Navigating koala conservation challenges with advanced tech and game-changing vaccine research

Discover the intricate tale of koala survival, from habitat struggles to the rise of Chlamydia vaccines, in this exclusive interview with Professor Peter Timms from The University of Sunshine Coast, Australia

Could you explain how the patterns of Koala distribution have changed in the last 20 to 50 years and why?

Historically, koalas were abundant, spanning much of Australia from north to south centuries ago. However, various factors have significantly altered their distribution, leading to a substantial reduction in their range.

In some instances, up to 50% of populations have dwindled, with specific areas experiencing complete wipe-outs. Consequently, what remains are fragmented populations scattered mainly along the East Coast, creating a landscape where smaller groups are at constant risk of extinction.

The decline in numbers is evident, with instances of populations shrinking from, for example, 10,000 to 5,000, then further dwindling to 2,000, and eventually reaching 500. While it's challenging to provide an accurate estimate of the total koala population, it is undeniable that their overall numbers have diminished.

Perhaps more critically, these populations are no longer continuous, hindering their ability to move and interact from a reproductive perspective. The reduction in numbers is alarming, prompting debates on whether koalas are on a trajectory toward extinction or are simply approaching a threatened status, with variations in the severity of the situation across different regions.

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What are some of the threats to the long-term survival of koalas?

The long-term survival of koalas faces several threats, with habitat destruction topping the list. The relentless expansion of human infrastructure, driven by the need for houses, roads, and shopping centers, continues to strip away crucial tree habitats, posing a persistent challenge. Despite efforts to mitigate risks, roads remain problematic, and the installation of protective fences is not universally feasible.

Another substantial threat is posed by dogs, both domestic and wild, adding to the complexities of koala survival.

Additionally, diseases loom large as a major concern, with chlamydial disease emerging as a particularly devastating factor. In some areas, chlamydial disease can afflict up to 50% of koala populations, signifying a significant threat to their overall well-being. Unlike habitat destruction, which has seen management strategies such as tree-planting initiatives, diseases like chlamydia have not been effectively integrated into comprehensive conservation plans.

Modelling studies consistently indicate that, in many regions, disease could be the primary factor pushing koala populations toward extinction.

So what diseases are threatening Koala populations the most and why?

There are two main diseases we need to focus our attention on. These are chlamydial disease and Koala retrovirus (KoRV). Although there are many other less prevalent diseases that affect the global population of Koalas, these
only account for 0.1% compared to Chlamydia and Koala retrovirus.

Koala retrovirus is a relatively new disease that appears in koalas and
is spreading through the population. And when you mix koala retrovirus with chlamydial disease, it seems to make things even worse. So chlamydial disease is a major one.

Why is Chlamydia so dangerous, and what are the consequences?

Chlamydial disease manifests in two primary forms of afflictions, with the most significant impact occurring in the reproductive tract.

In both male and female koalas, reproductive tract disease can be crippling. Females are particularly vulnerable due to the potential for infertility. Similar to its impact in humans, the infection begins in the lower reproductive tract and ascends, resulting in urinary incontinence. This symptom is visually identified in koalas by a distinctive brown patch caused by dripping urine; known as “wet bottom”. Furthermore, chlamydial disease leads to infertility through the formation of large reproductive cysts, intensifying its consequences on the koala population.

Chlamydial disease poses a prolonged threat to koalas, gradually rendering them infertile over a span of one to two years. The primary impact is on the reproductive tracts of both male and female koalas. In females, the infection ascends, causing urinary incontinence and infertility through the formation of reproductive cysts.

Males also face reproductive site infections, though less visibly. Additionally, chlamydial disease can affect their eyes, although this is a rarer occurrence. In a given koala population, around 95% may exhibit reproductive tract disease, with an additional 10 to 20% experiencing concurrent eye disease. While eye disease can lead to blindness, affecting feeding capabilities, it’s generally not immediately life-threatening.

The repercussions of reproductive tract disease are profound, illustrated by a case in New South Wales. A once- thriving koala population’ it now faces an 80% infection rate, resulting in a significant decline in female koalas reproducing offspring. This scenario underscores the serious consequences when

chlamydial disease infiltrates and establishes itself in a koala population, a common threat in major koala habitats.

Behind the doors of koala hospitals: Unveiling the challenges and mortality rates in koala rehabilitation

Our research, alongside similar investigations, sheds light on the challenges faced by koalas, especially when they find themselves under the care of wildlife hospitals. These studies extend beyond hospital boundaries, reaching into wild populations where monitoring becomes imperative due to transformative events like road constructions, revealing infection rates of up to 50%.

It is within the precincts of wildlife hospitals, often dubbed Koala Hospitals, that the severity of their challenges becomes evident. With several such institutions across the country, our focus in Queensland unveils a disheartening truth – over 500 koalas are admitted annually, yet less than half successfully navigate the treatment processes. The harsh reality is that, for many, the treatment is nearly as daunting as the diseases or injuries they endure, resulting in a devastating 50% mortality rate within these hospital walls.

Beyond the alarming mortality rates, the challenges intensify when confronted with the extent of chlamydial disease within the Koala populations. In Queensland alone, our observations reveal that this insidious infection afflicts over 40% of koalas seeking refuge in these hospitals.

The antibiotic challenge and treatment complexities

The University of the Sunshine Coast has taken a proactive approach to combat Chlamydia in koalas by developing a vaccine. This endeavor has encountered challenges, given the complexity of Chlamydia vaccines. Despite the difficulties, the university's research team has achieved promising results, conducting extensive trials on healthy koalas in various settings, including wildlife hospitals and several field studies.

