

Preventing postpartum uterine disease in dairy cattle depends on avoiding, tolerating and resisting pathogenic bacteria

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The uterus is exposed to multiple pathogenic bacteria, but uterine disease is a problem of modern dairy cattle



E. coli
T. pyogenes
Anaerobic bacteria

1950



Energy for 7 L milk:
0.6 x maintenance

< 9% uterine disease

2020


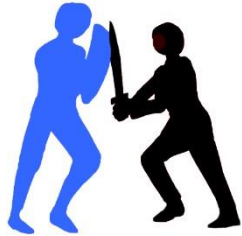



Energy for 45 L milk:
3.5 x maintenance

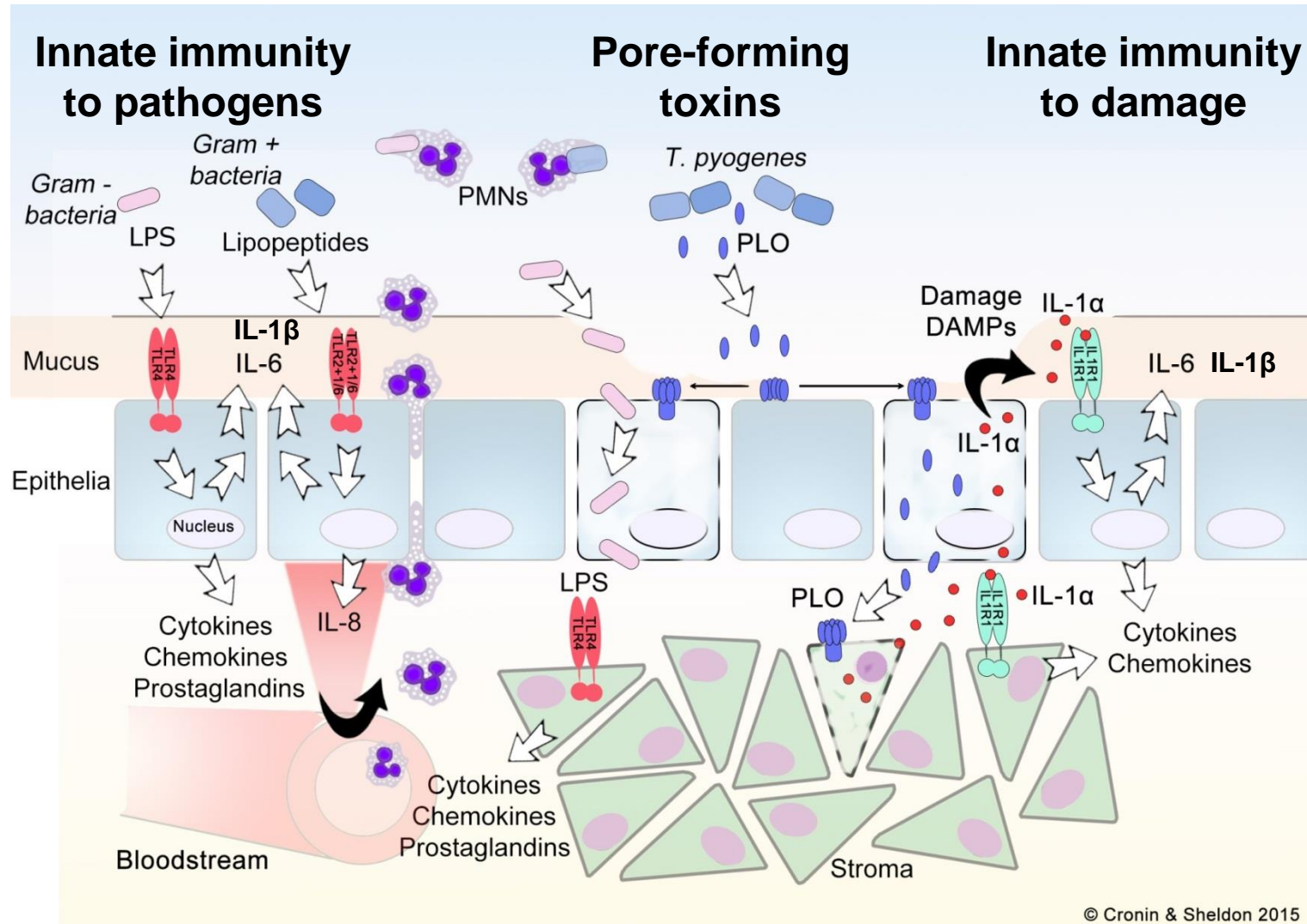
~ 40% uterine disease

\$2 billion/year USA+EU

Resilient cows prevent uterine disease developing by avoiding, tolerating and resisting pathogenic bacteria

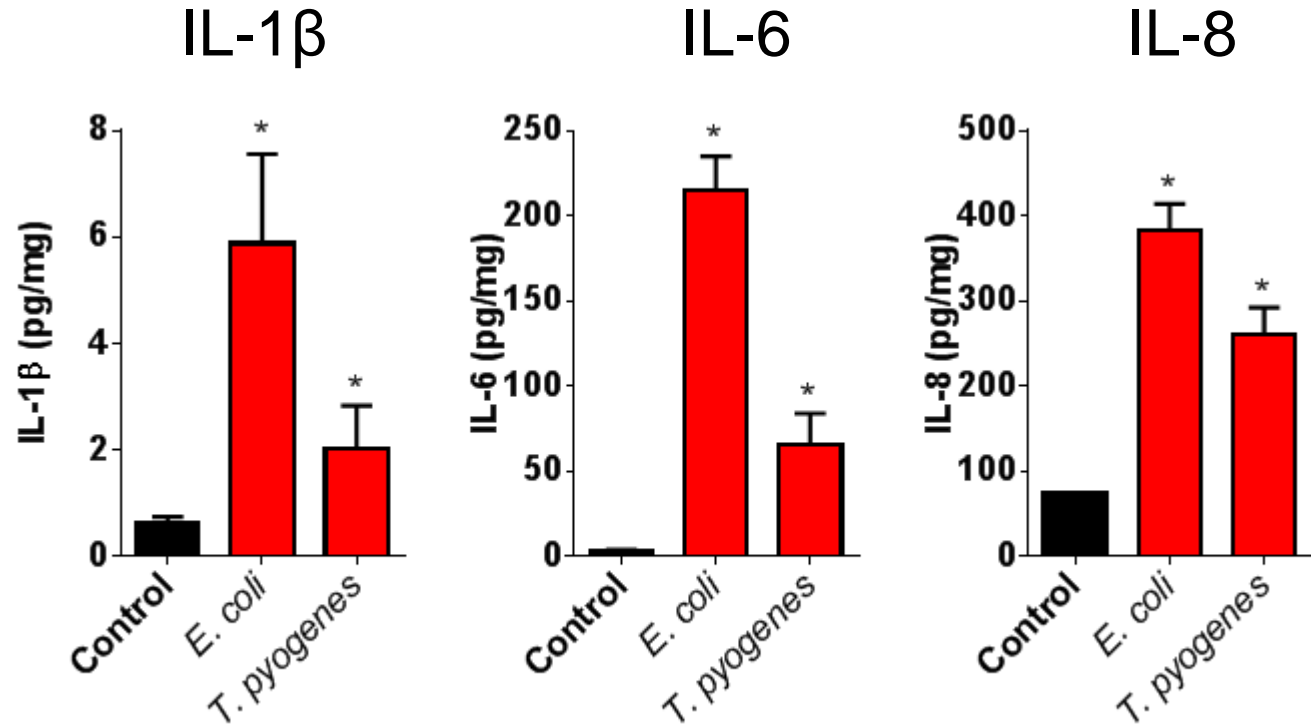
Resilience		
Avoidance	Tolerance	Resistance
		
