tiara Tick Induced Allergies Research & Awareness

Part 1:

TiARA Submission to the Senate Standing Committees on Community Affairs:

Inquiry into access to diagnosis and treatment for people in Australia with tick-borne diseases

from the TiARA (Tick-induced Allergies Research & Awareness) Committee

It's Time

To develop a "slip, slop, slap" style campaign to inform Australians at risk of tick bites

of the allergic diseases tick bites induce

of the evidence-based strategies to prevent these diseases

of the risks of making the alpha gal allergy antibody and that

if you develop allergy antibody to the tick transmitted allergen, alpha gal, it is curable

(provided you do not have another tick bite)

www.tiara.org.au

Ixodes holocyclus (Australian Paralysis Tick) (common name)

Photograph: Stephen Doggett

2/-

It's Time because

Tick-induced allergies are the most common medical problems following tick bites

- Mammalian meat allergy after tick bite (MMA) and
- Tick anaphylaxis (TA)

and they have killed several Australians (and more remain at risk)

TiARA Committee members have proven (or it has been proven by others) that

- Mammalian meat allergy (MMA) after tick bite (synonym: alpha gal syndrome) exists (and exists in 35 other countries around the world)
- MMA is due to tick bites
- MMA is the only food allergy where we know the cause
- MMA is preventable if tick bites are prevented
- MMA is curable provided there is no further tick bite
- MMA is most prevalent world-wide along the Eastern seaboard of Australia
- Tick anaphylaxis is also most prevalent in Australia and has increased exponentially
- Freezing the tick where it is "in situ" prevents 100% of tick anaphylaxis episodes
- 97% of tick bites in humans are from the Australian paralysis tick (*Ixodes holocyclus)*
- The allergen in mammalian meat to which people develop an antibody is "alpha gal"(a process called "sensitisation")
- Sensitisation to alpha gal occurs in 50% of people after two tick bites
- Around 25-30% of individuals in tick endemic regions will be sensitised to alpha gal
- The vast majority of people (80-85%) who are sensitised to alpha gal do not develop day to day allergy symptoms but can die from anaphylaxis because they do not know they are sensitised if injected with a magic bullet treatment for colon cancer, for example, which can be fatal or a life-threatening anaphylaxis may be experienced
- Sensitisation to alpha gal increases the burden of coronary artery disease (probably the most important public health consequence of a tick bite)

- ***Appropriate tick bite management prevents the allergic diseases and can cure MMA***
- ***Tick-induced allergies are the allergies we don't have to have***

Major unmet needs in tick-induced allergies

- Funded National tick bite prevention and management public education campaign
- Funded prevalence survey of the level of sensitisation to alpha gal

Wish list

- Funded clinical research nurse for TiARA (cost AUD 98582=107349 pa)

3/-

Please note that the 2016 Parliamentary Inquiry: resulted in

$3+ million being allocated to

CSIRO for looking for potential human pathogens in ticks

Prof Peter Irwin for looking at the pathogens in ticks $1,934,788

The University of Melbourne for looking at the clinical features and psychological approaches to dealing with illness of unsure aetiology $1,055,766

$0 million allocated to informing the Australian public of the most common diseases following tick bites (tick-induced allergies)

$0 million allocated to preventing these preventable diseases*

$0 million allocated to educating the 60% of Australians at risk of the evidence-based tick bite prevention and management strategies

Not a single one of the 12 Recommendations made was aimed at preventing tick bites.

It's Time because

TiARA has done the research and prepared the materials for dissemination

QR code "how to safely remove a tick"

www.tiara.org.au

So, seize this opportunity

and

While the funds to disseminate this information as widely as is needed are being found, for the sake of your health and those of your loved ones,

"Don't scratch anything you can't see (because it could be a tick)"

"Don't disturb a tick, because she will squirt allergen into you"

"Freeze it, don't squeeze it"

"Leave the frozen tick to detach itself"

"Treat your Backyard"

"Dress for the Occasion"

*The Australian Government Department of Health separately commissioned two consultancies to examine tick bite prevention and tick bite management strategies to which TiARA Committee members contributed over 83 hours to developing and editing these. They are published in English only and are lengthy, whereas the TiARA animations are

1min34secs "How to prevent tick bites" and 1min56sec "How to safely remove a tick", The animations are sufficiently

illustrative in any language.

