

# DEVELOPMENT OF A CHLAMYDIAL VACCINE FOR KOALAS



**Peter Timms *et al.***















# Keratoconjunctivitis





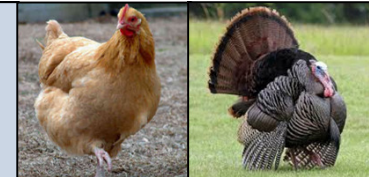











# Reproductive tract disease





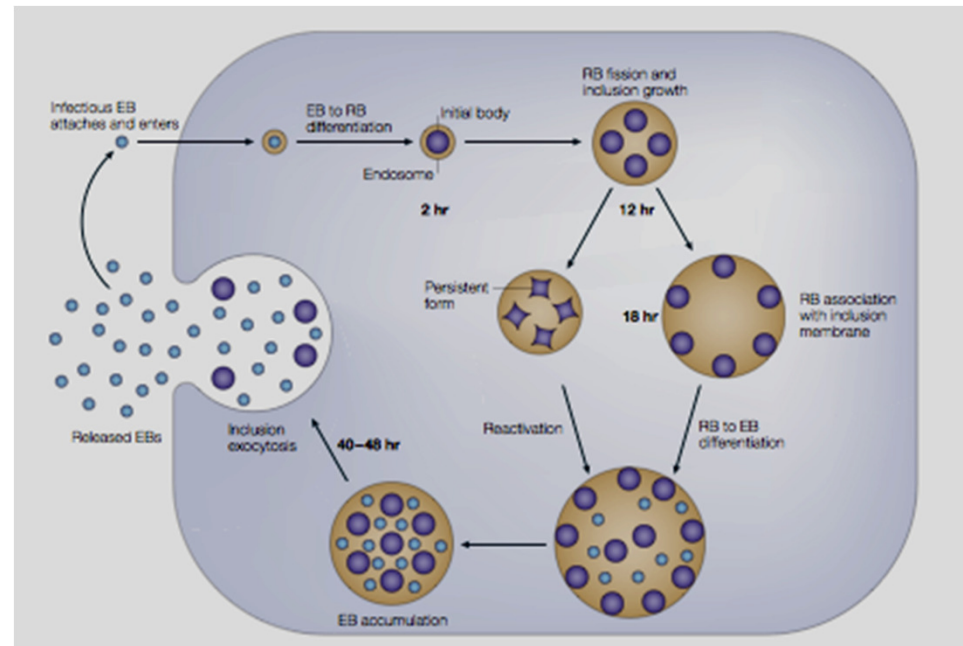
# “Current” taxonomy for *Chlamydiae*

<i>C. ibidis</i>		<i>C. muridarum</i>	
<i>C. gallinacea</i>		<i>C. felis</i>	
<i>C. avium</i>		<i>C. caviae</i>	
<i>C. psittaci</i>		<i>C. trachomatis</i>	
<i>C. abortus</i>		<i>C. suis</i>	
<i>C. pneumoniae</i>			
<i>C. pecorum</i>			



# Goal : To develop a vaccine to protect koalas against *C.pecorum* infection and disease

- **Vaccine should result in;**
  - **Antibodies**
    - Specific & high titres
    - Neutralising
    - Present at mucosal sites
  - **T cell response**
    - Lymphocyte proliferation
    - Cytokines (interferon-gamma)
  - **Two types of vaccine**
    - Prophalytic
    - Therapeutic





