



MACQUARIE
University

Into the wild: integration of human-derived microorganisms into flying fox microbiomes

MICHELLE POWER
BIOLOGICAL SCIENCES



Collaborators and Acknowledgments



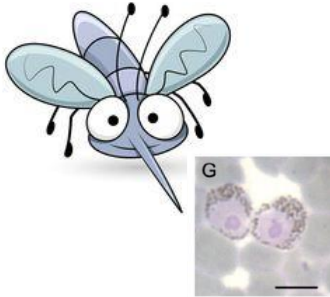
I acknowledge the traditional owners of this land, and pay my respects to Elders past, present and emerging.

- Fiona McDougall – GHFF
- Jen Sullivan – BFF
- Jenny MacLean Tolga Bat Hospital
- Kerryn Parry-Jones – Wildlife Arc
- Shoalhaven Bat Clinic
- WIRES
- Sydney Wildlife
- Beth Noel and Maxine Groves (Sutherland Shire Council)
- Amara Glynn (Royal Botanic Garden)
- Wayne Boardman – University of Adelaide
- Juliane Schaer – Humboldt University
- David Gordon (ANU)
- Michelle Baker (CSIRO)
- Adam McKeown and David Westcott (CSIRO)

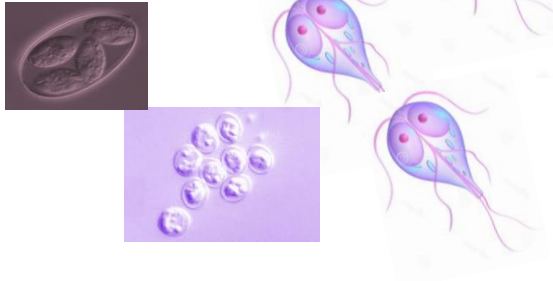


Non-viral diseases and flying fox health

Malarial parasites



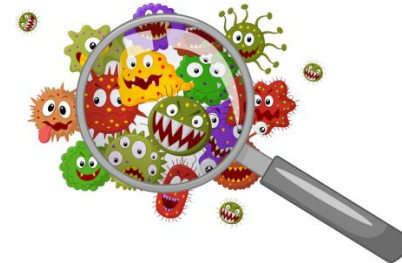
Enteric parasites



Pathogenic bacteria

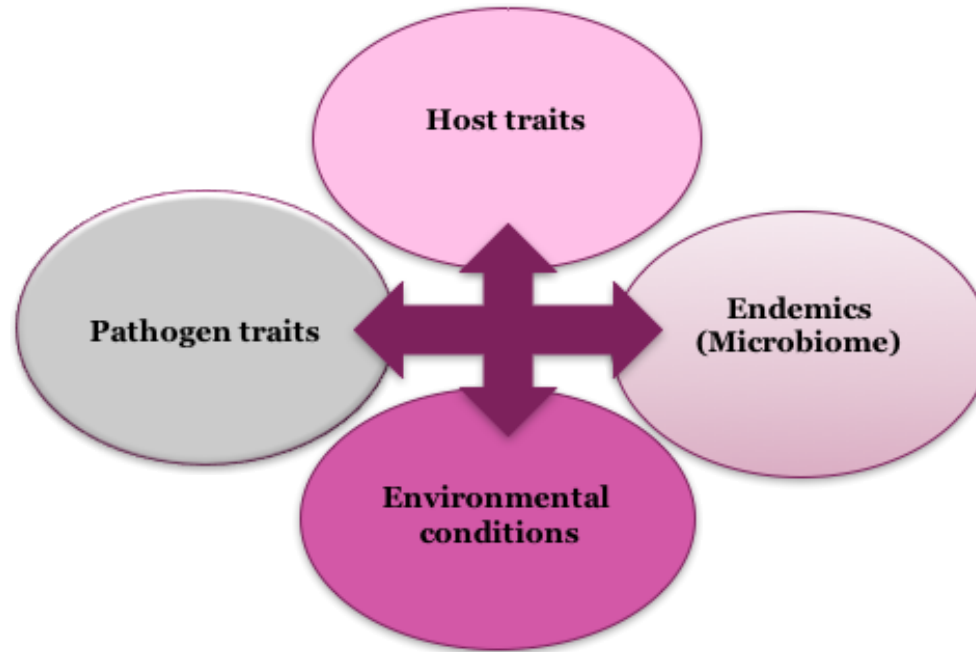


Endemic bacteria



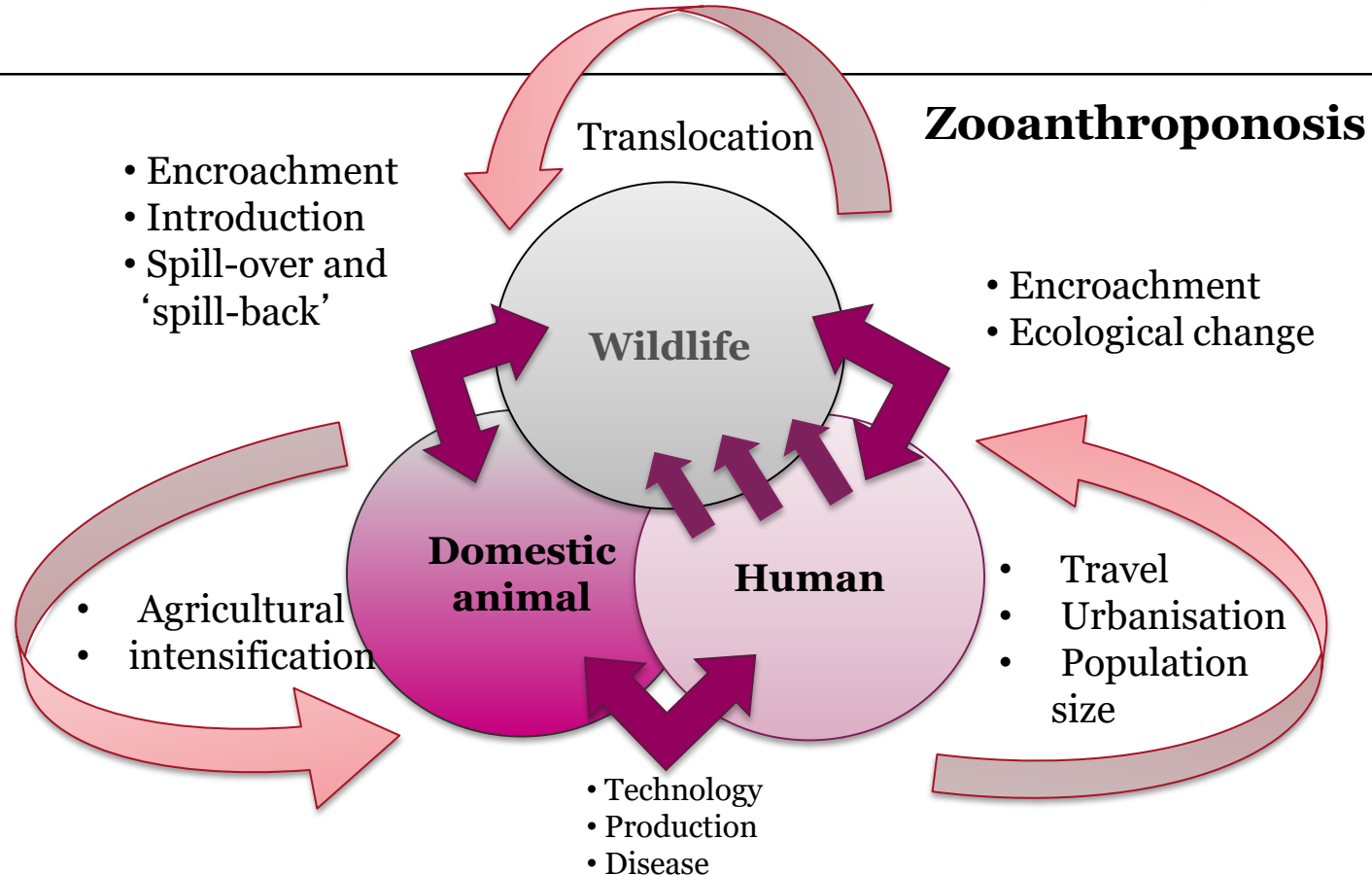
A complexity of factors drive disease outcomes

Disease tetrad

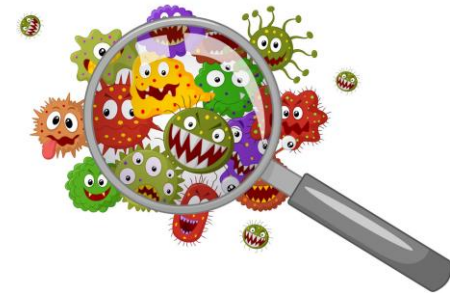


How do bacterial and parasite infections change relative to different environments?