4/-

https://www.tiara.org.au

The TiARA (Tick-induced Allergies Research and Awareness) Committee

Professor Nicholas Cowdery AO	Professor Tony Basten AO
Professor Emeritus Derek Anderson AM	Professor Emeritus Paul Canfield AM
Maria Said AM	Janelle Williams
A/Professor(ret.) Kevin Broady	A/Professor Andy Ratchford
Stephen Doggett	Dr Stephen Ginsborg
Melanie Burk RN	Professor Sheryl van Nunen OAM FRSN

Background information in Appendix 1. attached and PODCASTS attached.

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Community Affairs References Committee

Senate Standing Committees on Community Affairs

Parliament House, Canberra

Inquiry into access to diagnosis and treatment for people in Australia with tick-borne diseases

Part 2 of 2 of Submission by TICK-INDUCED ALLERGIES AND RESEARCH AWARENESS COMMITTEE (TiARA) 17 January 2025

The Terms of Reference of the Inquiry go beyond merely access to diagnosis and treatment:

Terms of Reference

Issues related to the access to diagnosis and treatment for people in Australia with tick-borne diseases, with particular reference to:

a. the initiatives and resources developed to improve awareness, diagnosis, treatment and management of tick-borne diseases in Australia since the release in 2016 of the Community Affairs References Committee report Growing evidence of an emerging tick-borne disease that causes a Lyme-like illness for many Australian patients;

b. the adequacy and effectiveness of the 'debilitating symptom complexes attributed to ticks' clinical pathway to support patients;

c. current research to advance the management of complex inflammatory diseases; and

d. any other related matters.

TiARA thanks the Committee for the opportunity to make a submission to the Inquiry and wishes to address:

1. Initiatives and resources developed to improve awareness, diagnosis, treatment and management (ToR a.) especially since 2016
2. The incidence of tick bites in humans, especially in eastern Australia (ToR d.)
3. Prevention of tick bites and tick removal (ToR d.)

TiARA does not specifically address Lyme-like syndrome or the matters referred to in ToR b. and c.

TiARA

Information about TiARA is available on its website: www.tiara.org.au TiARA was established in 2013 and has been operating continuously since then. It was an initiative of Clinical Professor Sheryl van Nunen OAM FRSN MBBS MM (Sleep Medicine) FRACP, a leading Australian immunologist and allergy specialist. (Particulars of her career are available under "Committee Members" on the website.) The TiARA Committee is comprised of eminent Australians with vastly different skill sets assembled to create synergism in both research into and awareness of tick-induced allergies (Mammalian meat allergy after tick bite and tick anaphylaxis). Given the seminal finding that tick bites lead to Mammalian meat allergy after tick bite (in 2007), the aim of the establishment of TiARA was to abolish both of these conditions, as when the cause of a disease is known then such diseases become both preventable and curable.

TiARA is run by volunteers with the assistance of donors from time to time. Its primary objectives are to disseminate evidence-based tick bite prevention and tick bite management strategies, widen general awareness of tick-induced allergies, to support those affected and to work towards a better understanding of Mammalian Meat Allergy after tick bite/Alpha Gal allergy/Alpha gal syndrome/AGS.

The "Resources" tab on the website gives an indication of the materials provided by TiARA for public information and see further below.

TiARA puts itself forward as a clear example of one of the most significant initiatives taken nationally, making resources available to improve awareness, diagnosis, treatment and management of tick-borne diseases in Australia to members of the public, community groups, medical practitioners including those in Emergency Departments, pharmacists, nurses and other health professionals, employers of persons at risk, schools, food service outlets, and so on.

