlton, Rhys Parry, Sergei L Kosakovskiy, Maciej F Boni, Edward C Holmes, David L Robertson, Kristen J Wade, Spyros Lytras, Blair W Perry, Todd A Castoe, David D Pollock. Viral CpG deficiency provides no evidence that dogs were intermediate hosts for SARS-CoV-2. *Molecular Biology and Evolution*, 2020; DOI: 10.1093/molbev/msaa178



# GROW YOUR BUSINESS WITH PETSFOREVER: SOCIAL MEDIA APP OFFERS A THRIVING COMMUNITY OF PET LOVERS FOR ETHICAL COMPANIES TO PARTNER WITH

Founded by entrepreneur Eric Hsu earlier this year, the PetsForever Social App holds the purpose of connecting pet enthusiasts from all over Australia with a trusted platform where they can build profiles of their pets, share content, join or create communities and, most importantly, shop with a variety of ethical partners chosen by the Pets Forever team.

“I wanted to create a safe space for pet owners to connect, share stories of their pets and be able to become better pet parents,” says Eric, when explaining what drew him to creating the platform. “Pet providers that meet our five-star rating system play a huge role in that scenario; in order to help our members become better pet parents, we should have a resource of ethical partners that they can shop with the certainty that we are promoting a business that values and respects animals.”

Just two weeks after its beta release, the PetsForever Social App accounts for hundreds of active users in dozens of different communities, sharing their content and shopping through a range of pet businesses selling a vast range of products, from fur health and premium designed bowls to genetic pet care and phone accessories.

Under that expansive scenario, Pets Forever is offering the opportunity for ethical business owners to partner with the brand

and grow their customer base under a great community of pet lovers who want nothing but the best for their furry families.

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# WELFARE CONCERNS HIGHLIGHTED OVER ‘INSTITUTIONAL HOARDING’ OF CATS

The compulsive hoarding of animals is a poorly understood psychiatric disorder in people. Characterised by failure to provide minimum standards of care, it can result in malnourishment, uncontrolled breeding, overcrowding and neglect. Typically there is denial of this failure and its impact on the animals and people involved. Even less well understood is the growing trend of ‘institutional hoarding’ by organisations masquerading to the public as legitimate shelters or rescue centres. A new epidemiological study by Dr Linda Jacobson, of the Toronto Humane Society (THS), and shelter medicine colleagues at Ontario Veterinary College and JVR Shelter Strategies, California, shows that there are significant welfare concerns for hoarded cats not just from the home environment but from institutional settings also.<sup>1</sup>

While animal hoarding is recognised to encompass a continuum of harm and severity, attention from the scientific community has mostly focused on large-scale cases and/or those involving legal seizure of animals and prosecutions. Comparatively little attention has been directed at smaller-scale cases, particularly those associated with a collaborative approach and voluntary relinquishment of animals.

Published recently in the *Journal of Feline Medicine and Surgery*, Dr Jacobson’s study looked at 371 hoarded cats relinquished over a three-year period to the THS, an adoption guaranteed (‘no-kill’) shelter with a full-service veterinary hospital. Groups of cats ranged from 10 to 77 in number, with nine groups originating from home environments (designated non-institutional hoarding) and three from rescues (designated institutional hoarding). The majority of cats (95%) were surrendered voluntarily, many with the assistance of a community intermediary who was able to provide a navigable pathway between the animal hoarders and the THS.

The authors documented a range of conditions typical for hoarded cats. Almost 90% of cats were unneutered and 18% of females of breeding age were pregnant. Upper respiratory infection (URI), skin disease, ear mites and oral disease (gingivitis)

were found in the largest number of groups. URI, which is associated with stress and overcrowding in cats, was the most common medical condition (38%) overall, followed by skin disease (30%). Notably, the risk of URI, and particularly chronic URI, was significantly greater for institutional hoarding compared with non-institutional hoarding settings.

As part of their study, the authors also analysed outcomes between hoarded and non-hoarded cats. Interestingly, they found similar adoption rates among their sample of 371 hoarded cats and a separate cohort of over 6000 non-hoarded cats that had been surrendered to the THS during the study period. In fact, the hoarded cats had a shorter maximum length of stay in the shelter than the non-hoarded cats. This reflects the fact that most of the hoarded cats were young and most of their medical conditions were curable or manageable, versus the complex medical or behavioural conditions among some non-hoarded cats. This finding, say the authors, underlines a shift in the expectations and abilities of shelters to successfully manage and rehome hoarded cats.

The study concludes that there is a need for a greater focus on institutional hoarding, and also points to the role that can be played by colony cat caregivers and other community intermediaries as an alternative to the legal seizure of animals in hoarding cases.

**Commenting, Dr Jacobson says ‘The “seize and euthanise” model is outdated and can often be successfully replaced by a least harms model.’**

This might help to reduce some of the unintended negative consequences associated with the traditional approach, such as delayed response times, stress for the animals and owners and overwhelming costs.



This group of cats was surrendered by an institutional hoarder. Hoarding of this nature is frequently not recognised despite the devastating harm that can be caused in these settings. Photo credit: Courtesy of Toronto Cat Rescue



The risk of chronic upper respiratory infection appears to be significantly greater for cats in institutional hoarding settings, as shown by this individual rescued by the Toronto Humane Society. Photo credit: Courtesy of Linda Jacobson/Toronto Humane Society

## Journal Reference:

1. Jacobson LS, Giacinti JA and Robertson JV. Medical conditions and outcomes in 371 hoarded cats from 14 sources: a retrospective study (2011–2014). *J Feline Med Surg* 2020; 22: 484-491. Free to read at: <https://journals.sagepub.com/doi/abs/10.1177/1098612X19854808>

# GRASSROOTS DOG VACCINATIONS CAN HELP TOP RABIES, BUT NOT ALONE

In most first world countries, dying from rabies is virtually unheard of. But around the world, rabies kills 59,000 people every year. Ninety-nine percent of those deaths are caused by dog bites; half of the people killed are children. There's a relatively simple way of preventing these deaths - vaccinating dogs against the disease - but systemic challenges make that easier said than done. In a new study in PLOS Neglected Tropical Diseases, an international team of researchers reported on a multi-year effort to vaccinate dogs in Kenya and highlighted some of the challenges scientists and public health officials face in eradicating the disease. They found that grassroots efforts helped lots of individuals - but that to stop the disease once and for all, these smaller campaigns must be coupled with large-scale efforts.

**“It’s important to focus on rabies because it’s 100% preventable,” says Adam Ferguson, a mammalogist at Chicago’s Field Museum and one of the study’s lead authors. “There’s no reason why people should be dying from rabies. It’s not like COVID in the sense that we don’t have a vaccine for it or we don’t know what to do with it.”**

Rabies is a virus, and it spreads through saliva in animal bites. It causes brain inflammation, and once a person begins showing symptoms, it’s nearly always fatal. Any mammal can carry rabies, but humans are most likely to pick it up from dogs, because we spend more time in close contact with them than with wild animals like raccoons and bats. And while a rabies vaccine was first discovered in 1885, large parts of the world remain vulnerable to the disease to this day. “It disproportionately impacts low-income, rural communities,” says Ferguson, who began the project as a National Science Foundation postdoctoral fellow at Kenya’s Karatina University. “In the US, we have the luxury that if one person dies of rabies a year, it makes the front page news. In Kenya, an estimated 2,000 people die of the disease every year.”