Human drivers and disease dynamics



Disease agents and flying fox health environments



Antibiotic resistance and wildlife

Ability of bacteria to overcome action of antibiotics

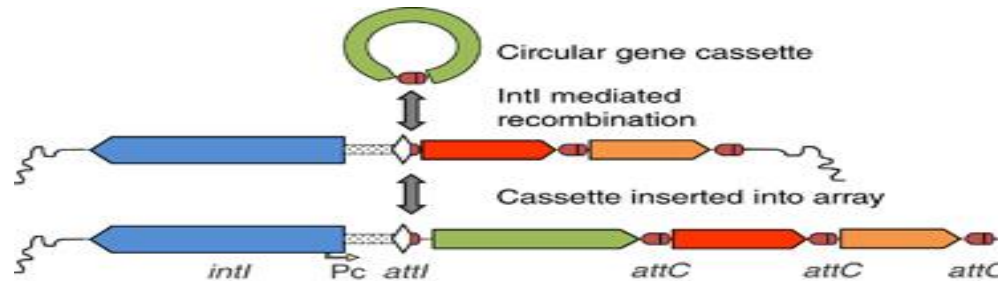
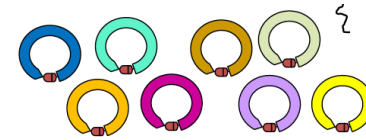