Limiting the exposure to pathogenic bacteria	Limiting the damage caused by pathogenic bacteria	Limiting the number of pathogenic bacteria
Behaviours to avoid diseased animals Maintaining hygiene	Protecting tissues against toxins Repairing damage	Activating innate and adaptive immunity Stimulating inflammation
Avoiding pathogens	Tolerating pathogens	Eliminating pathogens

Whether animals develop uterine disease depends on their resistance and tolerance to pathogens



Resistance - uterine organ cultures generate inflammatory responses to pathogenic bacteria

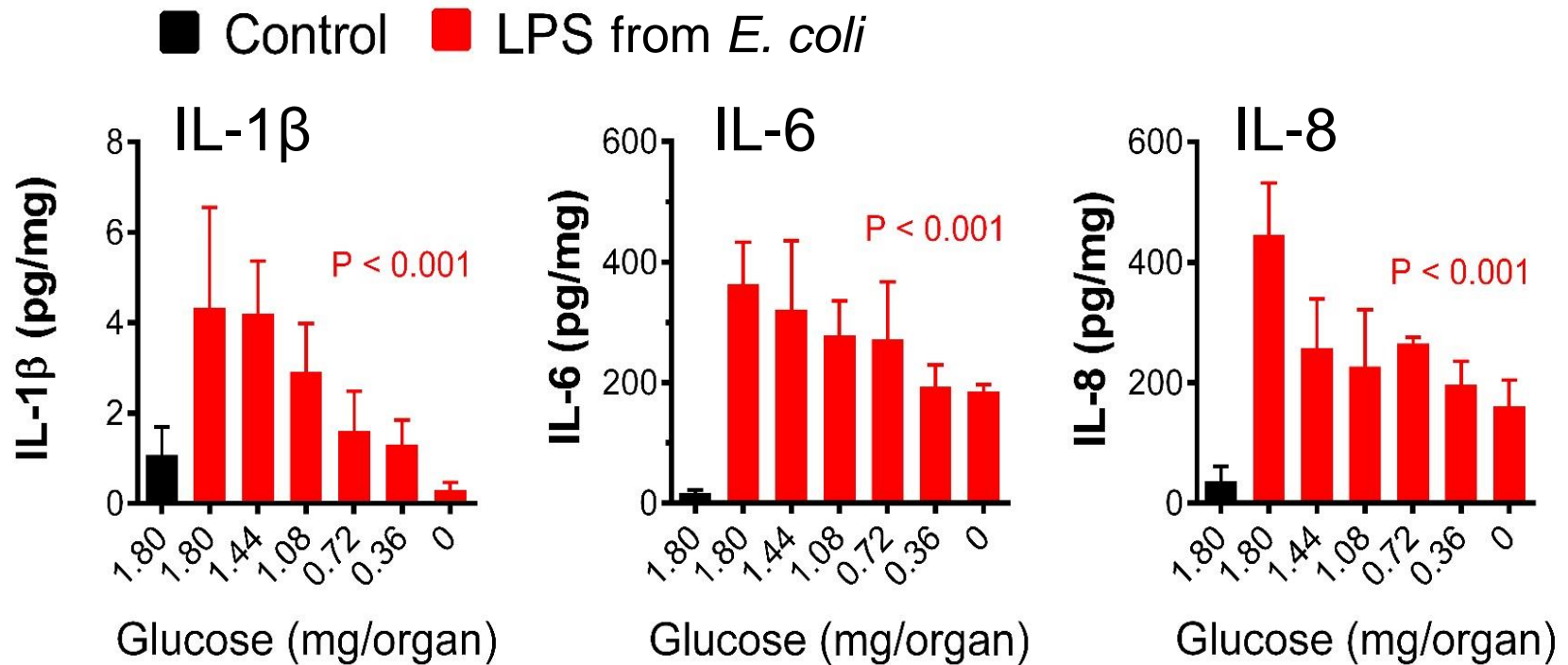
Organ culture



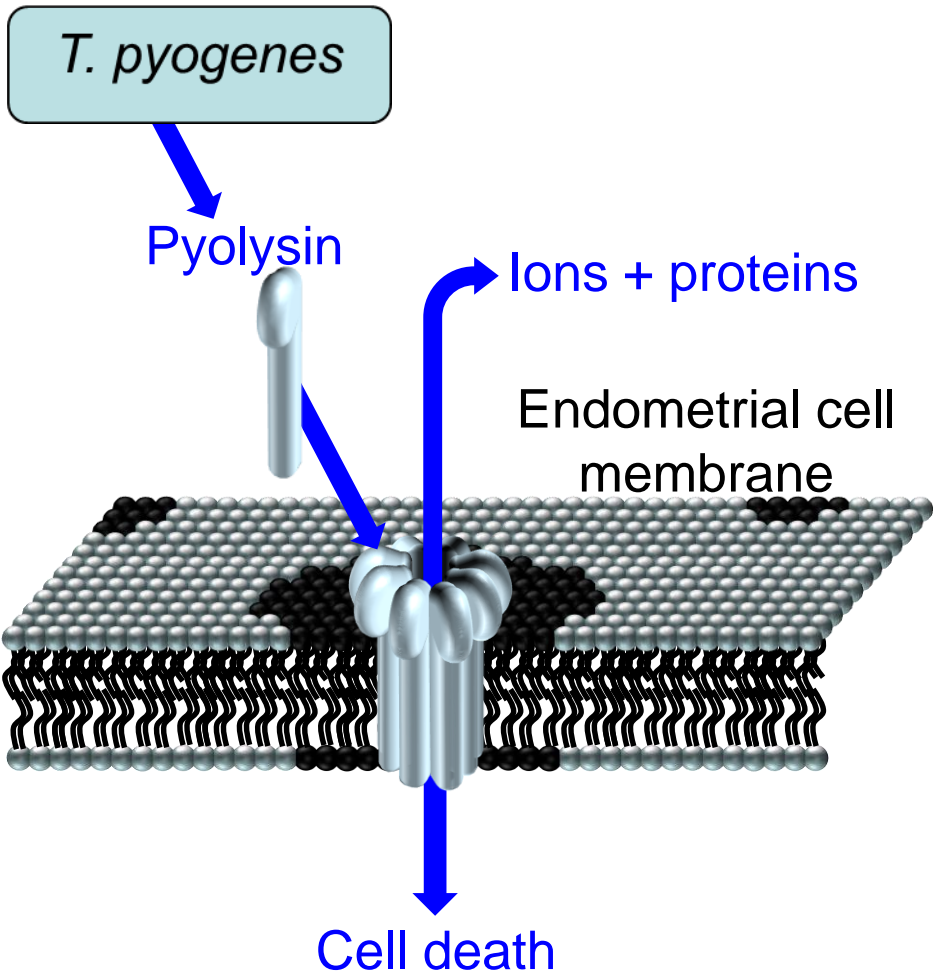
Data are mean (SEM), ANOVA, * P < 0.05 vs. control

Borges et al 2012 *AJRI* 67: 526

Reducing the availability of glucose compromises resistance and the uterine inflammatory response

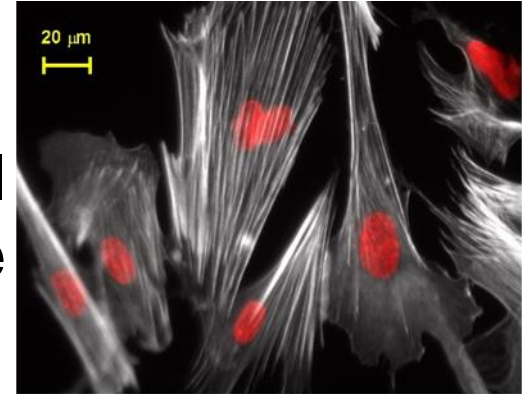


Tolerance – *T. pyogenes* secretes a pore-forming toxin, pyolysin, which damages and kills cells