# Basic vaccine formulation

## 1. Chlamydial antigen

1. Recombinant MOMP proteins
2. Koala *C. pecorum* – 3 genotypes

## 2. Adjuvant

1. Iscomatrix; Tri-adjuvant (VIDO)




## 3. Delivery : subcutaneous

## 4. Assessment

1. Swab eyes and UGT and measure infection (qPCR) load
2. Clinical disease

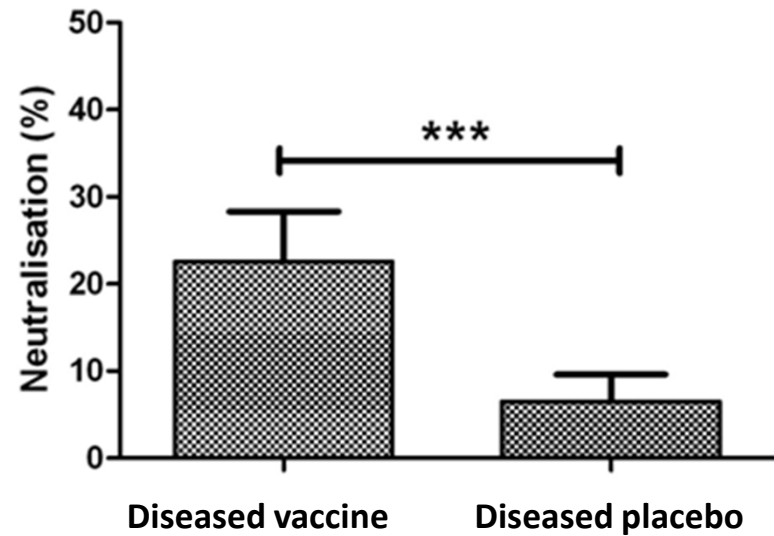
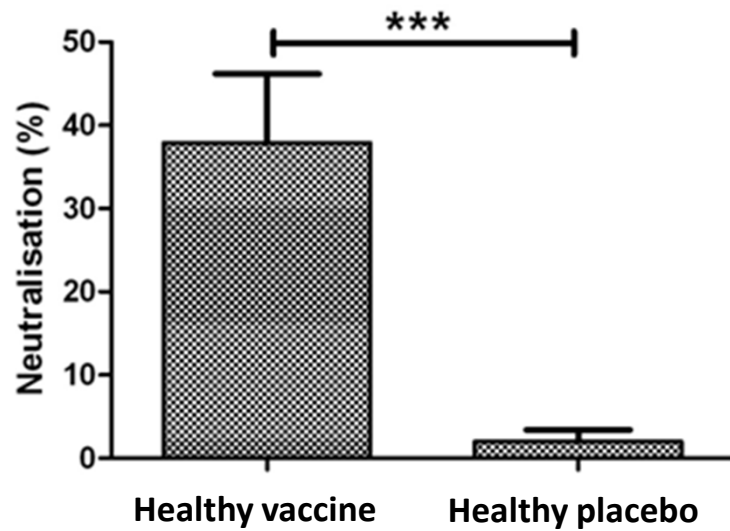


# The “10-year” project

1. Can koalas produce an immune response to chlamydial antigens ✓
2. Is the vaccine safe to give to animals with current infection / disease ✓
3. Can a vaccine do something that natural infection is currently not doing ✓
4. Is there cross-strain immune recognition ✓ 
5. Vaccination of male as well as female koalas ✓
6. Move from a multi-dose to a single dose vaccine ✓
7. Develop new koala immunological reagents ✓
8. Evaluate the vaccine under field conditions ✓
9. What is the basis of protection 
10. Can you vaccinate against disease 

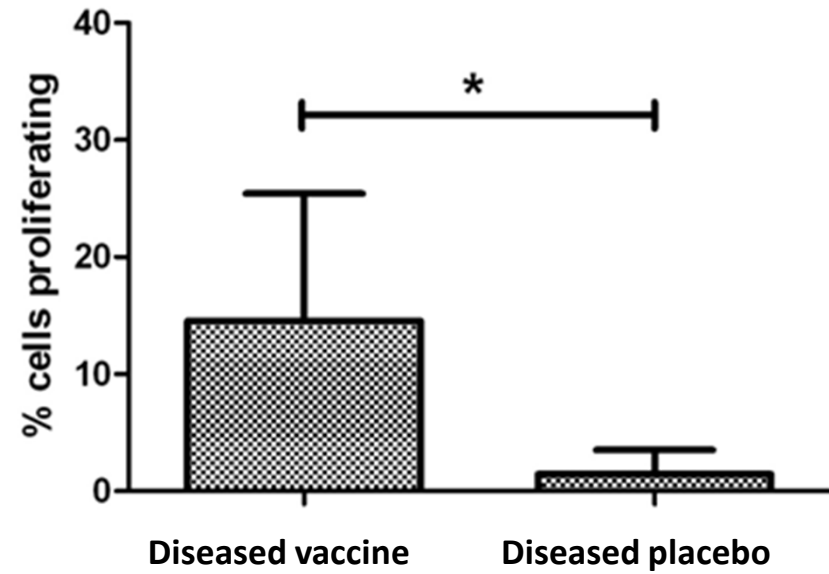
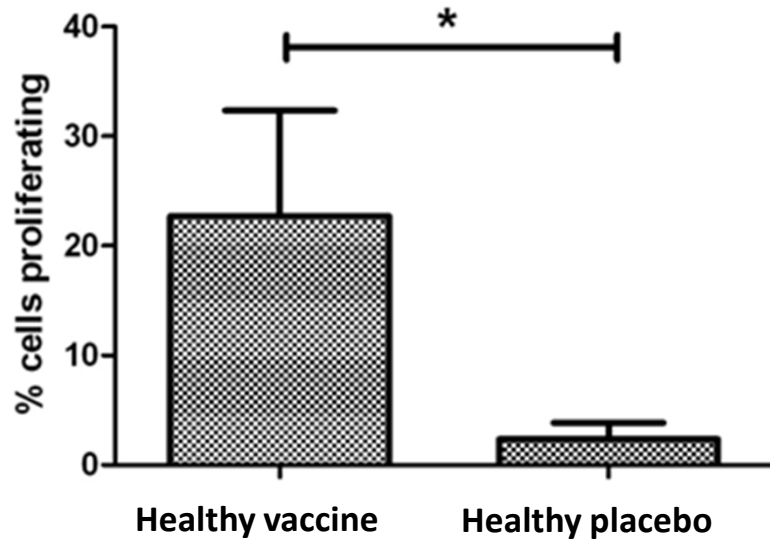