Genetic determinants of resistance

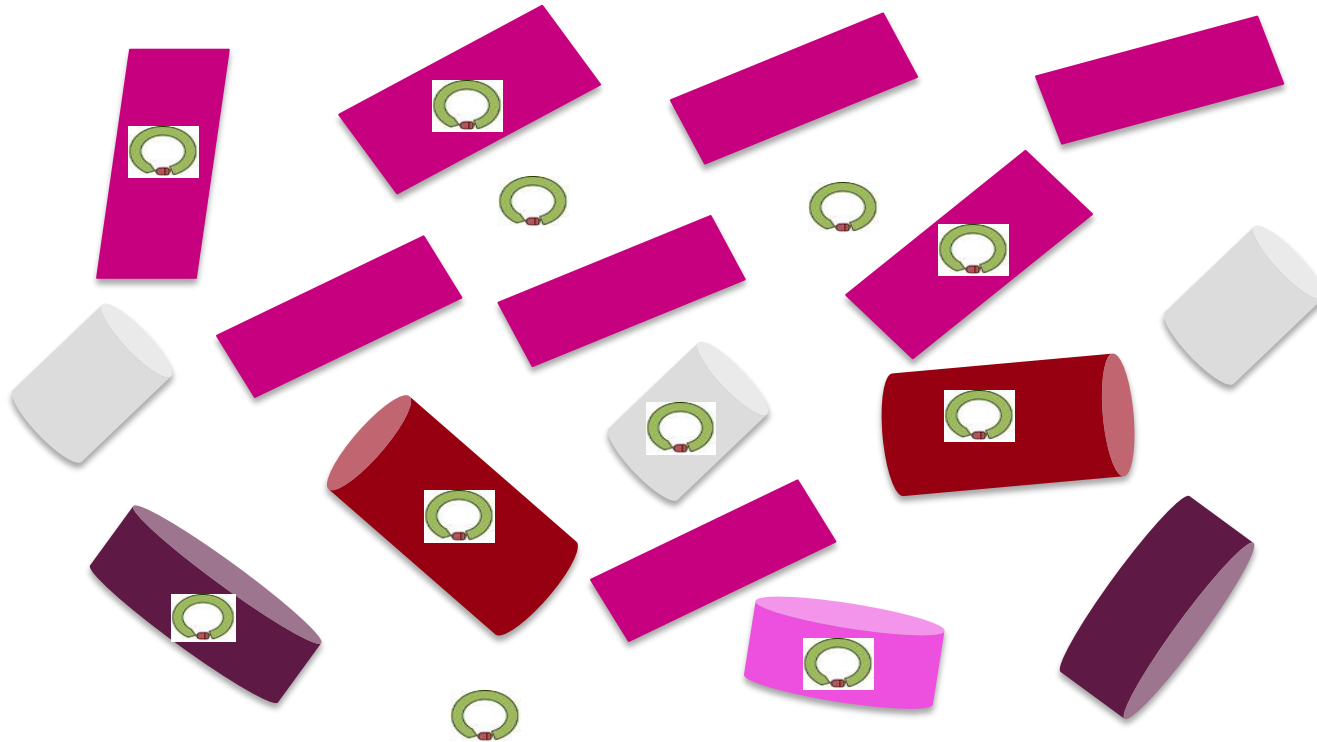
Class 1 integron



Pool of genes in the environment

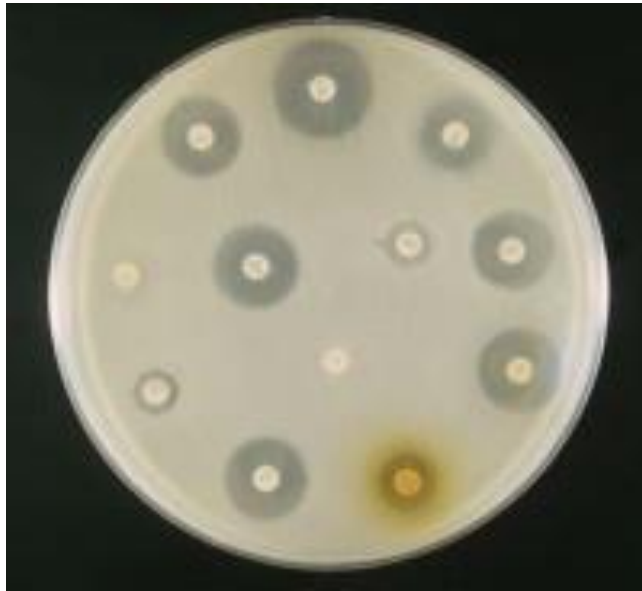


Integrans disseminate resistance within and between bacterial species



Detecting antibiotic resistance

PHENOTYPE ANALYSIS



GENETIC ANALYSIS

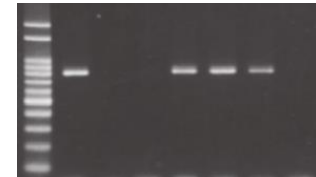
DNA



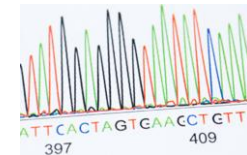
PCR



Detection of
resistance genes



DNA sequencing



Antibiotic resistance in Australian Wildlife

VARIABLE CONNECTIVITY TO HUMANS

MARINE

Pinnipeds



URBAN GRADIENT

Flying fox



CONSERVATION

Tasmanian devil



Little penguin



Possum