1. **Initiatives and resources developed to improve awareness, diagnosis, treatment and management**

The materials assembled and promoted by TiARA include (as listed in "Resources"): ALLERGY & ANAPHYLAXIS AUSTRALIA WEBINAR: MAMMALIAN MEAT ALLERGY VIDEO: HOW TO PREVENT A TICK BITE VIDEO: HOW TO SAFELY REMOVE A TICK; TICK ALLERGY AND MAMMALIAN MEAT ALLERGY FREQUENTLY ASKED QUESTIONS (FAQ); MAMMALIAN MEAT AND MAMMALIAN PRODUCT FREE DIETARY RESOURCES; FOOD ALLERGEN CARDS; DIETARY INFORMATION;TICK ANAPHYLAXIS & MAMMALIAN MEAT ALLERGY RESOURCES; WEBSITE RESOURCES;

TiARA has produced three episodes of a podcast addressing, in turn:

- **UNRAVELLING THE MYSTERIES OF ALPHA-GAL ALLERGIES**
- **BEYOND THE BITE: EXPLORING AUTOIMMUNE BREAKTHROUGHS AT THE GARVAN INSTITUTE**
- **EXPLORING TICK MYTHS & REALITIES IN AUSTRALIA WITH ENTOMOLOGIST STEPHEN DOGGETT**

TiARA has also produced a QR code for access to **"How To Safely Remove a Tick"**.

Information about the podcast, access to it, download statistics and information about the QR code are contained in **Appendix 1** to this submission.

TiARA and its officers have spoken to many media outlets (print and electronic) and interest groups over the years and has held public meetings explaining the matters within its remit. Some of its publications are on the website. TiARA meets quarterly to advance its program.

2. The incidence of tick bites in humans, especially in eastern Australia

A member of the TiARA Committee is Stephen Doggett BSC (UNSW) PEST CONT CERT (SYDNEY TAFE) MASM, Director, Department of Medical Entomology, Westmead Hospital, University of Sydney. (Further details are under "Committee Members" on the TiARA website.) He has substantially prepared this section of the submission.

To better understand the risks associated with tick-borne diseases and determine where anti-tick promotion strategies should be targeted, it is essential to identify when people in Australia are being bitten by ticks. Until recently, no comprehensive epidemiological data existed on the incidence of tick bites in humans.

To address this gap, in 2020-21 the Department of Medical Entomology at NSW Health Pathology, Westmead Hospital, conducted a study analysing 30 years of data on tick specimens submitted to the department. As the NSW state reference laboratory—and effectively the national reference laboratory—for identifying arthropods of medical significance, the department receives more tick specimens than any other pathology service in Australia. The study analysed tick samples submitted from 1988 to 2017, with findings published by Geary et al. (2021).

THE STUDY

Over this 30-year period, 821 tick specimens collected from humans were submitted, the most common species being the Australian paralysis tick, *Ixodes holocyclus*, which accounted for 708 submissions (Figure 1). Submissions of this species were consistently received throughout the study period (Figure 1a). Different life stages of the Australian paralysis tick displayed distinct seasonal patterns (Figure 1b).

- Larval stage: Most frequently encountered in autumn, peaking in March.
- Nymphal stage: Predominantly encountered in winter.
- Adult stage: Primarily encountered in spring, with a peak in November.

Given that the adult stage poses the greatest risk to human and animal health, public health warnings should be issued at the beginning of spring. However, it is important to note that adult ticks can be encountered year-round, albeit in smaller numbers outside the peak period.

Slightly more tick samples were submitted by males than females (Figure 1c), but this difference was not statistically significant. Regarding age groups, children aged 0–9 years accounted for the highest number of tick submissions, approximately three times higher than any other age group (Figure 1d). This trend may reflect parental concern, as children are more

vulnerable to tick adverse outcomes. Of the 20 documented deaths attributed to tick paralysis, 70% occurred in children under four years old (Geary et al., 2021).

The data collected provides valuable insights into the risks posed by ticks and will help refine the timing and focus of educational programs aimed at promoting anti-tick bite strategies and increasing awareness.

The kangaroo tick, *Amblyomma triguttatum*, was the second most common species, with 23 submissions. All specimens were collected from drier regions of Australia, particularly inland New South Wales, west of the Great Dividing Range. *Amblyomma triguttatum* is an aggressive human biter and has been reported to cause local skin reactions after removal, likely due to a delayed hypersensitivity reaction.

The third most common species was *Ixodes tasmani*, with 11 submissions. These ticks were collected from patients in coastal regions of New South Wales, where the species coexists with *Ixodes holocyclus*. Unlike *I. holocyclus*, *I. tasmani* is not known to cause any adverse effects in humans.