For the new study, Ferguson and his colleagues conducted grassroots dog vaccination campaigns in 2015, 2016, and 2017 in Kenya’s Laikipia County. The Laikipia Rabies Vaccination Campaign expanded over the course of the three-year period, and 13,155 dogs were vaccinated. Across different communities, the team set up a central station for people to bring their dogs to get vaccines. “The excitement and commitments by the communities to bring their dogs in the centres was overwhelming. This for sure made the effort feel worth investing into. You could tell that rabies eradication was tending to be more communal than an individual effort,” says Dedan Ngatia, a scientist at the University of Wyoming and one of the study’s lead authors.

For rural areas, team members used a combination of central stations and door-to-door vaccinations, asking people if they had dogs and offering free rabies vaccines. “We found that in the pastoral communities, you definitely need more door-to-door outreach than you do in the other communities,” says Ferguson,

partly because of how sparsely populated those areas are, and partly because many of the dogs there are working animals used to herd goats and sheep and wouldn’t be used to walking on a leash to go to one of the central vaccination stations.

As the project grew, more and more people were interested in getting their dogs vaccinated. But the project’s popularity presented the researchers with a tough decision. They could focus on smaller areas where they could try to get 70% of the dogs vaccinated, the amount needed for risk of dogs spreading the disease to humans to be effectively eliminated. Alternatively, they could vaccinate as many dogs from as many places as possible, without reaching a critical mass of vaccinations necessary for herd immunity. They didn’t have the resources to get to 70% immunity on the large scale.

“I think the question grassroots campaigns have to ask themselves is, is that their goal just to have local outreach and help a few individuals, or are they trying to eliminate it at the landscape-level scale, which is the bigger picture goal. I think, going forward, the answer should be, you should have both,” says Ferguson. “We need massive, large-scale efforts, but the reality is that money and resources are limited. That’s where these grassroots campaigns are helpful. We were able to expand from 5 to 17 communities because we partnered with the national and county government from the get-go.”

“Our target of vaccinating more than 70% of dogs in Laikipia County through sustained campaigns will interrupt transmission in the reservoir population so that the disease is eliminated. LRVV does more than just vaccinating dogs against rabies, we visit schools to raise awareness amongst children - the most affected population by the disease - about rabies prevention,” says Dishon Muloi, a scientist at International Livestock Research Institute and one of the study’s lead authors.

“The need to eradicate rabies is both for the protection of people as well as wildlife, which includes some of the most endangered carnivores like the African wild dogs. For many years, infectious diseases have remained the main cause of endangerment for these species, with rabies playing a leading role in the endangerment of the African wild dogs. With massive vaccinations, and achieving 70% coverage, we will be able to protect both people and wildlife,” says Ngatia.

This study was contributed to by scientists from the Field Museum, the Smithsonian Conservation Biology Institute, the University of Edinburgh, the International Livestock Research Institute, Karatina University, Maasai Mara University, the Kenya Agricultural and Livestock Research Organisation, the Kenya Zoonotic Disease Unit, Washington State University, the Zoological Society of London, the Ministry of Agriculture, Livestock, and Fisheries, County Government of Laikipia, the University of Liverpool, and the Mpala Research Centre.



## Journal Reference:

Adam W. Ferguson, Dishon Muloi, Dedan K. Ngatia, Wangechi Kiongo, Duncan M. Kimuyu, Paul W. Webala, Moses O. Olum, Mathew Muturi, Samuel M. Thumbi, Rosie Woodroffe, Lucy Murugi, Eric M. Fèvre, Suzan Murray, Dino J. Martins. Volunteer based approach to dog vaccination campaigns to eliminate human rabies: Lessons from Laikipia County, Kenya. PLOS Neglected Tropical Diseases, 2020; 14 (7): e0008260 DOI: 10.1371/journal.pntd.0008260

# PRUDENT ANTIBIOTIC USE IN VETERINARY DENTISTRY



BY DR DAVID E CLARKE REGISTERED SPECIALIST, VETERINARY DENTISTRY AND ORAL SURGERY

Antibiotics are commonly used in the management and treatment of oral diseases. The currently accepted use of antibiotics for dentistry fall into two categories:

1. Prophylactic therapy, where the aim is to provide 'short-term' antibiotic coverage to combat the bacteremia that results during the dental procedure.
2. Therapeutic therapy, where the aim is to provide antibiotics pre- and/or post-operatively to control and eliminate infection that is present in the oral cavity either alone or as a part of a treatment regime.

## PROPHYLACTIC THERAPY

**Prophylactic antibiotics should satisfy the following four principles:**

1. The procedure should have a significant risk of infection
2. The correct antibiotic must be selected
3. The antibiotic level must be high enough to be bactericidal
4. The time of administration and duration of the antibiotic should cover the period of bacteremia

**Prophylactic antibiotics are indicated for:**

1. Patients undergoing simultaneous elective sterile surgery
2. Select patients with arthritis or prosthesis
3. Select geriatric patients
4. Immune compromised patients
5. Patients with systemic diseases

Plaque, a bacterial biofilm, accumulates on teeth, gingiva and within the gingival sulcus. Plaque stimulates the host's immune system resulting in inflammation, characterised by vasodilation of capillaries, adherence of neutrophils to vessel walls, leukocytes leaving the capillaries, followed by neutrophils engulfing and phagocytosing bacteria.

If the inflammation continues, neutropenia may occur, as well as an increase in plasma cells and macrophages, production of lysosomes and acid hydrolases, and eventually permeability of the epithelial wall within the gingival sulcus and movement of the bacteria and inflammatory process into the deeper structures of the periodontal tissues.

The clinical signs are oedema, hyperplasia, hyperaemia, haemorrhage and inflammation of the gingiva, as well as oral pain and halitosis. During ultrasonic dental scaling, the dislodgement of plaque from the tooth allows excessive numbers of bacteria to enter the capillaries, potentially producing a significant bacteremia.

When dentistry is performed in conjunction with sterile surgery, i.e. simultaneous dental scaling and ovariohysterectomy, the bacteraemia combined with haemorrhage from an open wound, often with blood clots and surgical ligatures or subcutaneous sutures, have been opportunity to result in abscess development or peritonitis.

Patients with inflamed cartilage within arthritic joints, prostheses (hip/stifle/elbow), implants (ACL repair devices / teeth), degeneration of major organs and those with a compromised immune system who do not have the capability to control the bacteremia may be adversely affected during dental scaling.

They also have a high chance of suffering both an overwhelming systemic infection or localised organ infection and inflammation with bacteria lodging on heart valves resulting in compromised heart function, as well as in the liver, kidneys and joints resulting in hepatitis, glomerulonephritis and arthritis respectively.

## SOLUTION

1. Provide peri-operative antibiotics to cover the period of the dental procedure.
2. Do not perform elective sterile surgery and dentistry simultaneously. It is prudent to schedule the procedures separately, and even better to clean the teeth at the initial anaesthesia and then schedule time for the elective sterile surgery at a later date.



## RECOMMENDATION

The major isolates from dental infections are polymicrobial in nature reflecting the aerobic-anaerobic oral flora. Whilst there is no universally perfect empiric antibiotic which covers the oral flora in prophylaxis, the recommended antibiotics are:

1. Amoxicillin or Cephazolin 22mg/kg administered intravenously within 2 hours of the procedure and at 4 hours post-op, or
2. Clindamycin 5.5mg/kg PO bid commenced 48 hours pre-op and continued for 48 hours post-op.

If severe pathology is found during the oral examination, these antibiotics provide the practitioner with the option of continuing or administering a post-operative course of antibiotics.