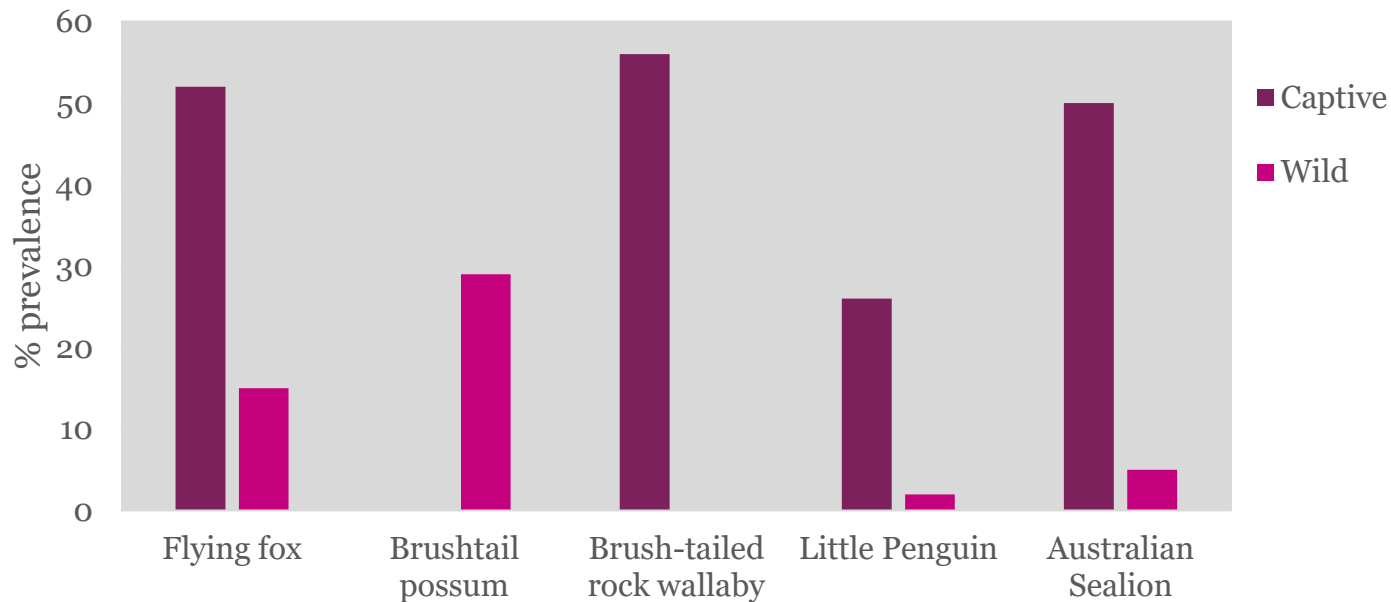


Rock wallabies

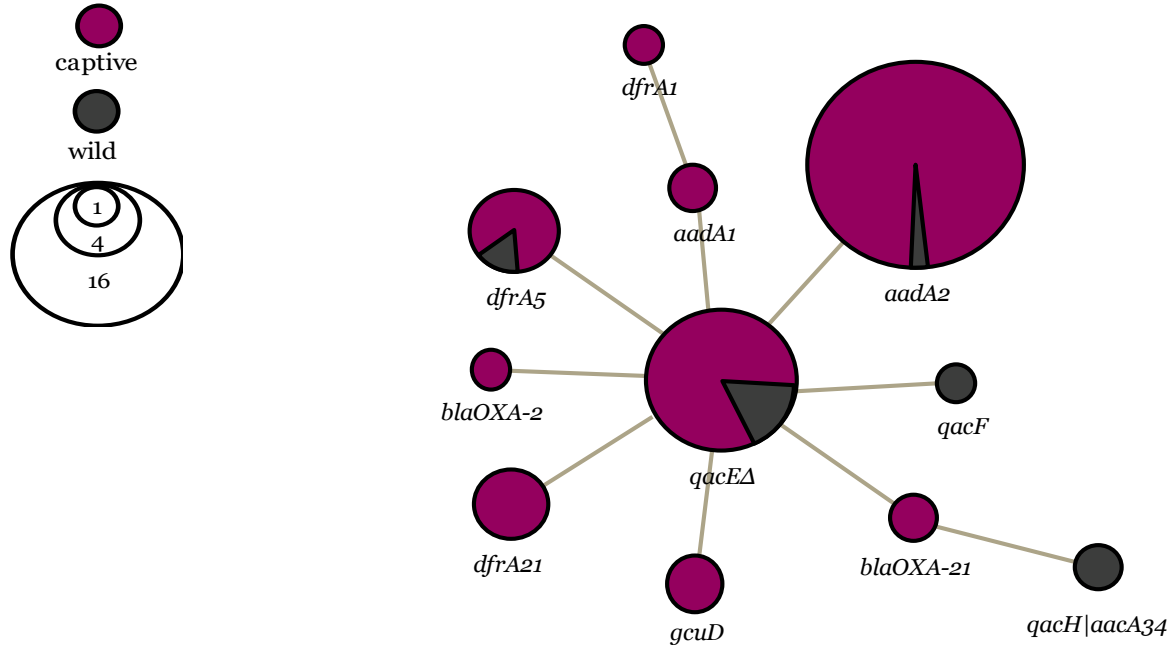


Antibiotic resistance genes (class 1 integrons) in captive and wild hosts

Antibiotic resistance genes in wildlife



Antibiotic resistant genes in flying foxes



Antibiotic resistant *E. coli* in flying foxes

- Tested a panel of fourteen common antibiotics
 - Trimethoprim
 - Aminoglycosides x 3
 - Fluoroquinolones x 2
 - Beta –lactams x 7
- Low level of ESBL resistant bacteria in grey-headed flying foxes
 - Amoxycillin
 - Amoxycillin + clavulanic acid
 - Cephalexin
 - Cephazolin
 - Cefotaxime



Resistant bacteria in flying foxes – why is this significant?