Other tick species collected from humans included:

- *Haemaphysalis longicornis* (7 specimens)
- *Haemaphysalis bancrofti* (6 specimens)
- *Amblyomma moreliae* (5 specimens)
- *Rhipicephalus sanguineus* (2 specimens)
- *Ixodes australiensis* (1 specimen)
- *Ixodes ornithorhynchi* (1 specimen)

The submission of *Ixodes ornithorhynchi* marked a new record for this species biting humans. None of these ticks is known to transmit pathogens to humans.

Additionally, several ticks were submitted from patients who had acquired them while traveling overseas. These included *Dermacentor andersoni* and *Ixodes persulcatus*, both of which are known vectors of various tick-borne diseases. These submissions underscore the potential risks faced by travellers and highlight the importance of vigilance regarding tick-borne diseases when visiting endemic regions. They show the need for education to improve awareness of the risks.

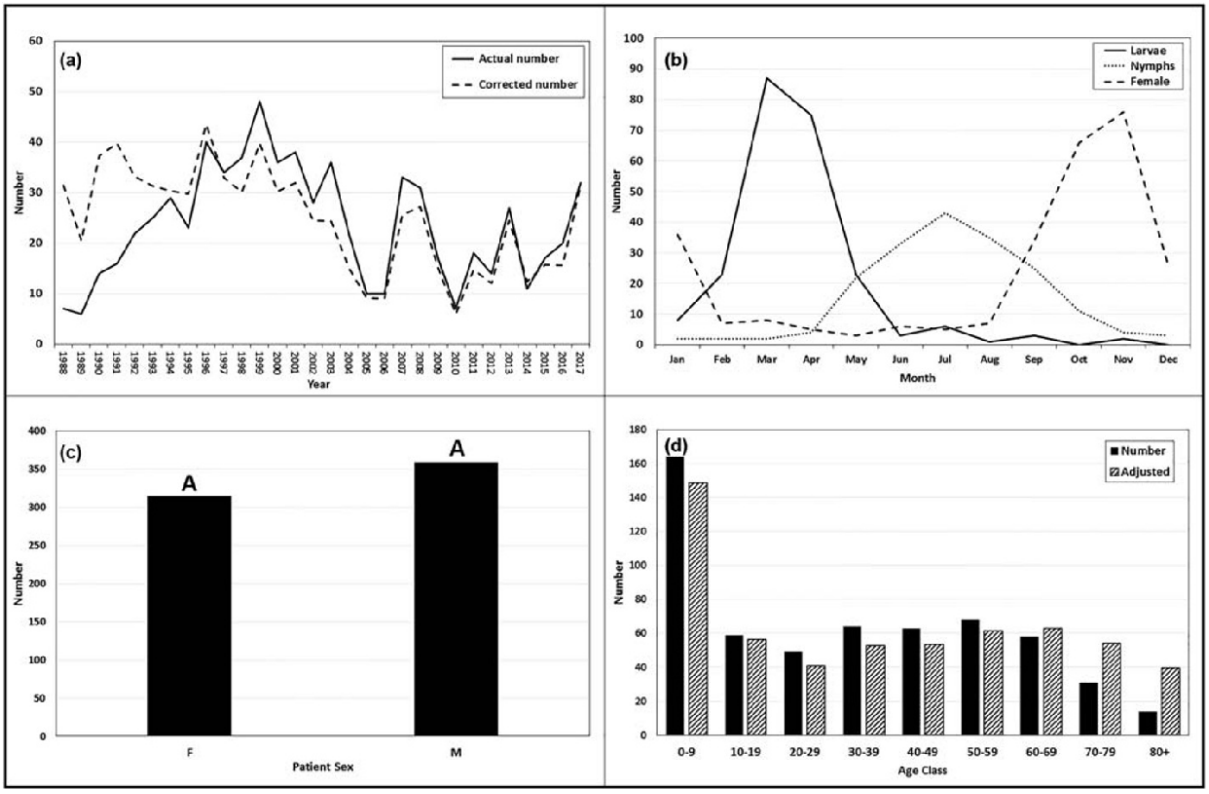

Figure 1. Trends of the Australian paralysis tick (*Ixodes holocyclus*) specimens sent to the Department of Medical Entomology for identification, 1988–2017. (a) Submissions by year; solid lines represents actual number, dashed line represents corrected number (see text). (b) Submissions by month; solid line represents larval ticks, dotted line represents nymphal ticks, and dashed line represents adult female ticks. (c) Submissions by female (F) vs. male (M) patients. Note that the letter next to the bar graph denotes the statistical relationship; the same letters indicate no statistical difference. (d) Patient age classes; number = actual number of specimens, adjusted = adjusted for population numbers of the particular age class. The Y-axis is the same for actual and age adjusted numbers.

3(a). Prevention of tick bites

The evidence presented above demonstrates that the Australian paralysis tick, *Ixodes holocyclus*, is the species most likely to bite humans in eastern Australia (from Cape York to Lakes Entrance and for some kilometres inland). This species significantly impacts human health, causing conditions such as paralysis, allergic reactions (including Mammalian Meat Allergy), and the transmission of Queensland Tick Typhus. Preventing tick bites is crucial to reducing the risk of these conditions. However, it is surprising—and concerning—that despite the growing attention ticks have received in recent years, research into tick-bite prevention has long been neglected and underfunded.

PERSONAL REPELLENTS

In 2019, the first study on the prevention of tick bites from *Ixodes holocyclus* was published (Sukkanon et al., 2019). This study tested five personal repellents (applied to the skin), coconut