## THERAPEUTIC THERAPY

Therapeutic antibiotics are indicated when:

1. Periodontal therapy is performed involving significant periodontal pockets, furcation involvement or alveolar bone loss
2. Extractions are performed in the presence of a purulent discharge or periapical abscess
3. Treating bone fractures, oral neoplasia and procedures involving maxillectomy or mandibulectomy surgery
4. Root canal therapy when periapical infection is present

### Periodontal disease (periodontitis) *Figure 1*



**Figure 1.** Advanced periodontitis in a dog presented for oral pain and halitosis. Clinical examination demonstrating plaque and calculus accumulation, inflammation, oedema, hyperaemia, recession of the gingiva, furcation exposure, mobile teeth and on oral exam under general anaesthesia highly likely increased periodontal probing depths.

Sub-gingival pockets and alveolar bone harbour multiple aerobic and anaerobic bacterial species (in particular *Porphyromonas gingivitis* / *P. gulae*). Gram negative bacteria are capable of producing a wide variety of bioactive molecules that affect the host including lipopolysaccharides (LPS), proteases and other cytotoxic molecules. The predominant leukocyte in the blood is the neutrophil. It is also believed to be the initial and predominant defence cell in the periodontium. *P. gingivalis* has been shown to possess an arsenal of proteases, which can cleave immunoglobulins preventing opsonization of the bacteria.

Macrophages are a major component in the host response to periodontitis. Macrophages are stimulated by bacterial stimuli, which then secrete interleukin 1B (IL-1B), tumour necrosis factor A (TNF-A) and prostaglandin E2 (PGE-2). IL-1B is a cytokine that is produced primarily by macrophages, which have been stimulated by LPS, which has an action of bone resorption. The main cellular source of TNF-A is tissue macrophages. TNF-A also has the capacity to stimulate bone resorption.

Unlike the cytokines, the prostaglandins are short acting lipids

from arachidonic acid released from damaged cell membranes by phospholipase A2.

LPS is a potent stimulator of PGE-2 and collagenase secretion by macrophages, which result in bone resorption and periodontal ligament degradation respectively. Studies have shown there is more PGE-2 in diseased sites than in healthy tissue and levels are related to periodontal disease progression.

Studies show that in advanced periodontitis, up to 107 colony forming units (CFUs) are present in each mm<sup>3</sup> of plaque biofilm. Subgingival scaling can remove up to 90% of organisms but many hide in roughened cementum, furcations, alveolar bone and periodontal tissues making elimination by mechanical debridement alone more difficult. Even if 99% were able to be removed, the count would be lowered by only 2 logs (107 to 105), which requires only 7 generations, or 42 days to re-establish to pre-scaling levels. In advanced periodontal disease, where deep pockets are present, treatment requires mechanical debridement via open/closed root planning. Root planning using a curette debrides the root surface of calculus, endotoxin laden cementum/dentin, plaque and hair. The curette also acts to debride the epithelial lining of the pocket. Antimicrobial therapy directed against suspect pathogens can provide additional improvement in severe or refractory cases when used in conjunction with mechanical debridement.

There are many published articles in the human literature which support a combination of both oral antibiotics and local delivery systems (LDS) to both extend and delay the time of re-establishment of sulcus pathogens and reduce the need for excessive use of systemic antibiotics. LDS provide antimicrobial activity within the periodontal pocket and may in the future be available to improve the successful management of periodontal disease without the need for systemic antibiotics. Local delivery of doxycycline has been reported in the veterinary literature using a pluronic gel combination, whereas metronidazole has also been used in human periodontitis. The long-term benefit of antibiotics for treatment of periodontitis is currently not proven.

The long-term intermittent use of clindamycin or doxycycline in what has been termed 'pulse-therapy' where the drug is given for the first 7 days of every month in the management of chronic periodontitis is not recommended and there is no published data to support the success of this regime.

Other diseases related to periodontitis, such as, gingivo-stomatitis in Oriental and Burmese breed cats, ANUG (Acute Necrotizing Ulcerative Stomatitis) or CUPS (Chronic Ulcerative Parodontal Syndrome) in Maltese and Greyhounds are often responsive to antibiotic therapy. In selective cases, treatment may also be enhanced with immune-modulating medications and extractions. It cannot be stressed enough that a home-care program is paramount to the success of periodontitis treatment and management, including tooth brushing, plaque-reducing diets and actives such as water additives and gels.

### Choice of antibiotic for periodontitis treatment:

1. Doxycycline (2.5mg/kg PO BID + LDS) (when have high owner compliance to administration of PO antibiotics and able to maintain LDS antibiotic within deep periodontal pockets (greater than 7mm) or furcation defects)
2. Cefovecin (8 mg/kg SQ) (when have low owner compliance to administration of PO antibiotics or unable to maintain LDS antibiotic in a shallow pocket or furcation defect)
3. ANUG - metronidazole (15mg/kg PO BID)
4. CUPS - amoxicillin (11mg/kg SQ) and metronidazole (15mg/kg PO BID)

## EXTRACTIONS *Figure 2*

The extraction of the tooth (or teeth) is indicated when:

1. Pulp exposure and owner unwilling to proceed with root canal or restorative treatment.
2. Periodontitis with associated osteomyelitis, resorption of alveolar bone and increased periodontal probing depth and loss of gingival attachment +/- furcation exposure and owner unwilling to proceed with bone graft or gingival flap reposition surgery
3. Teeth in a fracture line or within a neoplastic lesion.

### Choice of antibiotic following extractions:

1. Clindamycin (11mg/kg PO) (when have high owner compliance to administration of PO antibiotics )
2. Cefovecin (8mg/kg SQ) (when have low owner compliance to administration of PO antibiotics)

### Other conditions when antibiotics are indicated:

1. Bone fracture *Figure 3*
2. Neoplasia treated by maxillectomy or mandibulectomy *Figure 4*

### Choice of antibiotic following repair of fractures and oral surgery

1. Clindamycin (11mg/kg PO BID) (when have high owner compliance to administration of PO antibiotics)
2. Cefovecin (8mg/kg SQ) (when have low owner compliance to administration of PO antibiotics)

## NO ANTIBIOTIC COVERAGE

Antibiotic therapy is not indicated in a number of situations including:

1. A healthy patient with a competent immune system who has its teeth cleaned because of gingivitis, plaque or calculus accumulation and has normal periodontal sulcus measurements *Figure 5*
2. A healthy patient with a fractured tooth +/- pulp exposure of less than 24 hours duration treated by endodontic therapy (direct pulp capping) or tooth extraction. Direct pulp capping procedure when performed within 24 hours of the pulp exposure will remove any superficial infection in the coronal portion of the pulp. When there is no periodontal infection, the bacteraemia will be minimal during tooth extraction and the tooth socket should heal quickly and uneventfully *Figure 6*
3. A healthy young patient with no periodontal disease who has a persistent deciduous tooth extraction performed. There is rarely infection associated with the persistence of a deciduous tooth, so extraction should produce minimal bacteremia and healing is quick and uneventful *Figure 7*
4. Patients receiving orthodontic treatment *Figure 8*



**Figure 2.** Radiograph shows radiolucency associated with both root apices of the 1st mandibular molar tooth in a dog consistent with periapical abscess or granuloma formation.



**Figure 3.** Compound fracture through body of left rostral mandible caudal to the canine tooth in a dog.



**Figure 4.** Photograph of a dog with a squamous cell carcinoma located adjacent to the mandibular right canine and incisor teeth to be treated by rostral mandibulectomy.







