



2017 RESEARCH FINDINGS

in the School of
**VETERINARY & LIFE
SCIENCES**



STEPHANIE HING^a, ANDREW THOMPSON^a, EDWARD NARAYAN^b & STEPHANIE GODFREY^c

Stress, wildlife health and the conservation of a critically endangered marsupial, the woylie

When you are stressed, do you find you get sick more easily? And if you're stressed and sick, do you feel like it takes you longer to recover?

Hormones released when we encounter stressors can affect many parts of the body, including the immune system. Studies in domestic animals and people indicate a complex relationship between stress, the immune system and infection, but we know very little about how stress affects immune function and infectious disease in wildlife¹. This is concerning, because wildlife face a number of potential

stressors and infectious disease threats that have the potential to affect their health and survival².

This project investigated the relationship between stress physiology, immune function, and patterns of parasite infection in a critically endangered Australian marsupial, the woylie. Stress, immunity and infection (particularly with *Trypanosoma* blood parasites) are particularly relevant in woylie conservation because these processes have been suggested as factors contributing to the species' dramatic decline.

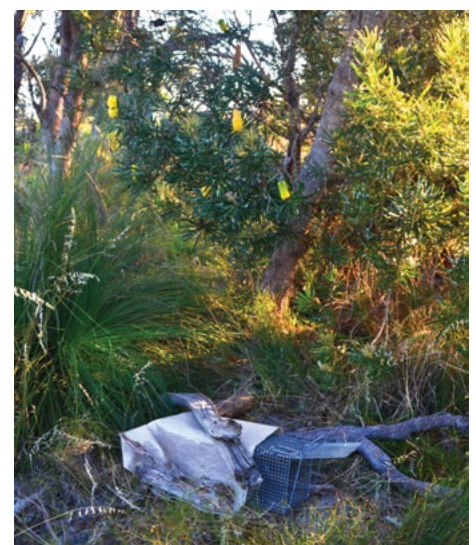


Understanding how stress affects wildlife including Australian marsupials will help us protect biodiversity in a world full of potential stressors and disease threats³.

Methods and results

We trapped, examined and collected blood and faecal samples from woylies living in captivity, fenced reserves and the wild. Hundreds of samples were analysed for stress hormones and parasites.

In addition, we adapted an immune function test developed in pre-term human babies to conduct the first immune function study in woylies¹. An interaction between host stress physiology and *Trypanosoma* blood parasites was associated with the functional efficiency of woylie white blood cells¹. This is consistent with the hypothesis that stress-related immunosuppression may be associated with infection status in the woylie¹.



TOP: A woylie pinworm egg under the microscope.
ABOVE: A woylie trap set, ready and welcoming.

Woylies

What are woylies?

Woylies are **native Australian marsupials** — they are also called brush-tailed bettongs (*Bettongia penicillata*).

Healthy ecosystems

They play an important role as nature's gardeners, **keeping ecosystems healthy**.

Declined 90%

Once numerous across Australia, woylies have **declined by over 90%** since the 1990s.

Critically endangered

Woylies are listed as **critically endangered**.



TOP: In the lab, working with my co-supervisor running stress hormone assays.

ABOVE: Footage from night-vision cameras reveals the secret life of woylies. Here's one enjoying a little midnight snack.

In a longitudinal study, we identified factors that influenced the stress physiology of woylies including season, sex, body condition index and nematode parasite status⁴. This information helped us interpret data and conduct investigations during real-world conservation events including management interventions⁵ and a natural disaster⁶. After translocation (a mainstay strategy in wildlife conservation), faecal stress hormones concentration was found to be higher compared to before or at translocation⁵. This may indicate translocation stress or a response to other factors⁵. In contrast, following a bushfire, faecal stress hormone concentration was

What are glucocorticoid hormones?

- Glucocorticoid hormones are produced by the adrenal glands located near the kidneys
- Glucocorticoid hormones mobilise and redistribute the body's resources to respond to stressors
- They can affect every system in the body with consequences for growth, health, reproduction and survival
- Many types of animals produce glucocorticoid hormones including mammals, birds, reptiles and fish

not found to be higher compared to before the fire possibly because woylies are well-adapted to fire prone landscapes⁶.

Conclusions and recommendations

Overall this project provides an unprecedented and in depth examination of the stress physiology of woylies in a range of conservation relevant contexts. Our results support existing studies that found associations between declining woylie populations and immunological challenges and infection with potentially pathogenic *Trypanosoma* haemoparasites. More broadly, we have highlighted the importance of the relationship between stress, immune function and infection in wildlife. We



recommend that this relationship is taken into account in management decisions to maximise health, welfare and conservation outcomes for all animals. ■

More information

Contact Stephanie Hing

E: s.hing@murdoch.edu.au

References

1. Hing, S., Currie, A., Broomfield, S., Keatley, S., Jones, K., Thompson, R. A., Narayan, E., and Godfrey, S. S. (2016). Host stress physiology and *Trypanosoma* haemoparasite infection influence innate immunity in the woylie (*Bettongia penicillata*). *Comparative immunology, microbiology and infectious diseases* **46**, 32–39.
2. Hing, S., Narayan, E. J., Thompson, R. A., and Godfrey, S. S. (2016). The relationship between physiological stress and wildlife disease: consequences for health and conservation. *Wildlife Research* **43**, 51–60.
3. Hing, S., Narayan, E., Thompson, R. A., and Godfrey, S. S. (2014). A review of factors influencing the stress response in Australian marsupials. *Conservation Physiology* **2**, cou027.
4. Hing, S., Narayan, E. J., Thompson, R. C. A., and Godfrey, S. S. (2016). Identifying factors that influence stress physiology of the woylie, a critically endangered marsupial. *Journal of Zoology*. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/jzo.12428/full> [accessed 8 March 2017].
5. Hing, S., Northover, A. S., Narayan, E. J., Wayne, A. F., Jones, K. L., Keatley, S., Thompson, R. C. A., and Godfrey, S. S. (2017). Evaluating Stress Physiology and Parasite Infection Parameters in the Translocation of Critically Endangered Woylies (*Bettongia penicillata*). *EcoHealth*. doi:10.1007/s10393-017-1214-4.
6. Hing, S., Jones, K., Rafferty, C., Thompson, R., Narayan, E., and Godfrey, S. (In Press). Wildlife in the line of fire: evaluating the stress physiology of a critically endangered Australian marsupial after bushfire. *Australian Journal of Zoology*.

Authors

^a Murdoch University

^b Western Sydney University

^c Otago University



If you are interested in our research and would like to know more, then please contact us on vlsresearch@murdoch.edu.au

Our research bulletins can be downloaded from www.murdoch.edu.au/School-of-Veterinary-and-Life-Sciences/Our-research/Our-Bulletins/

Undergraduate or postgraduate degrees, please see www.murdoch.edu.au/School-of-Veterinary-and-Life-Sciences/Our-courses/