oil, and a citronella patch and wristband for their effectiveness in repelling ticks. These were evaluated in a laboratory assay at intervals of 15 minutes, 1 hour, 2 hours, 3 hours, and 4 hours post-application.

The five tested personal repellents contained the following active ingredients respectively:

- Picaridin (9.3%)
- DEET (11.5%)
- Lemon eucalyptus oil (36.0%)
- A combined formulation of citronella and tea tree oil (28.4%)
- An extract of *Andrographis paniculata* (30% w/v)

Coconut oil was tested at 30% v/v. The citronella patch contained 120 mg/patch, while the wristband contained 750 mg/band.

At 4 hours post-application, no statistical differences in repellency were observed among picaridin, DEET, and lemon eucalyptus formulations, with all achieving over 84% repellency. Based on these results, these three formulations are recommended for preventing tick bites. In contrast, the citronella patch only provided localized repellency near the patch, making it unsuitable for routine use.

SPATIAL REPELLENTS

The study also evaluated two spatial repellents, typically used outdoors to prevent mosquito bites. Unfortunately, neither of the tested spatial repellents caused any tick mortality, and their use cannot be recommended for tick prevention.

TREATED CLOTHING

Another highly effective method of tick-bite prevention is the use of insecticide-treated clothing. This approach has been employed for many years, particularly by the military, to protect against bites from various arthropods, including ticks. Research suggests that insecticide-treated clothing often provides better protection than personal repellents (Panthawong et al., 2020). Building on this knowledge, the next stage of research into preventing tick bites from *Ixodes holocyclus* focused on evaluating the effectiveness of insecticide-treated clothing.

The most commonly used insecticide for treating clothing is permethrin. There are two types of permethrin-treated fabrics available: Do-It-Yourself (DIY) packs and pre-impregnated fabrics. Both have been sold in Australia for many years, but until 2020, no data existed on their efficacy against *Ixodes holocyclus*. To address this, a study was conducted to compare the contact toxicity of a DIY product with two pre-impregnated fabrics (shirt and trousers). The study also assessed the efficacy of these fabrics after repeated laundering (0, 10, 30, and 50 washes).

Key findings included:

- **Unwashed fabrics**: All treated fabrics caused 100% knockdown of *Ixodes holocyclus* ticks.

- **After 10 washes**: The pre-impregnated shirt and trousers retained high efficacy, with 95% and 90% knockdown, respectively. The DIY product was significantly less effective, with only 15% knockdown.

- **After 30 washes**: The knockdown efficacy decreased to 70% for the shirt and 20% for the trousers. The DIY product's efficacy dropped further to 10%.