- **Wildlife health**

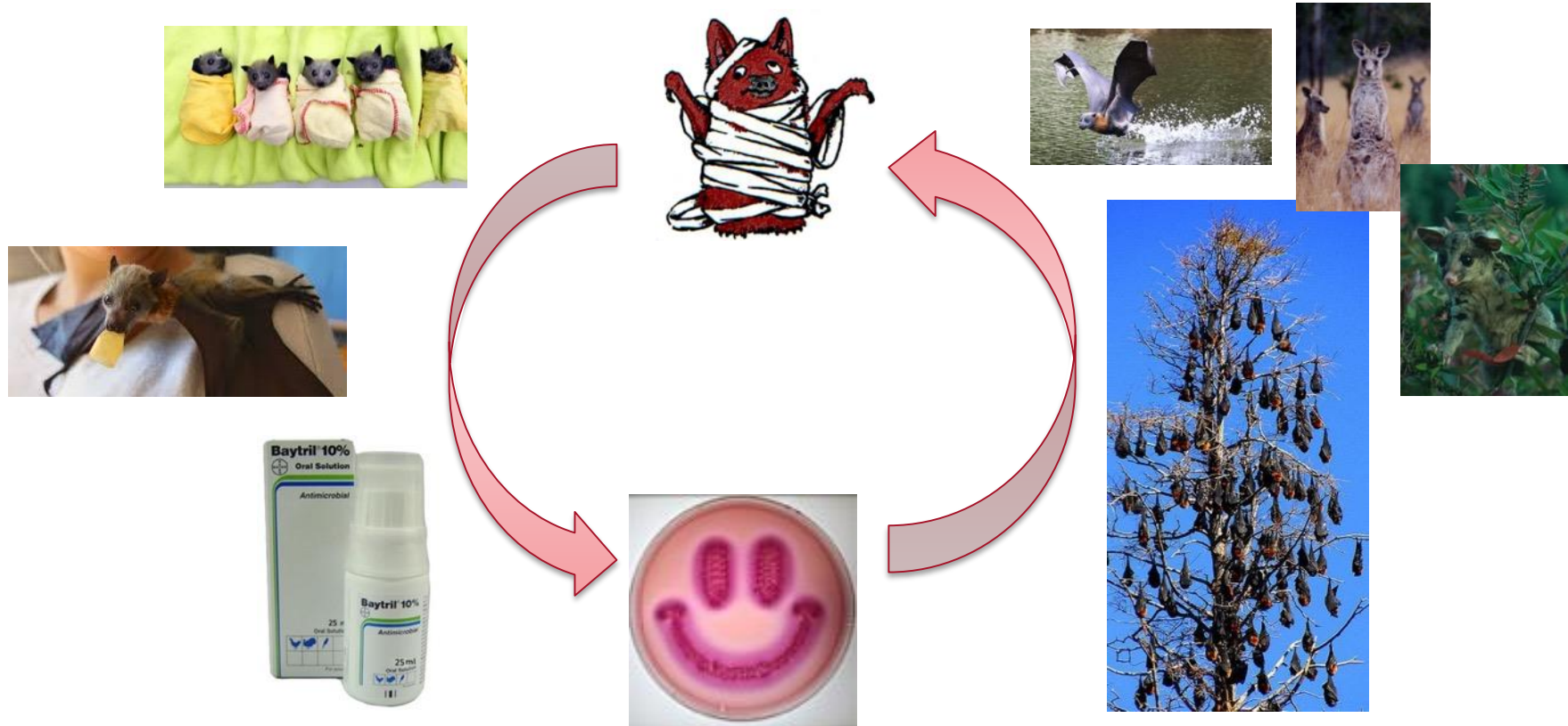
- Are flying foxes impacted but resistant bacteria?
- Resistance indicates transfer of human-associated bacteria to flying foxes
 - disease risks?
- Genetic machinery transfer to microbiota?
- What are the risks of releasing animals with antibiotic resistant bacteria into wild populations?

- **Treatment implications**

- Treatment can select for bacteria with resistant genes
- Antibiotic may not work



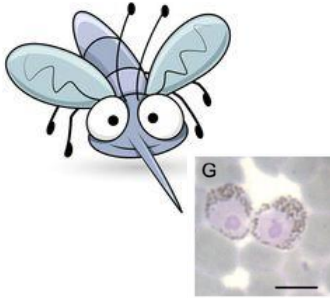
Cycle of antibiotic resistant bacteria



Non-viral diseases and flying fox health

Grey-headed flying fox and Black flying fox

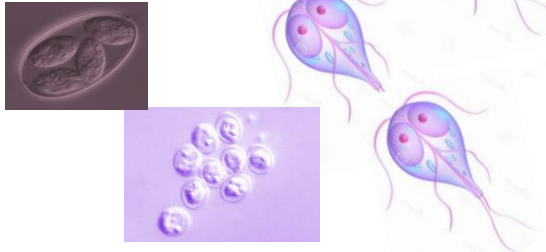
Malarial parasites



Pathogenic bacteria



Enteric parasites



Endemic bacteria