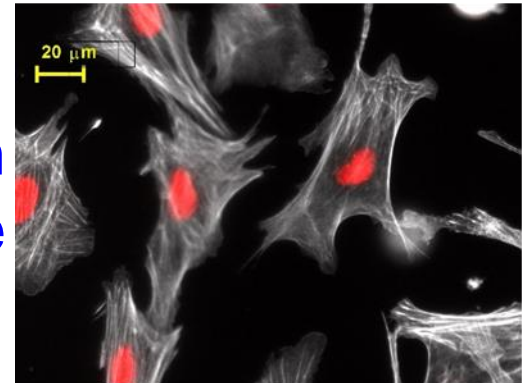


Endometrial cells

Control challenge

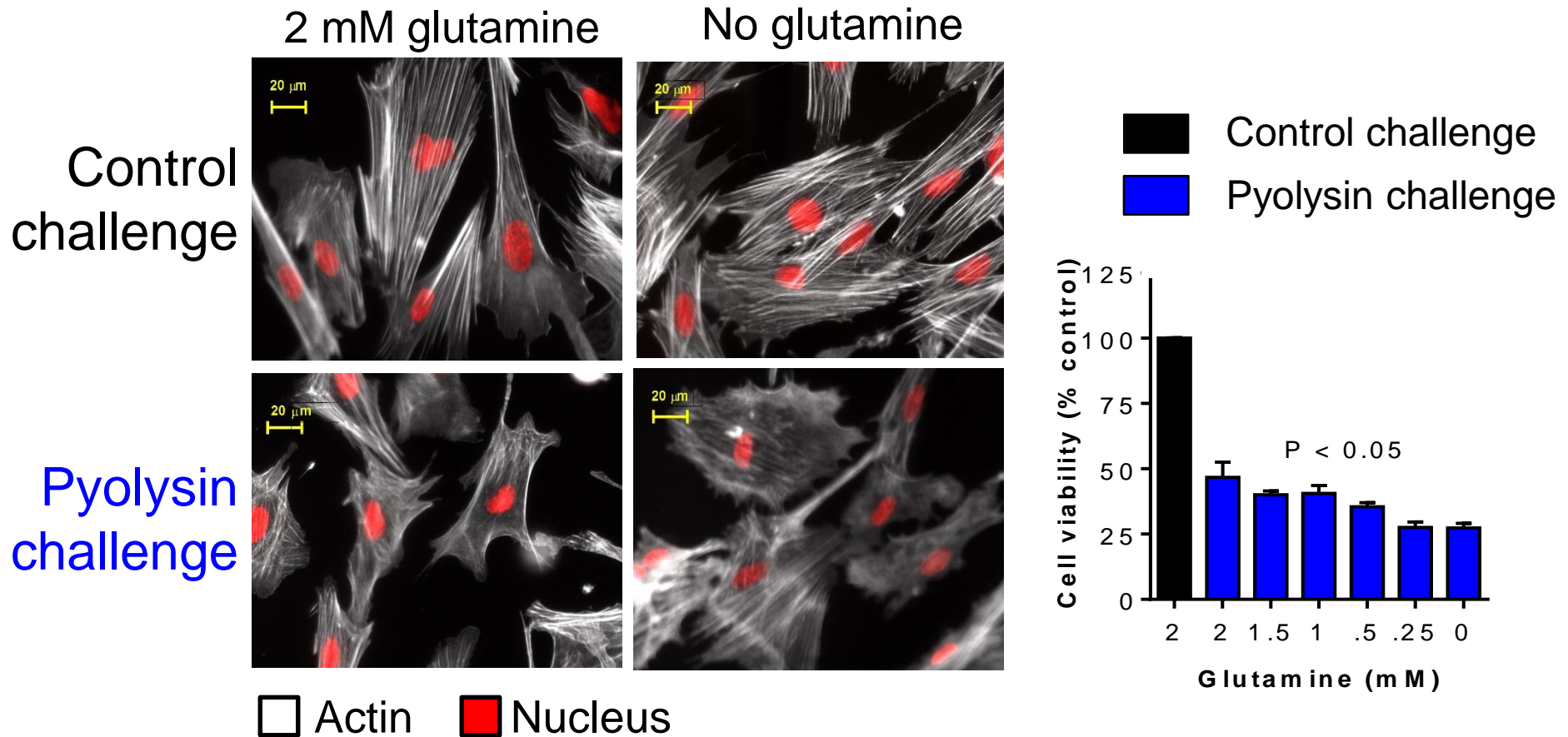


Pyolysin challenge