## Production of *in vitro* neutralising antibodies following vaccination








## Production of a T cell response





# The “10-year” project

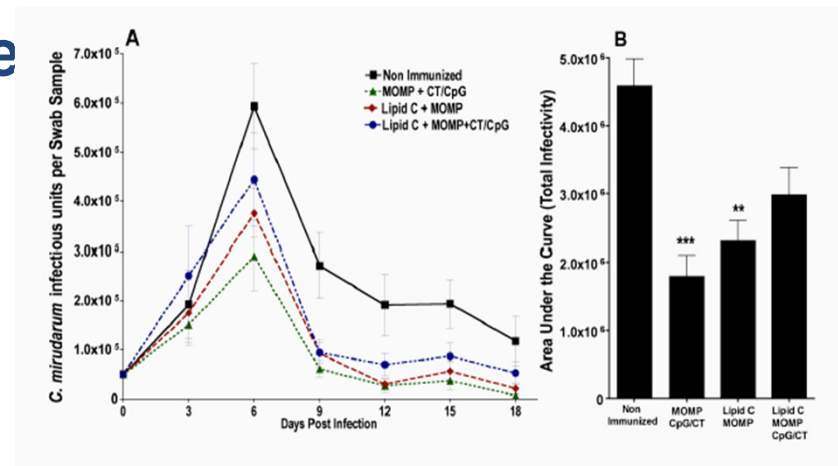
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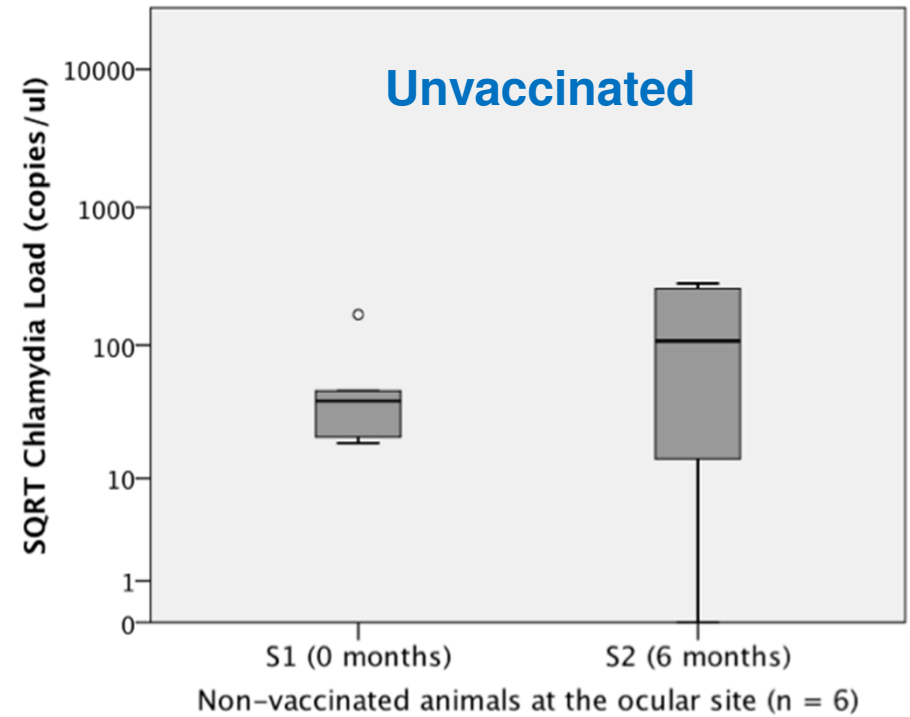