- **After 50 washes**: Knockdown levels fell to 45% for the shirt and remained at 20% for the trousers, while the DIY product achieved just 5%.

This study demonstrated that pre-impregnated fabrics are significantly more effective than DIY impregnation packs in repelling *Ixodes holocyclus*. However, the efficacy of pre-impregnated clothing degrades notably after 10 washes, emphasizing the need for periodic re-treatment or replacement to maintain protection.

ULTRASOUND

The final phase of research into tick-bite prevention strategies evaluated a highly publicized product: ultrasonic repellers. These devices are widely marketed as effective tools for protecting against tick bites. However, prior to 2021, no research had been conducted to assess their effectiveness against the Australian paralysis tick, *Ixodes holocyclus*.

To address this gap, a study tested nine ultrasonic devices with varying sound frequencies against female *Ixodes holocyclus* (Panthawong *et al*., 2021). The results showed that ultrasonic devices achieved less than 19.5% repellency. This low level of effectiveness indicates that ultrasonic repellers cannot be recommended as a reliable method for preventing tick bites.

It is worth noting that all the research projects described above were financially supported by TiARA. The findings from these studies now form the foundation of tick-bite prevention strategies in Australia.

References cited.

Geary M.J., Russell R.C., Leendert M., Hassan A. and Doggett S.L. (2021). **30 Years of Samples Submitted to an Australian Medical Entomology Department**. *Austral Entomology*, 60: 172-197

Panthawong A., Doggett S.L. and Charoenviriyaphap T. (2021). **The efficacy of ultrasonic pest repellent devices against the Australian Paralysis tick, *Ixodes holocyclus* (Acari: Ixodidae)**. *Insects*, 12(5): 400.

Panthawong A., Charoenviriyaphap T. and Doggett S.L. (2020a). **The efficacy of ultrasonic pest repellent devices against the Australian Paralysis tick, *Ixodes holocyclus* (Acari: Ixodidae).** *Austral Entomology*, 59(4): 845-851.

Panthawong A., Sukkanon C., Charoenviriyaphap T. and Doggett S.L. (2020b). **How are insect repellents tested?** *FAOPMA Magazine*, Apr: 48-53.

Sukkanon C., Chareonviriyaphap T. and Doggett S.L. (2019). **Topical and spatial repellent bioassays against the Australian paralysis tick, *Ixodes holocyclus* (Acari: Ixodidae)**. *Austral Entomology*, 58(4): 866-874.

3(b). Tick removal

In 2019 a TiARA paper was published reporting on the removal of ticks and the consequences for different methods of removal: Taylor B.W.P., Ratchford A., van Nunen S., Burns B. (2019). **Tick killing in situ before removal to prevent allergic and anaphylactic reactions in humans: a cross-sectional study**. Asia Pac Allergy, 9(2):e15.

It is worth stating this has become **the** national guideline for tick removal in Australia. Thus **ALL** the work on the prevention of tick borne-disease by safe tick removal in Australia has been initiated by TiARA.

PAPER SUMMARY

Background: Tick anaphylaxis is a potentially life-threatening condition caused by improper tick removal.

Objective: To evaluate whether killing ticks in situ using ether-containing sprays or permethrin cream before removal reduces the risk of allergic or anaphylactic reactions.

Methods: A six-month prospective study was conducted during the 2016 tick season at Mona Vale Hospital Emergency Department (ED) in Sydney, recording tick removal methods and subsequent allergic or anaphylactic reactions.

Results: Among 121 patients:

- **Tick Killing and Removal**: 61 patients had ticks killed in the ED with Wart-Off Freeze [a similar product named Tick Off has since become available] or Lyclear Scabies Cream before removal using fine-tipped forceps or Tick Twister. Allergic reactions occurred in 3 patients (5%), including 2 during the killing process. No cases of anaphylaxis were observed.

- **Post-Tick Removal**: Of 50 patients presenting after self-removal using various methods, 43 (86%) experienced allergic reactions, including 2 cases of anaphylaxis.

- **Live Tick Removal**: 5 patients had live ticks removed without prior killing, 2 of whom experienced allergic reactions.

Conclusion: Killing ticks in situ before careful removal reduces the risk of allergic and anaphylactic reactions.