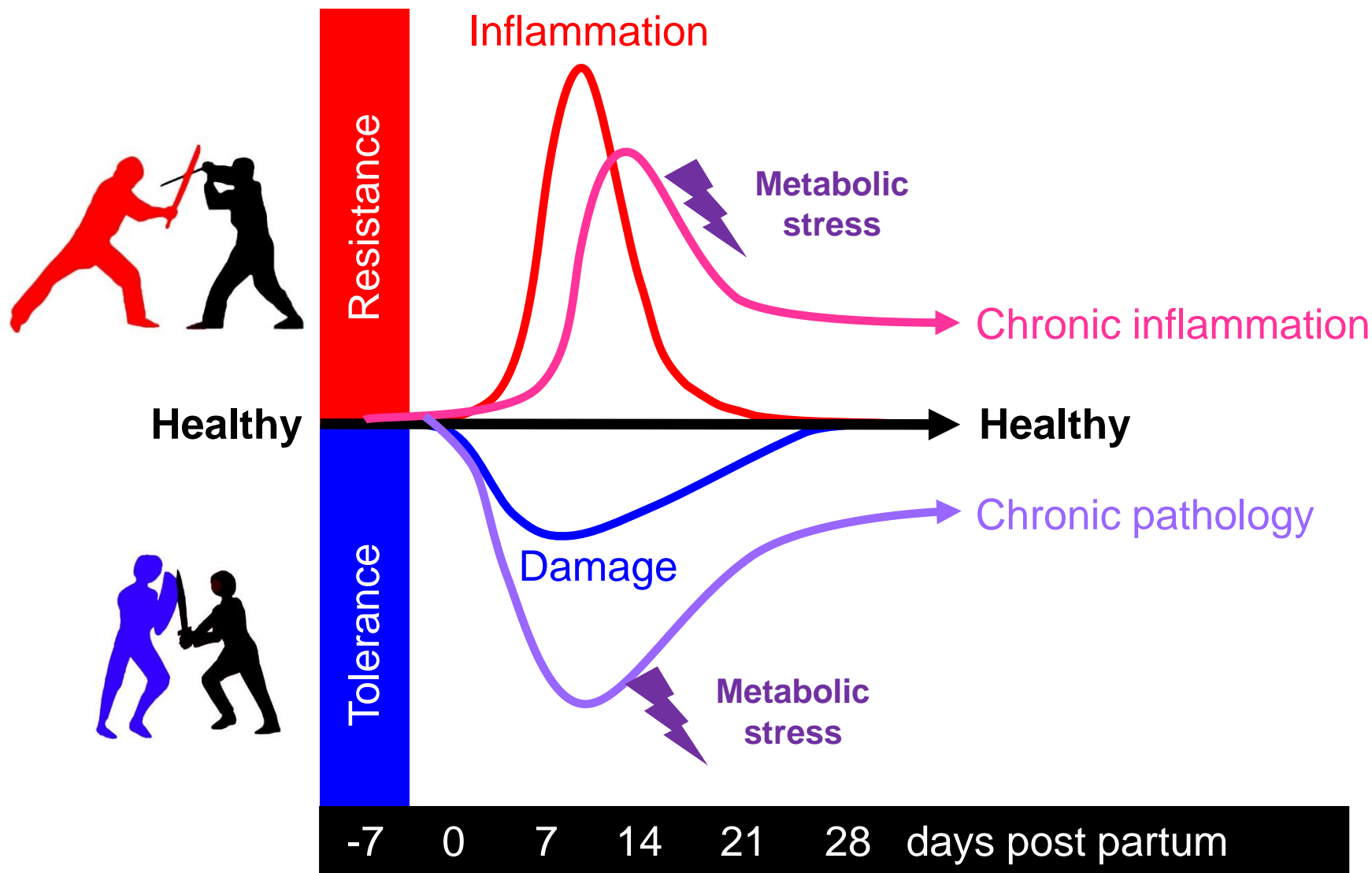


□ Actin ■ Nucleus

Reducing the availability of glutamine compromises endometrial cell tolerance to pore-forming toxins