# First major field trial

- 60 free-ranging koalas; 30 Vaccine & 30 Control
- Vaccine
  - Antigen: Major Outer Membrane Protein (MOMP)
  - Adjuvant: Immune Stimulating Complex (ISC)
  - Immunisation Schedule : Days 0, 30 and 60
- Analysis
  - IgG antibody production; Cytokine production
  - *Chlamydia* infection load as determined by qPCR
  - Incidence of new disease





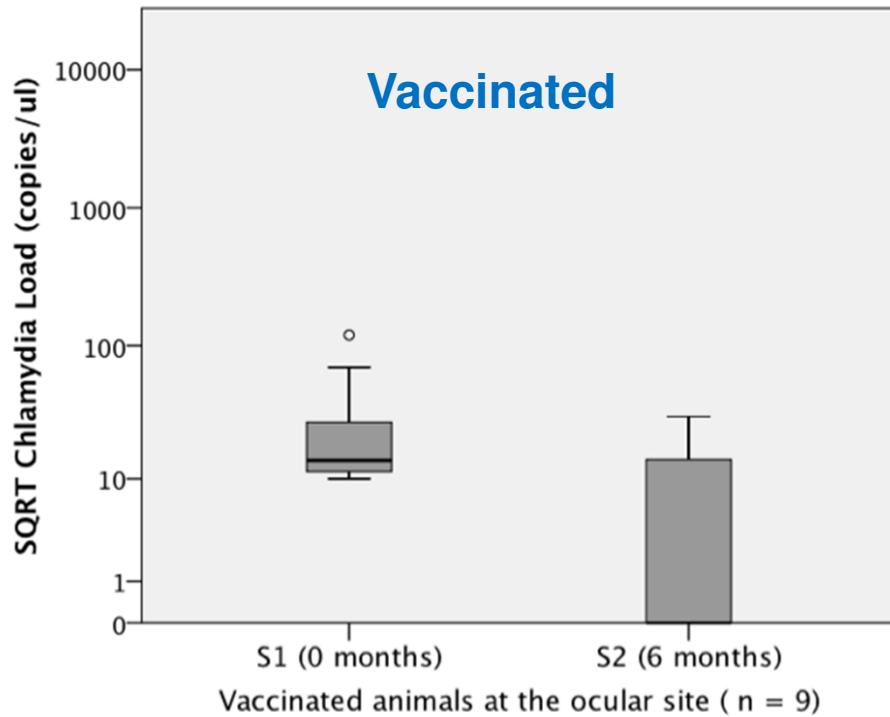


*S1 Mdn* of 39 [IQR = 20.3 – 76.4]

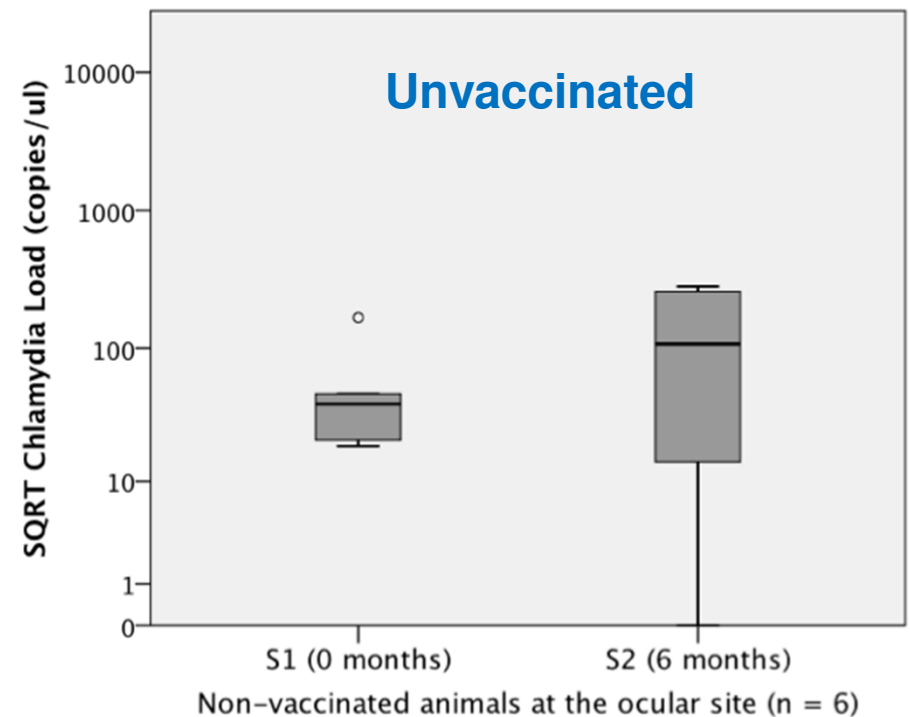
*S2 Mdn* 119.6 [IQR = 10.6 – 204.1]