Figure 5. Photograph of a dog with plaque and calculus.



Figure 6. Photograph of a cat with a fractured distal cusp of the mandibular molar tooth and pulp exposure



Figure 7. Photograph of a dog with persistent maxillary and mandibular left deciduous canine teeth



Figure 8. Photograph of a dog with orthodontic buttons and elastic chain to move the maxillary third incisor tooth rostrally

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# RISKS OF TAKING A PUPPY FROM IT'S MUM TOO EARLY

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Separating a puppy from its mother too early may have long-term consequences on physiological and behavioural development that risks behavioural problems later in life, a major reason why dogs are given up or left in shelters, warns authors of a recent study.

In the UK many welfare and veterinary organisations, such as the Animal Welfare Foundation, Blue Cross, PDSA and the Dogs Trust, recommend that puppies shouldn't be separated from their mothers until they are at least 8 weeks (56 days) old. There are legal restrictions on selling a puppy under this age in the UK.

Their guidance also recommends that prospective buyers should view the puppy with its mother, and this has been enshrined in English law since 2018.

The researchers wanted to find out if particular factors were associated with the acquisition of puppies under the age of 8 weeks and without viewing the puppy's mother.

They drew on data for 2392 puppies collected between May 2016 and February 2019 as part of 'Generation Pup', a long term UK study of dog health, behaviour, and welfare.

The data were obtained from three questionnaires, with details around the process of acquisition completed by owners before or after they had acquired their puppy. In all, 1844 puppies were eligible for inclusion in the final analysis.

The responses showed that 1 in 4 (461) puppies had been acquired before they were 8 weeks old, a proportion that is considerably higher than what has been reported before. Around 1 in 12 (149; just over 8%) had been acquired without viewing the puppy's mother. Just 30 (just over 1.5%) had been acquired under 8 weeks of age and without viewing the mother.

Five factors were independently associated with acquisition of an 'under age' puppy.

Owners who visited their puppy at least once before taking it home were more likely to acquire the animal before it was 8 weeks old. This might be because they couldn't bear to leave without taking the puppy home, or because they felt the puppy was old enough, suggest the researchers, by way of an explanation.

Owners who intended to use their puppy as a working dog, such as for herding animals, pest control, work in the police or military, as a search and rescue, or guard dog were also more likely to acquire their puppy before it was 8 weeks old. This might be because they wanted to start training the puppy as soon as possible, say the researchers.

The analysis also revealed that the odds of early acquisition increased in tandem with the number of dogs already in the household and if the dog was a mix of unknown breeds.

"Mixed breed puppies may be more likely to have been bred by a hobby breeder than a licensed breeder, or be a result of accidental mating," suggest the researchers. "Hobby breeders do not need to conform to the same selling restrictions as licensed breeders."

At the other end of the spectrum, the likelihood of acquiring a puppy under the recommended age fell as the level of annual household income rose.

Similarly, owners who visited their puppy before taking it home, or bought a puppy registered with the Kennel Club, or who viewed the puppy's father and/or collected the puppy from the breeder's home, had lower odds of acquiring a puppy without viewing the mother.

The researchers suggest that prospective owners may be more aware of the recommendations to view the puppy with its mother than those around the recommended minimum age.

Their findings might help target specific owners, "with educational or media campaigns that could decrease the proportion of puppies acquired in this way in the future," they conclude.

In a linked research comment, vet Dr Federica Pirrone, University of Milan, Italy, emphasised the importance of the guidance and regulations.

**"Early separation of a puppy from its mother and littermates is a husbandry strategy that may increase the animal's chances of exhibiting potentially problematic behaviours as an adult," she warns.**

"The occurrence of problematic behaviours is the most common reason why dogs are relinquished, abandoned or, in countries where it is allowed, even euthanised."

Early separation impairs early brain development which restricts the ability of puppies to adapt to new stimuli and to develop good social skills as adults. They are highly likely to exhibit fear and anxiety-related behaviours as adults, which are then often perceived by owners as problematic, she explains.

Similarly, she emphasises "Seeing the mother before buying a puppy enables the prospective owner to ascertain that she is unstressed and free from behavioural problems, which in turn helps predict that the puppy will not develop behavioural problems later in life."

"It is, therefore, essential to encourage prospective owners to be well informed regarding dog behaviour and to be aware of the importance of correct socialisation," she says.

Daniella Dos Santos, British Veterinary Association President, commented "There are very good reasons why puppies shouldn't leave their mother before they're eight weeks old. Rehoming from this age means puppies are fully and correctly weaned, and staying with their mother in early development plays a vital role in social and behavioural development.

"Prospective puppy buyers should always ask to view them alongside their mother first and we strongly recommend using the free Puppy Contract to make sure that they're getting a happy, healthy and well-socialised animal from a reputable breeder or rehoming centre."

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## Journal Reference:

Rachel H Kinsman, Rachel A Casey, Toby G Knowles, Séverine Tasker, Michelle S Lord, Rosa E P Da Costa, Joshua L Woodward, Jane K Murray. Puppy acquisition: factors associated with acquiring a puppy under eight weeks of age and without viewing the mother. *Veterinary Record*, 2020; 187 (3): 112 DOI: 10.1136/vr.105789

# MYSTERY ABOUT HISTORY OF GENETIC DISEASE IN HORSES

Warmblood fragile foal syndrome is a severe, usually fatal, genetic disease that manifests itself after birth in affected horses. Due to the defect, the connective tissue is unstable. Under force, for instance, the skin tears from the tissue underneath and the joints can suffer dislocation. A research team from the Universities of Göttingen and Halle has now been able to prove that the disease did not stem from the English thoroughbred stallion Dark Ronald XX, which had been the assumption until now. The results have been published in the journal *Animal Genetics*.

The mystery of the genetic defect could have been solved in 2012: this is when gene responsible was identified. It is called PLOD1 and normally ensures that collagen molecules in the skin and connective tissue can bind to form a stable network. The mutation in the PLOD1 gene prevents “cross-linking” which is needed for stable collagen. The exact origin of the mutation was previously unclear. Since the spread of the genetic defect is also a problem in horse-breeding in Germany, the Vereinigte Informationssysteme Tierhaltung (IT-Solutions for Animal Production) in Verden 2019 determined the possible origin of the genetic defect from the test results of around 2,000 horses and their pedigree records. The investigation concluded that the genetic defect was probably due to the English thoroughbred stallion Dark Ronald XX (1905-1928) or his father, Bay Ronald XX, and the defect was then spread through their offspring. The current research, led by the University of Göttingen, calls this theory into question. “We have now succeeded in proving that Dark Ronald XX was not a carrier of the PLOD1 mutation and can therefore be excluded as the original source of this genetic defect,” says Professor Bertram Brenig, Director of the Institute of Veterinary Medicine at the University of Göttingen and lead author of the study. Doubts about whether the mutation descended from Dark Ronald XX were already expressed in 2019, and further investigation reveals a Hanoverian stallion born in 1861.

Dark Ronald XX was an important thoroughbred stallion who had a great influence on German horse-breeding. He was sold to Germany in 1913 and was used as a stud - a stallion with highly prized heritable characteristics - first in Graditz and later in Altefeld. In 1928, he was brought to the veterinary clinic of the University of Halle for treatment due to intestinal colic and this is where he died. Since then his remains - such as skeleton, heart and skin - have been kept in one of the natural science collections of the Martin Luther University Halle-Wittenberg.