Compromised resistance or tolerance to pathogens causes postpartum disease

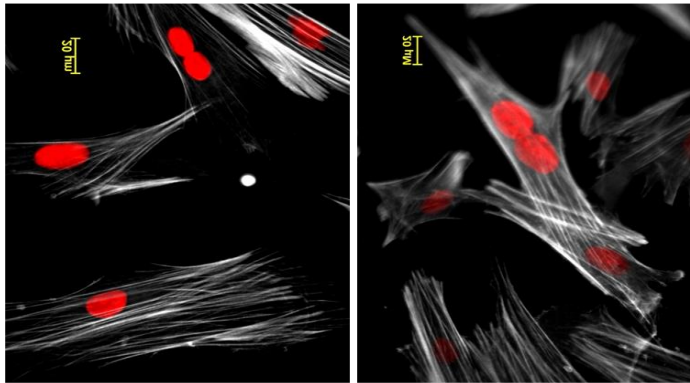


Treatments can increase endometrial cell tolerance to pore-forming toxins

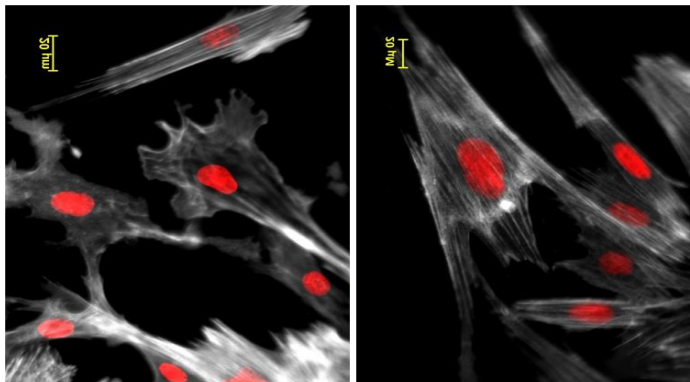
Vehicle

Rx72

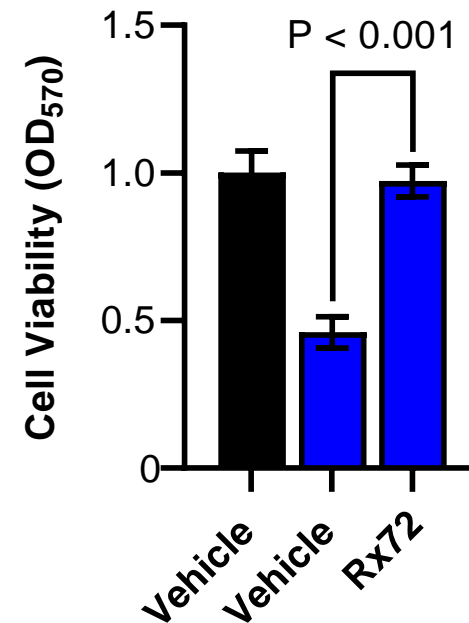
Control challenge



Pyolysin challenge



Control challenge
Pyolysin challenge



Take-home messages

The postpartum uterus is always exposed to multiple pathogenic bacteria

Resilient cows prevent uterine disease developing by avoiding, tolerating and resisting pathogenic bacteria

Metabolic deficits compromises resistance and tolerance in the uterus

New treatments to enhance the ability of animals to tolerate and resist pathogens, and controlling metabolic stresses that impair resistance and tolerance, will help prevent uterine disease, and reduce the use of antibiotics.