Wilcoxin signed rank test

**$z = -1.572, p = 0.116, r = 0.45$**

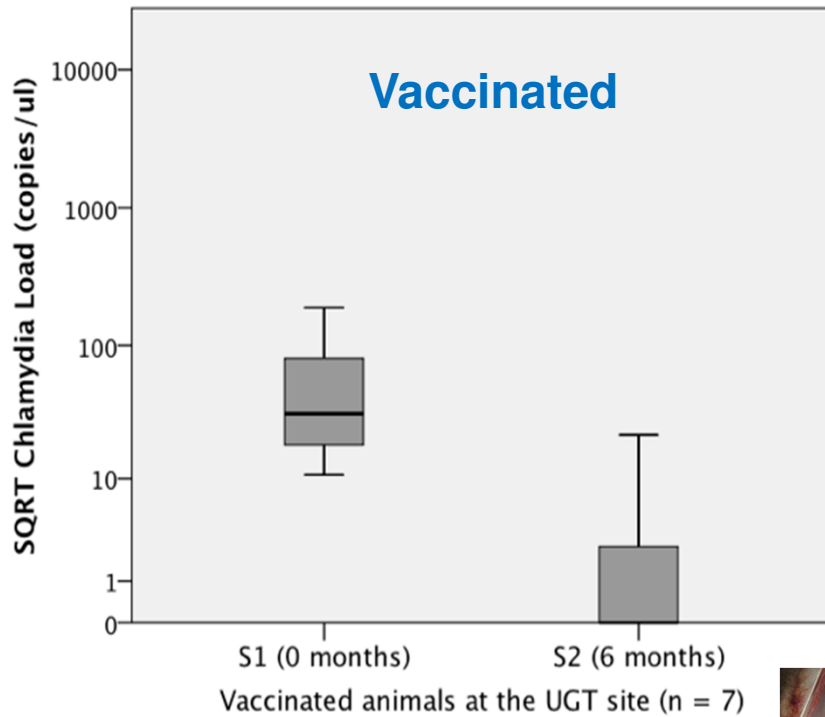


S1 *Mdn* = 13.9 [IQR = 10.7-48.2]  
 S2 *Mdn* = 0 [IQR = 0-21.8]  
 Wilcoxin signed rank test  
 $z = -2.310, p = 0.021, r = 0.54$

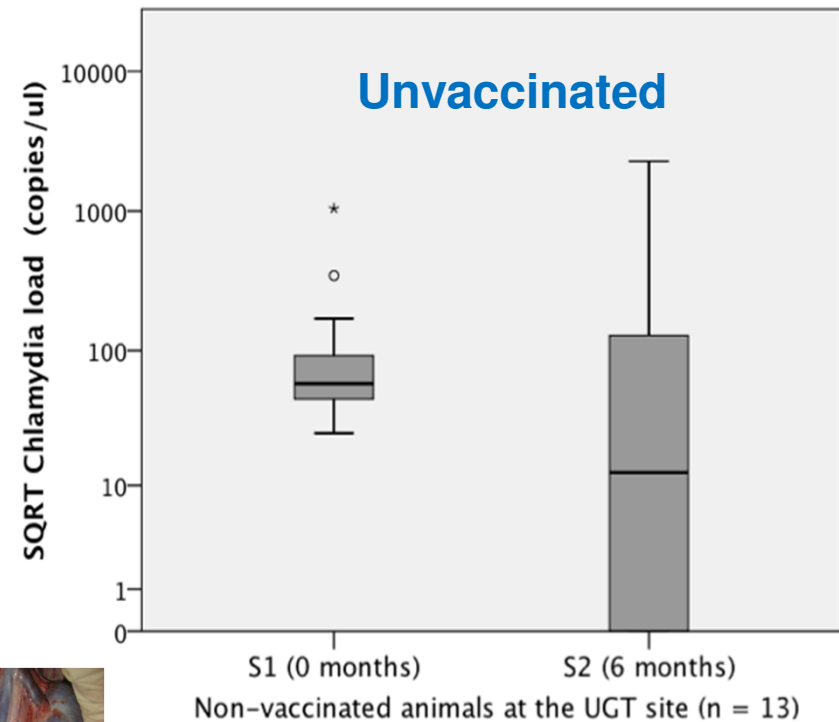
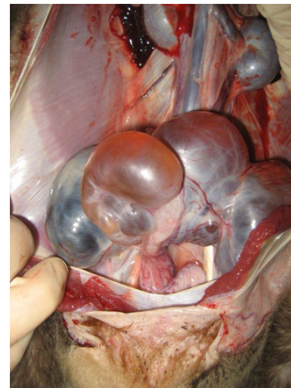