**“This is most fortunate, as it has allowed us to examine Dark Ronald XX directly for the presence of the PLOD1 mutation,” says Brenig. The scientists were thus able to examine small pieces of Dark Ronald XX’s skin. “Examining the DNA from the nearly 100-year-old skin of Dark Ronald XX was not easy,” says co-author Dr Renate Schafberg from the University of Halle, “because we knew nothing about the tanning or other preservation treatments of the skin.”**

The disease itself is not new and probably originated in the middle of the 18th century. Since then, all breeding animals have been consistently tested for the genetic defect. There is a comparable genetic disease in humans, known as Ehlers-Danlos syndrome, which shows similar symptoms.



Dark Ronald XX was a stallion who significantly influenced the breeding lines. Photo credit: From the publication of the natural science collections of the Martin Luther University Halle-Wittenberg



## Journal Reference:

Xuying Zhang, Marc Hirschfeld, Renate Schafberg, Hermann Swalve, Bertram Brenig. Skin exhibits of Dark Ronald XX are homozygous wild type at the Warmblood fragile foal syndrome causative missense variant position in lysyl hydroxylase gene PLOD1. *Animal Genetics*, 2020; DOI: 10.1111/age.12972

# RESEARCHERS DIGITISE DOGGIE MOTIONS

Researchers from the University of Bath have developed motion capture technology that enables you to digitise your dog without a motion capture suit and using only one camera.

The software could be used for a wide range of purposes, from helping vets diagnose lameness and monitoring recovery of their canine patients, to entertainment applications such as making it easier to put digital representations of dogs into movies and video games.

Motion capture technology is widely used in the entertainment industry, where actors wear a suit dotted with white markers which are then precisely tracked in 3D space by multiple cameras taking images from different angles. Movement data can then be transferred onto a digital character for use in films or computer games.

Similar technology is also used by biomechanics experts to track the movement of elite athletes during training, or to monitor patients' rehabilitation from injuries. However, these technologies - particularly when applying them to animals - require expensive equipment and dozens of markers to be attached.

Computer scientists from CAMERA, the University of Bath's motion capture research centre digitised the movement of 14 different breeds of dog, from lanky lurchers to squat pugs, which were residents of the local Bath Cats' and Dogs' Home (BCDH).

Wearing special doggie motion capture suits with markers, the dogs were filmed under the supervision of their BCDH handlers doing a range of movements as part of their enrichment activities.

They used these data to create a computer model that can accurately predict and replicate the poses of dogs when they're filmed without wearing the motion capture suits. This model allows 3D digital information for new dogs - their shape and movement - to be captured without markers and expensive equipment, but instead using a single RGBD camera. Whereas normal digital cameras record the red, green and blue (RGB) colour in each pixel

in the image, RGBD cameras also record the distance from the camera for each pixel.

PhD researcher Sinéad Kearney said: "This is the first time RGBD images have been used to track the motion of dogs using a single camera, which is much more affordable than traditional motion capture systems that require multiple cameras.

**"This technology allows us to study the movement of animals, which is useful for applications such as detecting lameness in a dog and measuring its recovery over time."**

"For the entertainment industry, our research can help produce more authentic movement of virtual animals in films and video games. Dog owners could also use it to make a 3D digital representation of their pet on their computer, which is a lot of fun!"

The team presented their research at one of the world's leading AI conferences, the CVPR (Computer Vision and Pattern Recognition) conference in June.

The team has also started testing their method on computer-generated images of other four-legged animals including horses, cats, lions and gorillas, with some promising results. They aim in the future to extend their animal dataset to make the results more accurate; they will also be making the dataset available for non-commercial use by others.

Professor Darren Cosker, Director of CAMERA, said: "While there is a great deal of research on automatic analysis of human motion without markers, the animal kingdom is often overlooked.

"Our research is a step towards building accurate 3D models of animal motion along with technologies that allow us to very easily measure their movement. This has many exciting applications across a range of areas - from veterinary science to video games."



Sinead Kearney adjusts the cameras to collect the motion capture data of a lurcher. Photo credit: University of Bath



# ANIMAL SCENTS

People love their furry family members - and so does Young Living! Young Living have designed products especially for our four-legged friends. A portion of all proceeds from Animal Scents® products goes to support Vital Ground, a nonprofit organisation dedicated to protecting the habitat of grizzly bears and other wide-roaming wildlife.

## Inner Balance

This gentle and comforting blend contains a variety of oils including ginger, peppermint, tarragon and fennel. The most effective area to apply this oil is on your dog's belly. Simply place a drop in the palm of your hand and rub on location. For small breeds or puppies, rub your palms together so that you absorb most of it before rubbing on their belly area. Inner Balance can be applied as needed. Another time applying this oil would be just before you take your dog in the car. This makes for a very settle journey.

## Pet Care

The Pet Care oil blend has so many amazing oils in it. What dog wouldn't feel uplifted after this oil? To receive the full benefits of this blend, place a drop into the palm of your hand, rub your palms together, and pet all over their coats, leaving them in a state of calm and balance. Apply as often as you feel your dog would benefit from this oil.

## Puriclean

Dogs are very social creatures and they love to play. However



sometimes their playtime can turn a little rowdy. PuriClean contains some beautiful skin pampering oils such as Patchouli, Lavender and Tea Tree, helping to improve the appearance of your dog's skin. Apply a drop on location, and you may wish to dilute even more if this is your dog's first experience with essential oils or if they are a puppy.

## Pet Fresh

Reach for Pet Fresh when you are wanting to help protect and clean the skin of your dog following playtime or a long outdoor adventure. Often applied after PuriClean, Pet Fresh contains the beneficial properties of oils such as Myrrh and Patchouli. Apply a drop on location and consider additional dilution if it is your dog's first experience with oils.

## Pet Renew

After the application of PuriClean and Pet Fresh, apply Pet Renew to gently moisturise the skin of your dog. There are many beautiful oils in this blend. Your dog will love you for it! Like PuriClean and Pet Fresh, apply a drop on location and it is recommended to dilute even more if this is the first time you are applying essential oils to your dog.

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# ELANCO CLOSES ACQUISITION OF BAYER ANIMAL HEALTH

Elanco Animal Health Incorporated (NYSE: ELAN) announced in early August that it has closed the acquisition of Bayer Animal Health. The transaction, valued at \$6.89 billion, expands Elanco's scale and capabilities, positioning the company for the long term as a leader in the attractive, durable animal health industry.

"Nearly two years into our journey as an independent company, we have made significant progress in creating a purpose-driven, independent global company dedicated to animal health - all while weathering the century's most significant animal and human health pandemics: African Swine Fever and COVID-19," said Jeff Simmons, president and CEO of Elanco. "Delivering on the timely close of the acquisition and bringing momentum into Day 1 in this challenging environment underscores the deep capability and disciplined execution from both companies."

"This milestone is another key step in Elanco's journey. But, ultimately, today is about improving the lives of animals, people and improving the health of the planet. Pets and protein have never been more important," Simmons said. "Food supply disruptions and increasing unemployment are driving food security challenges around the world. At the same time, research shows increased time at home has changed the long-term relationship between pets and their owners, as pets increasingly provide valuable emotional support. We know making life better for animals, simply makes life better."

Meanwhile, the pandemic has accelerated key trends transforming the industry, particularly pet owners' desire to access veterinary care and animal health products in a variety of forms, from curbside care and telemedicine to online purchases shipped direct to the doorstep. The combination of Elanco and Bayer Animal Health joins Elanco's existing strong relationship with the veterinarian with Bayer Animal Health's focus in retail and online in order to create an omni-channel leader best positioned to serve veterinarians and pet owners where they want to shop.