Crafting a Chlamydia vaccine is inherently challenging, and the process demands precision. In our case, progress in creating a koala-specific vaccine has been promising. Distinct from the mRNA-based COVID vaccines, our approach involves targeting surface proteins on Chlamydia and using bacteria in the lab to make the chlamydial proteins for the vaccine. This strategy is akin to other vaccines, including those for influenza, meningococcal disease and others.

Trials for the koala Chlamydia vaccine have been underway, starting with experiments on mice in the very early stages. However, our research group phased out mouse trials a decade ago, recognizing that mice are not the ultimate beneficiaries of our efforts. Koalas possess unique attributes, necessitating a tailored approach to vaccine development.

The vaccine aims to stimulate an immune response against Chlamydia, targeting specific surface proteins. The trials indicate that the vaccine can reduce infection levels and, importantly, prevent healthy koalas from progressing to a diseased state. Encouragingly, the vaccine demonstrates potential not only for prevention but also for the reduction of infection in already affected individuals.

The current stage of research shows that the Chlamydia vaccine is safe, with minimal adverse effects. The ongoing rollout trials in wildlife hospitals involve vaccinating recovered koalas before releasing them back into the wild. This large-scale study, encompassing hundreds of koalas, aims to evaluate the vaccine's effectiveness in real-world scenarios.

As we navigate the delicate balance between human development and wildlife conservation, the quest for a Chlamydia vaccine stands as a beacon of hope for the survival of Australia's beloved koalas.

Evaluating Long-Term Effects: A Glimpse into the Efficacy of Koala Vaccination

The team conducted a study that delved into the long-term impact of vaccinating koalas in a wild population. Unlike small-scale trials, this study, involving five to ten people in the field veterinary team, was a substantial undertaking, both in terms of effort and resources. The challenges were evident, with each field trial involving many teams, not just ours, and often costing hundreds of thousands of dollars due to the complexities of fieldwork and the meticulous care provided by veterinarians.

The objective was clear: to assess the efficacy of the Chlamydia vaccine over a prolonged period. The team monitored vaccinated and non-vaccinated koalas for 5-10 years, aiming to answer a critical question akin to the evaluation of COVID vaccines: How effective was vaccination in preventing or mitigating serious disease?

The results yielded a significant breakthrough, revealing that approximately 60% of the vaccinated koalas were shielded from disease and, crucially, from mortality attributed to illness. This finding mirrored the pivotal inquiries surrounding COVID vaccines, emphasizing the real-world impact of large-scale vaccination efforts. In essence, the study provided an optimistic glimpse into the potential of the Chlamydia vaccine to offer substantial protection against severe disease, akin to the preventative measures witnessed in human vaccine studies.

While the trials were demanding, they underscored the potential transformative impact of the Chlamydia vaccine on the long-term health and survival of koala populations. Modelling studies have been instrumental in understanding the potential impact of the vaccine. If a population is grappling with 30% to 40% disease prevalence, achieving 60% or more protection through vaccination can be a game-changer. It has the potential to shift a population from a trajectory toward extinction to a more stabilized state, fostering positive reproductive patterns.

Are additional booster vaccines required?

The vaccine is designed as a single-dose shot for practical reasons. Administering a second dose might be challenging given the nature of koalas and their environment. Regarding the need for booster shots, ongoing studies are investigating if natural infections could act as a built-in booster. At present, there is no clear evidence pointing to the necessity of booster vaccinations. Antibody response studies in captive populations indicate that, even five to eight years after vaccination, antibodies to the vaccine remain detectable.

This extended duration aligns with certain aspects of the ongoing COVID situation, where questions arise about the protective effectiveness of prolonged immune responses. Despite uncertainties, the current consensus suggests that the single-dose vaccine could offer lasting protection without requiring additional booster shots.

How would a vaccine be deployed more widely in the future?

The integration of advanced tools into conservation practices is proving revolutionary.

Drones equipped with heat-seeking capabilities and powered by artificial intelligence are emerging as invaluable allies in the quest to protect koala populations. These sophisticated aerial devices can navigate vast areas around trees, distinguishing heat signals indicative of wildlife presence. What sets them apart is their ability to go beyond mere detection, utilizing AI algorithms to discern whether the thermal signature belongs to a koala or another creature like a possum.

Once a koala is identified, strategic measures can be implemented, such as setting up a protective barrier at the base of the tree for capture and subsequent vaccination. This method not only streamlines the vaccination process but also ensures targeted intervention where it is most needed.

Researchers can also leverage the surprising utility of koala poo pellets. Through DNA fingerprinting, scientists can uniquely identify individual koalas, offering a non-invasive and efficient method for monitoring populations. This groundbreaking approach allows for a periodic census by collecting and analyzing fecal samples. Remarkably, Australia has even enlisted detection dogs, trained to sniff out koala poo pellets in the wild, complementing the high-tech arsenal of drones.

The marriage of drones, AI, and DNA analysis presents a futuristic vision for wildlife conservation.

What does the future hold and what further funding/ support is needed?

In 2024, our main focus is to expand the wildlife hospital rollout, ensuring more koalas receive vaccinations. This practical initiative blends scientific understanding to provide real assistance to the numerous koalas in need.

A significant part of our efforts is directed towards navigating the Veterinary Registration process, a demanding path similar to that of human vaccine development. Despite its challenges, it is a crucial step in creating a genuine veterinary product. Our goal for the year involves progressing through the vaccine registration process and conducting additional field trials.