S1 *Mdn* of 39 [IQR = 20.3 – 76.4]  
 S2 *Mdn* 119.6 [IQR = 10.6 – 204.1]  
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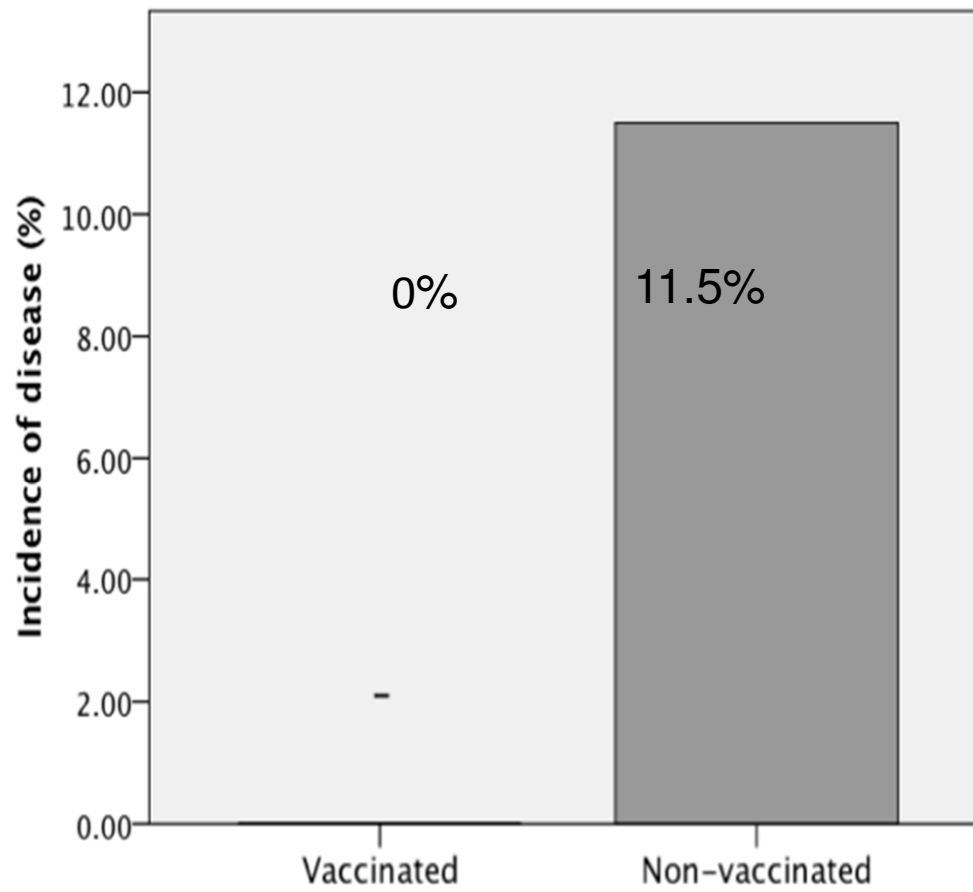




S1 *Mdn* = 31.4 [IQR = 13.9 – 89.1]  
 S2 *Mdn* = 0, [IQR = 0 -11.53]  
 Wilcoxin signed rank test  
 **$z = -2.366$ ,  $p = 0.018$ ,  $r = -0.89$**