This acquisition strengthens Elanco's Innovation, Portfolio, Productivity (IPP) strategy, which the company has been executing on since before its IPO in 2018. Both companies come to closing with a disciplined focus on the strategy and diligent execution to drive momentum.

**Innovation:** Elanco's robust R&D pipeline is now bolstered with five expected launch equivalents from Bayer - bringing Elanco's anticipated total to 25 by 2024 - with five of those expected to launch by the end of 2021. The transaction also adds new R&D capabilities, including innovative dosing and delivery technology platforms, and provides access rights to Bayer's Crop Science R&D pipeline and de-prioritized clinical pharma assets.

**Portfolio:** The combination expands Elanco's portfolio to provide farmers, pet owners, and veterinarians more comprehensive animal health solutions. By combining Elanco's longstanding focus on the veterinarian with Bayer's direct-to-consumer experience, the transaction opens new opportunities for growth and expands Elanco's omni-channel presence, enabling the company to meet customers where and how they want to shop.

**Pet Health:** The combination elevates Elanco's pet business to approximately 50 percent of revenues and nearly triples the company's international pet health business. This expanded portfolio of care provides for pets at all ages and stages, from disease prevention and wellness for the youngest puppies to helping pets remain an active, central part of the family in their later years. The transaction also broadens Elanco's pet

parasiticide portfolio with topical treatments and collars, making the blockbuster Seresto collar Elanco's top product globally.

**Farm Animals:** The combined company brings together complementary farm animal portfolios that position Elanco to serve an even broader spectrum of the industry and better leverage data, and services for customers. The transaction adds a number of anchor cattle brands, enhances the company's global bio-protection portfolio, and expands the company's aqua presence into warm water fish.

**Productivity:** Elanco plans to leverage its extensive integration experience - and ownership mindset - to efficiently and quickly integrate the new business. The combined company is expected to generate significant operating cash flow as a result of the durable industry and resilient portfolios. While the timing of achieving goals from the deal announcement have been impacted by the COVID-19 pandemic, the company still expects to deliver \$275 - \$300 million in synergies by 2025.

"Most importantly, today is about the farmers, veterinarians, and pet owners we serve. If COVID-19 has made anything clear - it's that the world has never needed animals and the work farmers and veterinarians do more," Simmons said. "Together, we are better positioned to advocate for our customers, to deliver solutions to their greatest unmet needs, so they can keep healthy, sustainably sourced meat, milk, fish and eggs in the center of the dinner table and healthy, active pets in the center of families. Together, we have the potential to improve animal health and the lives of billions."







# APIAM: UP, UP AND AWAY

Apiam Animal Health Limited released its financial results for the 12 months to 30 June 2020 with revenue increasing 6.0% to \$118.4 million underpinned by Apiam's diversified customer segments, new business initiatives and the acquisitions made over the period.

Apiam's dairy and companion animal segment revenues performed strongly, particularly as underlying industry conditions in many regional dairy areas recovered in the second half due to higher rainfall. Companion animal revenues also grew strongly with double digit growth recorded in most of Apiam's companion animal clinics, supported by on-going growth in pet ownership as COVID-19 restrictions occurred. Apiam also increased market share in some clinics in regional areas.

Revenues from the Company's beef feedlot segment were solid but came off the back of a record FY19 performance, while revenues from pigs continued to be affected by challenging industry conditions.

New business initiatives & acquisitions, along with reviewed management implemented several new business initiatives over FY20 to deliver greater revenue and earnings opportunities.

Since launching Best Mates, member growth has been very strong, with members growing from 501 as at the 30 June 2019 to 3,155 as at 30 June 2020. Growth on a quarterly basis was particularly strong through Q3 & Q4, despite broader economic COVID-19 challenges.

The ProDairy consultancy was another initiative launched in early FY20 and an agreement with Zoono Animal Health to distribute Zoono Group's (ASX:ZNO) proprietary sanitiser and protectant technology for use in livestock facilities in Australia and to US-based swine customers.

Apiam completed the strategic acquisitions of ACE Laboratory Services, Grampians Animal Health and Devoted Vets in Warragul in FY20. Each of these businesses featured a compelling acquisition rationale - either the addition of a specialist service offering that was attractive to Apiam's customer base, or a new high-growth regional exposure.

All three acquisitions made during the past year have performed extremely well and are making a strong financial contribution to Apiam's business.

# CARING FOR SYNTHETIC LAWN WITH PETS

Artificial grass is saving pet owners time and money compared to maintaining a natural lawn, but a common and increasing issue has been pet urine and odour build-up on synthetic surfaces over time.

With a bit of lawn maintenance and using quality deodorising and disinfecting products, you can keep your artificial lawn clean and fresh, and your four-legged family safe and happy year round, said David Campbell from The Turf Doctor Australia, experts in deodorising and disinfecting artificial lawns loved by pets.

David has been working in the artificial turf industry for 20 plus years. Having installed synthetic turf in his own backyard over a decade ago to deal with the constant demands of three young children and two dogs, he is well versed in the advantages of imitation lawn and how to keep it clean and odour-free.

Installing artificial turf is one solution to managing environmental allergies (grass pollen) in dogs and humans, said David. "What I learned from my dogs is that they love synthetic turf! Scotty is 11 years old now and still loves to play, roll around and scratch himself on the surface," he said.

The problem arises when pets urinate, and the urine settles in the crushed rock base and the backing mat of the synthetic turf. Once urine dries, it crystallises forming uric acid crystals, which is the source of the urine odour, and they're difficult to remove, he said.

When David couldn't find anything on the market that was organic and wouldn't harm either his pets or the kids, he developed the smellBgone range - a deodoriser and disinfectant all in one.

The Turf Doctor's smellBgone 'infill' product is designed to remain in the turf; it is organic and naturally occurring (similar to sand). The smellBgone 'liquid' is an anti-bacterial disinfecting deodoriser applied as a spray onto the affected area.

"The smellBgone infill and liquid products are non-toxic, biodegradable and provide a fast, permanent and safe solution to smelly pet problems," said David.

Maintaining artificial turf with pets To maintain your backyard

turf, David advises regular raking and removing rubbish, such as leaves and of course, dog poo.

"Pick up after your dog every day to avoid discoloration or staining of the grass," he advised. "Applying vinegar and water only masks the pet urine smell; it does not eliminate or remove the source. SmellBgone absorbs and destroys pet urine odours."

David has found the key to protecting synthetic lawn from playful pups is to give them something to do. Providing chew toys and treats and playing ball or scent games are fun ways to distract those busy paws, he suggested. You can also build a dog run.

"If your dog loves to dig, like Scotty, you can create a spot in your yard for excavation (a sand box or dog wading pool) and redirect his efforts there. A dog trainer can help with training," he said.

Got a smelly problem in the dog run or sandbox? Not to worry - smellBgone works its magic there, too. Be sure to provide plenty of shade and water for your dog, David said.

**To discover more about smellBgone, visit [www.theturfdoctor.com.au](http://www.theturfdoctor.com.au)**



David Campbell of Turf Doctor and Scotty. Photo credit: SmellBgone

# AUSTRALIA'S WISH LIST OF EXOTIC PETS

Unsustainable trade of species is a major pathway for the introduction of invasive alien species at distant localities and at higher frequencies. It is also a major driver of over-exploitation of wild native populations. In a new study, published in the peer-reviewed open-access scholarly journal *Neobiota*, scientists estimated the desire of Australians to own non-native and/or illegal alien pets and the major trends in this practice. In addition, the team suggests ways to improve biosecurity awareness in the country.