S1, *Mdn* = 57.9 [IQR = 41.6-131.2]  
 S2, *Mdn* = 12.7 [IQR = 0 – 143.5]  
 Wilcoxin signed rank test  
 **$z = -0.804$ ,  $p = 0.422$ ,  $r = -0.22$**

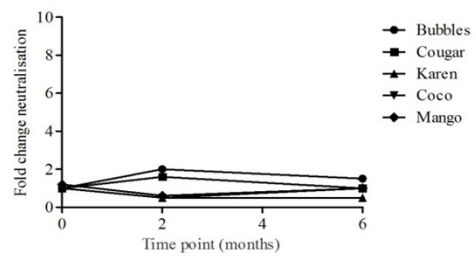
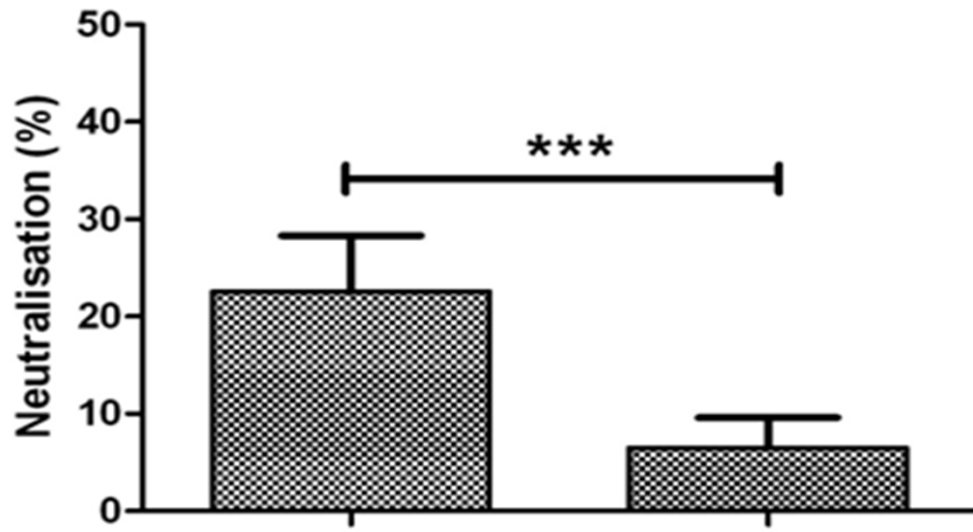




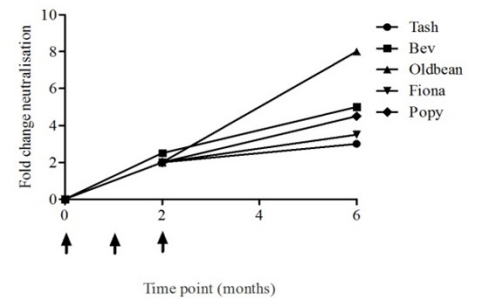
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# In vitro neutralisation antibody levels