Over the last two decades, Australia has been experiencing an increased amount of non-native incursions from species prominent in the international pet trade, such as rose-ringed parakeets, corn snakes and red-eared sliders. On many occasions, these animals are smuggled into the country only to escape or be released in the wild.

In general, the Australian regulations on international pet trade are highly stringent, in order to minimise biosecurity and conservation risks. Some highly-desirable species represent an ongoing conservation threat and biosecurity risk via the pet-release invasion pathway. However, lack of consistent surveillance of alien pets held, legally or otherwise, in Australia remains the main challenge. While there are species which are not allowed to be imported, they are legal for domestic trade within the country. Pet keepers have the capacity to legally or illegally acquire desired pets if they are not accessible through importation, and the number of such traders is unquantified.

Since keeping most of the alien pets in Australia is either illegal or not properly regulated, it is really difficult to quantify and assess the public demand for alien wildlife.

"We obtained records of anonymous public enquiries to the Australian Commonwealth Department of Agriculture, Water and the Environment relating to the legality of importation of various alien taxa. We aimed to investigate whether species desired in Australia were biased towards being threatened by extinction, as indicated by broader research on pet demand or towards being invasive species elsewhere, which would indicate trade-related biosecurity risks," shares the lead author Mr. Adam Toomes from the University of Adelaide.

According to the research team's analysis, pets desired by Australians are significantly biased towards threatened species, invasive species and species prominent in the U.S. pet trade.

"This novel finding is of great concern for biosecurity agencies because it suggests that a filtering process is occurring where illegally smuggled animals may already be "pre-selected" to have the characteristics that are correlated with invasive species," warns Mr. Adam Toomes.

However, the bias towards species already traded within the U.S. suggests that there is potential to use this as a means of predicting future Australian desire, as well as the acquisition of pets driven by desire. Future research from the Invasion Science & Wildlife Ecology Group at The University of Adelaide will investigate whether Australian seizures of illegal pets can be predicted using U.S. trade data.

#### Journal Reference:

Adam Toomes, Oliver C. Stringham, Lewis Mitchell, Joshua V. Ross, Phillip Cassey. Australia's wish list of exotic pets: biosecurity and conservation implications of desired alien and illegal pet species. *Neobiota*, 2020; 60: 43 DOI: 10.3897/neobiota.60.51431

# 3BD

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# NEW CANCER TREATMENT NOW AVAILABLE FOR DOGS

The Journal of Veterinary Internal Medicine published results in June from a pivotal canine field study of STELFONTA® (tigilanol tiglate), the lead anticancer pharmaceutical from Australian life sciences company, QBiotics Group Limited (QBiotics).

The study of 123 client-owned dogs demonstrated that in those with Mast Cell Tumours (MCTs), a single intratumoural injection of STELFONTA® removed 75% of MCTs at day 28, significantly higher compared to untreated controls ( $p < 0.001$ ). Further, the trial showed no recurrence in 93% of STELFONTA®-treated dogs at day 84. Importantly, the treatment was well tolerated, and animals had a good quality of life during and after treatment.<sup>1</sup>

STELFONTA® is a first-in-class pharmaceutical treatment for all grades of MCT now available in Europe with anticipated launches in the USA and Australia, pending approvals.

Dr Chad Johannes, a leading USA veterinary oncologist said, “The study determined STELFONTA® is an efficacious and well-tolerated new option for the local treatment of canine MCT.

“STELFONTA® is administered by injection directly into the tumour. Generally, dogs undergoing treatment do not require sedation or anaesthesia, which carries potential increased risk for older dogs and brachycephalic breeds,” said Dr Johannes.

Cancer is the leading cause of death in dogs,<sup>2</sup> and MCTs are the second most frequent canine cancer diagnosed.<sup>3</sup> STELFONTA® represents an exciting additional treatment option for MCT where surgical removal of the tumour mass is currently the standard of care.

The launch of STELFONTA® marks the first commercialisation of QBiotics’ lead anticancer compound tigilanol tiglate and creates a repeatable revenue stream for the company.

QBiotics’ CEO and Managing Director, Dr Victoria Gordon said

“The inclusion of our pivotal safety and efficacy clinical study in such a reputable publication as the Journal of Veterinary Internal Medicine is a significant accolade for QBiotics and reaffirms the validity of the study’s results.

**“Having recently launched STELFONTA® in Europe, our marketing partner the global veterinary pharma company, Virbac, will work to distribute the product locally amidst country-specific COVID-19 requirements. We also advise that STELFONTA® may be launched in the USA and Australia, pending local approvals.**

“Here at QBiotics we develop our products simultaneously for the human and veterinary markets. The sound results from the tigilanol tiglate pivotal canine field study informs our human clinical program, while revenue from sales of STELFONTA® financially supports human product development,” said Dr Gordon.

## About QBiotics

QBiotics is a public unlisted Australian life sciences company which discovers, develops and commercialises novel anticancer and wound healing products for human and veterinary markets.

Its lead product, tigilanol tiglate, is an anticancer pharmaceutical targeting a range of solid tumours across multiple species.

QBiotics’ business model is to develop products that have application in both veterinary and human markets. Success in the veterinary programs validates QBiotics technology and de-risks human development, while generating early, non-diluting revenues.



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2. Kelsey JL, et al. 1998. Epidemiological studies of risk factors for cancer in pet dogs. *Epidemiology Review* 20:204-217
3. Garrett, LD. 2014. Canine mast cell tumors: diagnosis, treatment, and prognosis. *Veterinary Medicine: Research and Reports*, Vol 5. <https://doi.org/10.2147/VMR.R.S41005>
4. Vail DM, Thamm DH and Liptak JM (editors) 2020. *Small Animal Clinical Oncology*, edition 6, Elsevier Inc, St Louis, Missouri.



# WHEN SHOULD YOU NEUTER DOGS TO AVOID HEALTH RISKS?

Some dog breeds have higher risk of developing certain cancers and joint disorders if neutered or spayed within their first year of life. Until now, studies had only assessed that risk in a few breeds. A new, 10-year study by researchers at the University of California, Davis, examined 35 dog breeds and found vulnerability from neutering varies greatly depending on the breed. The study was published in the journal *Frontiers in Veterinary Science*.

“There is a huge disparity among different breeds,” said lead author Benjamin Hart, distinguished professor emeritus at the UC Davis School of Veterinary Medicine. Hart said there is no “one size fits all” when it comes to health risks and the age at which a dog is neutered. “Some breeds developed problems, others didn’t. Some may have developed joint disorders but not cancer or the other way around.”

Researchers analysed 15 years of data from thousands of dogs examined each year at the UC Davis Veterinary Medical Teaching Hospital to try to understand whether neutering, the age of neutering, or differences in sex when neutered affect certain cancers and joint disorders across breeds. The joint disorders examined include hip dysplasia, cranial cruciate ligament tears and elbow dysplasia. Cancers examined include lymphoma; hemangiosarcoma, or cancer of the blood vessel walls; mast cell tumours; and osteosarcoma, or bone cancer.

In most breeds examined, the risk of developing problems was not affected by age of neutering.

## Breed differences by size and sex

Researchers found that vulnerability to joint disorders was related to body size.