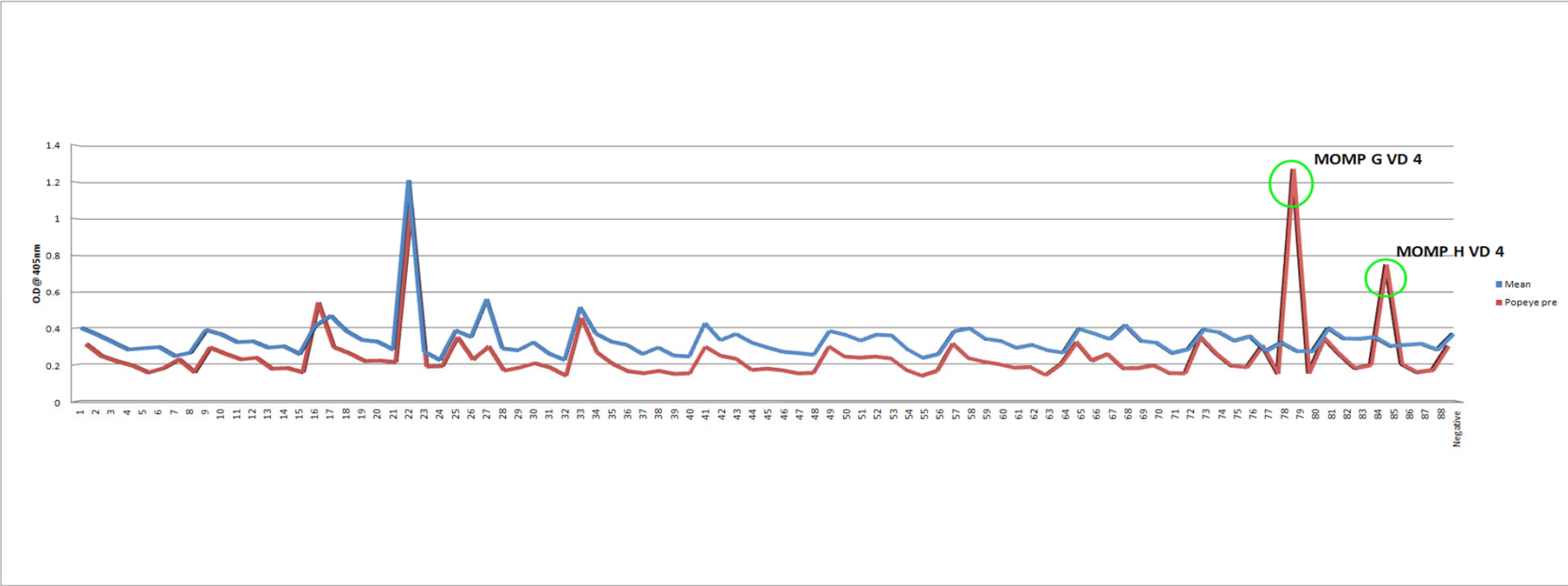
**C** *Chlamydia* infected



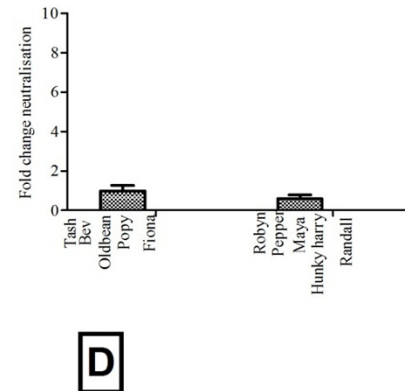
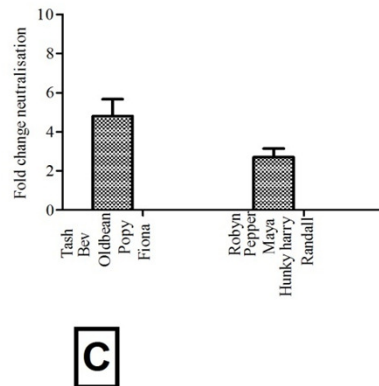
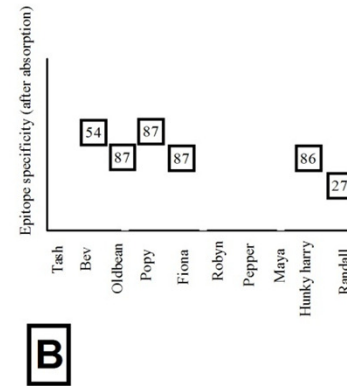
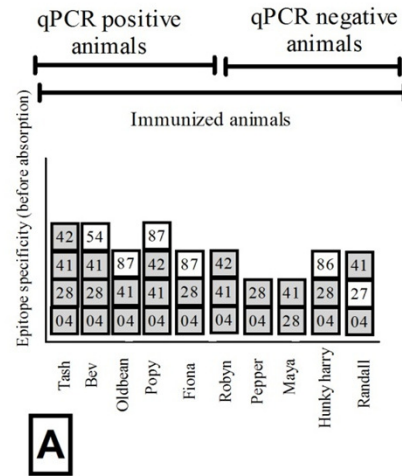
**D** *Chlamydia* infected



# Mapping of the MOMP epitopes : PepScan technology



# Absorption of sera against peptides and evaluation of remaining *in vitro* neutralisation ability







# Acknowledgements

## Partners

- University of Sunshine Coast
- Queensland Univ Technology
- Gold Coast City Council
- Moreton Bay Regional Council
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- DTMR; MBRL team
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- VIDO, Canada
- Endeavour Veterinary Ecology
- Australia Zoo Wildlife Hospital
- Koala Action Inc.
- Redland City Council



## Key people

- P Timms
- K Beagley
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- P Kanyoka
- A Kollipara
- S Nyari
- M Descoleux
- C Mangar



Australian Government  
Australian Research Council