“The smaller breeds don’t have these problems, while a majority of the larger breeds tend to have joint disorders,” said co-author Lynette Hart, professor at the UC Davis School of Veterinary Medicine.

One of the surprising exceptions to this was among the two giant breeds - great Danes and Irish wolfhounds - which showed no increased risk to joint disorders when neutered at any age.

Researchers also found the occurrence of cancers in smaller dogs was low, whether neutered or kept intact. In two breeds of smaller dogs, the Boston terrier and the shih tzu, there was a significant increase in cancers with neutering.

Another important finding was that the sex of the dog sometimes made a difference in health risks when neutered. Female Boston terriers neutered at the standard six months of age, for example, had no increased risk of joint disorders or cancers compared with intact dogs, but male Boston terriers neutered before a year of age had significantly increased risks.

Previous studies have found that neutering or spaying female golden retrievers at any age increases the risk of one or more of the cancers from 5 percent to up to 15 percent.

## Discuss choices with Owners

Dog owners in the United States are overwhelmingly choosing

to neuter their dogs, in large part to prevent pet overpopulation, euthanasia or reduce shelter intake. In the U.S., surgical neutering is usually carried out by six months of age.

This study suggests that dog owners should carefully consider when and if they should have their dog neutered.

**“We think it’s the decision of the pet owner, in consultation with their veterinarian, not society’s expectations that should dictate when to neuter,” said Benjamin Hart. “This is a paradigm shift for the most commonly performed operation in veterinary practice.”**

The study lays out guidelines for pet owners and veterinarians for each of 35 breeds to assist in making a neutering decision.



## Journal Reference:

Benjamin L. Hart, Lynette A. Hart, Abigail P. Thigpen, Neil H. Willits. Assisting Decision-Making on Age of Neutering for 35 Breeds of Dogs: Associated Joint Disorders, Cancers, and Urinary Incontinence. *Frontiers in Veterinary Science*, 2020; 7 DOI: 10.3389/fvets.2020.00388



# ‘WAR DOGS’ SHINES SPOTLIGHT ON HERO DOGS AND THE HIDDEN PROBLEM OF PTSD IN PRIVATE MILITARY CONTRACTORS

‘War Dogs’, a riveting true-life tale of fearless explosive detection dogs and their equally brave handlers during the war in Afghanistan, also exposes the sleeping issue of post traumatic stress disorder in civilian contractors engaged in modern warfare.

A report by the Rand Corporation in the US found that contractors were twice as likely to suffer PTSD than uniformed military veterans, yet they do not have access to the same levels of healthcare and support.

The book tells the story of Shane Bryant, a former Australian Army and police dog handler from the Illawarra in NSW who served 10 years as a private military contractor in Afghanistan, initially on active service with the US military.

First released in 2010, this expanded edition of War Dogs now tells the story of Shane’s own battle with PTSD, brought on by repeated exposure to combat, and one particularly terrifying incident where Shane was nearly executed in cold blood.

Shane’s story was brought to light by co-writer Tony Park, a fellow Afghanistan veteran and the author of 18 thriller novels set in Africa.

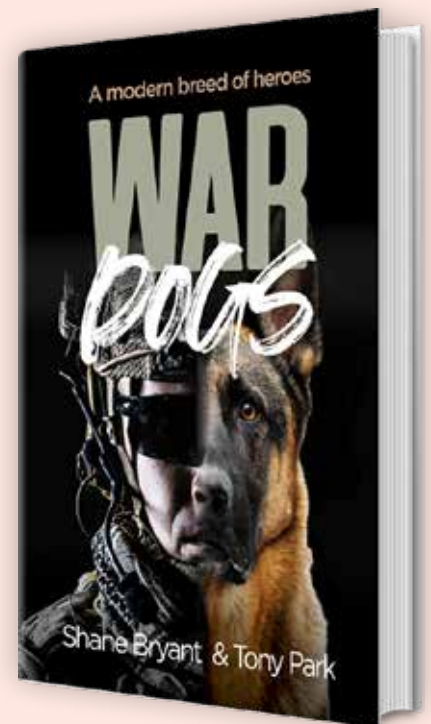
Although a foreign civilian, Shane’s service in Afghanistan began with attachments to elite US Army Special Forces A Teams in Uruzgan Province. War Dogs is also very much the story of Ricky and Benny, two plucky explosive detection dogs, and the bonds that form between working dogs and their handlers.

Shane, Ricky and Benny and their human and animal friends seek out deadly improvised explosive devices (IEDs), and get caught in fire fights with the Taliban. The insidious nature of this war without frontlines is brought home to Shane and his US brothers in arms when an undercover suicide bomber is discovered in their base.

Back home in Australia Shane finds that commuting to and from a war zone over 10 years takes its toll on his relationships, and his children. He’s torn between having a sense of purpose in Afghanistan, and not being around for his loved ones.

While uniformed military personnel deploy for fixed periods, War Dogs shows that the world’s new breed of contract warriors - like Shane - often sign up for a seemingly never ending tour of duty that almost inevitably takes its toll.

**The paperback is \$29.99 and e-book is \$10.99, available from all major online bookstores.**



## PETS AND FACE MASKS

BY VETERINARIAN DR SASHA NEFEDOVA

Pets have a natural ability to understand and respond to human expression and it plays a significant role in building a positive relationship and trust between pet and owner.

With face masks now being mandatory in Victoria and encouraged to be worn in other parts of the country, for pets, seeing their owners wear face masks may cause them to feel scared or anxious, particularly for those that are naturally timid or shy.

To help your pet feel safe and at ease, gradually introducing a face mask in a familiar space such as your home will help them feel comfortable when leaving the house for their daily walk when the full mask is required. To do this, wear the mask partly on your face when you interact with your pet and as they become familiar with the mask, gradually cover more of your face.

If your pet continues to demonstrate symptoms of anxiety, including shaking, licking of the lips or pacing, remove the mask and try again the next day. The key is to keep these sessions short and sweet to prevent your pet from becoming irritated, tired, or anxious.



It’s important to make positive associations with face masks, so rewarding your pet with treats while you’re wearing the mask will help keep them relaxed. Using food as a reward is a powerful tool for shaping positive social behaviors, building trust, and providing reassurance. When you leave your home wearing your mask, take some treats with you to further encourage your dog to respond positively to others wearing masks in public.

There is limited evidence that pets and companion animals can get infected with COVID-19 and no evidence they can pass it to humans. Therefore, there is no need to place a face mask on your pet and doing so may cause them significant distress and in some cases cause life threatening breathing difficulties. As a precaution, practice good hand hygiene and minimise contact with your pet if sick.



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\*Based on sales data collected from Animal Medicines Australia (Baron) Audit Report – Canine Parasiticide Category – MAT June 2020.

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# TRIPLE PROTECTION



The first and only combination chew for dogs with moxidectin



Simparica Trio complements your vet-exclusive ProHeart® SR-12 business by allowing you to provide your clients with an annual injection or a monthly chew option for heartworm prevention, both with the efficacy of moxidectin.

- Protects against a trio of the biggest threats facing dogs: fleas and ticks; deadly heartworm; intestinal worms
- Tasty monthly liver flavoured chew that can be given with or without food
- Suitable for dogs from 8 weeks of age and 1.25kg

We welcome the opportunity to outline a program that will address many of your frustrations with this product category and will enable you to compete in a way that's sustainable for your practice.

For more information please contact your local **Zoetis representative** or contact **Zoetis Customer Service** on **1800 022 442**.

Now available to purchase on **Zoetis Direct**.