

# The Impact of Infectious Disease on Costly Social Signals



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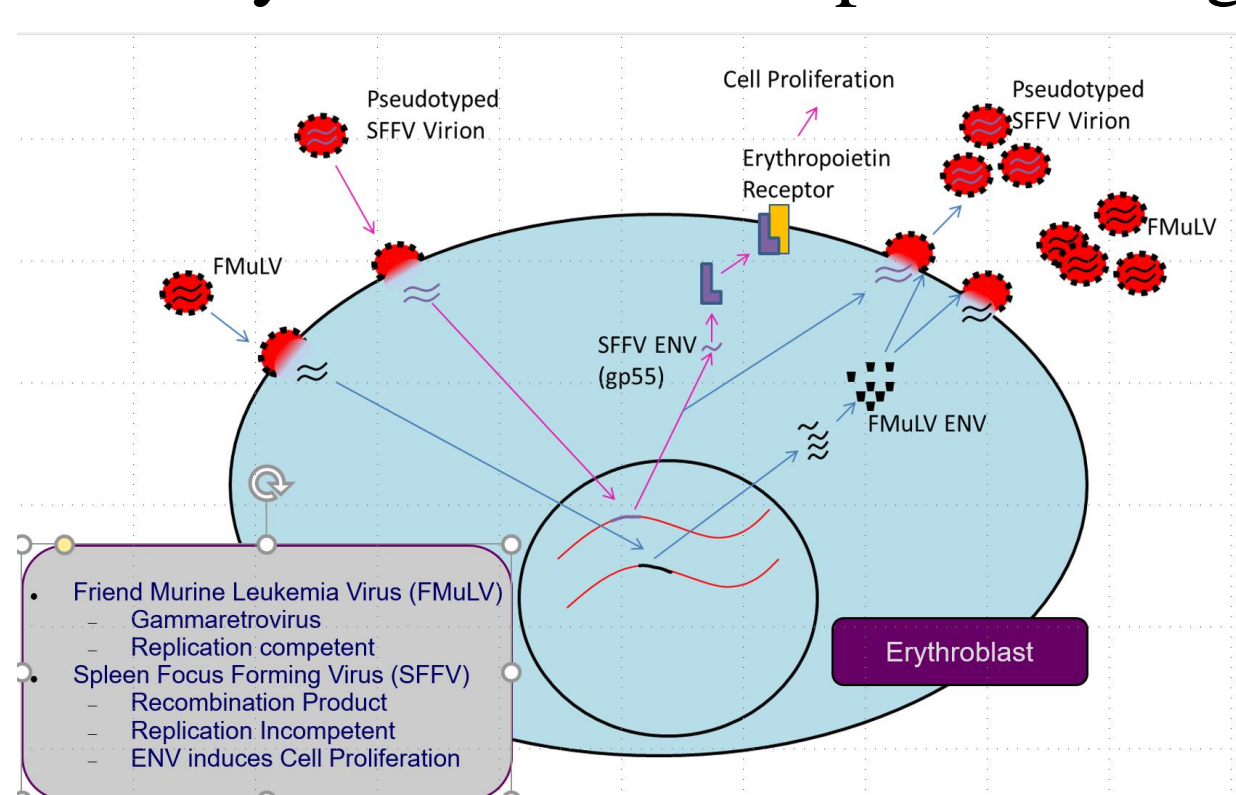
## Introduction

Male house mice (*Mus musculus*) excrete large quantities of proteins, known as major urinary proteins (MUPs), in their urine. These MUPs are thought to be a sexually selected handicapping trait, allowing males to honestly advertise their genetic quality to a female. These traits have to be costly to maintain otherwise it would not be honest and individuals could cheat (1). Studies have shown that dominant males have higher MUPs and that the specific MUP protein, Darcin, is predictive of dominance. Furthermore females prefer dominant males who scent mark more often and have higher MUPs concentration (2). However, few studies have directly addressed to what extent MUPs are an honest signal of an individual's health.



## Methods

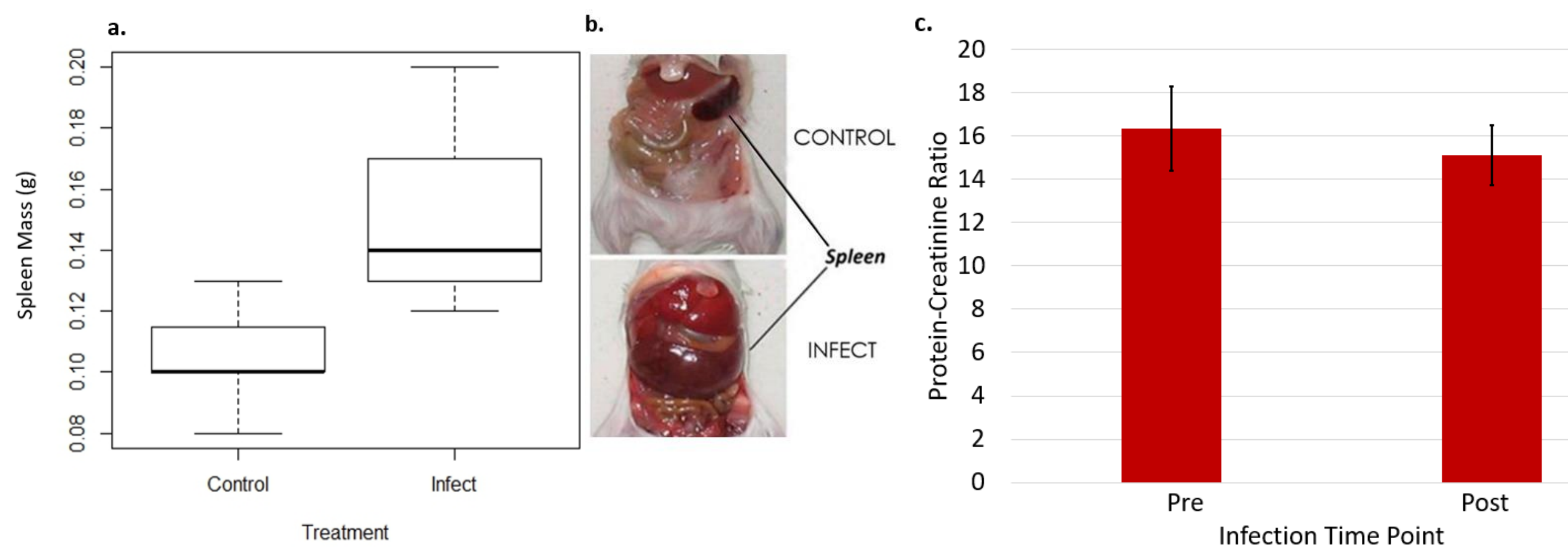
- Animals were infected with the mouse specific retrovirus, Friend Virus Complex (FVC) for twelve days. FVC causes splenomegaly.



- Experiment One: Balb/C mice were infected with either a low or high virulent strain of FVC, and control animals were sham-infected
- Experiment Two: Balb/C mice were infected with an even higher virulent strain of FVC
- Urine was collected at three time points: 1. pre-infection 2. during infection 3. post-infection
- On the final day of the experiment animals were dissected and spleen mass was measured, as an indicator of virulence.
- MUPs concentration was quantified using Bradford assays and corrected for urine dilution by taking the ratio with creatinine (a measurement of hydration in the urine).

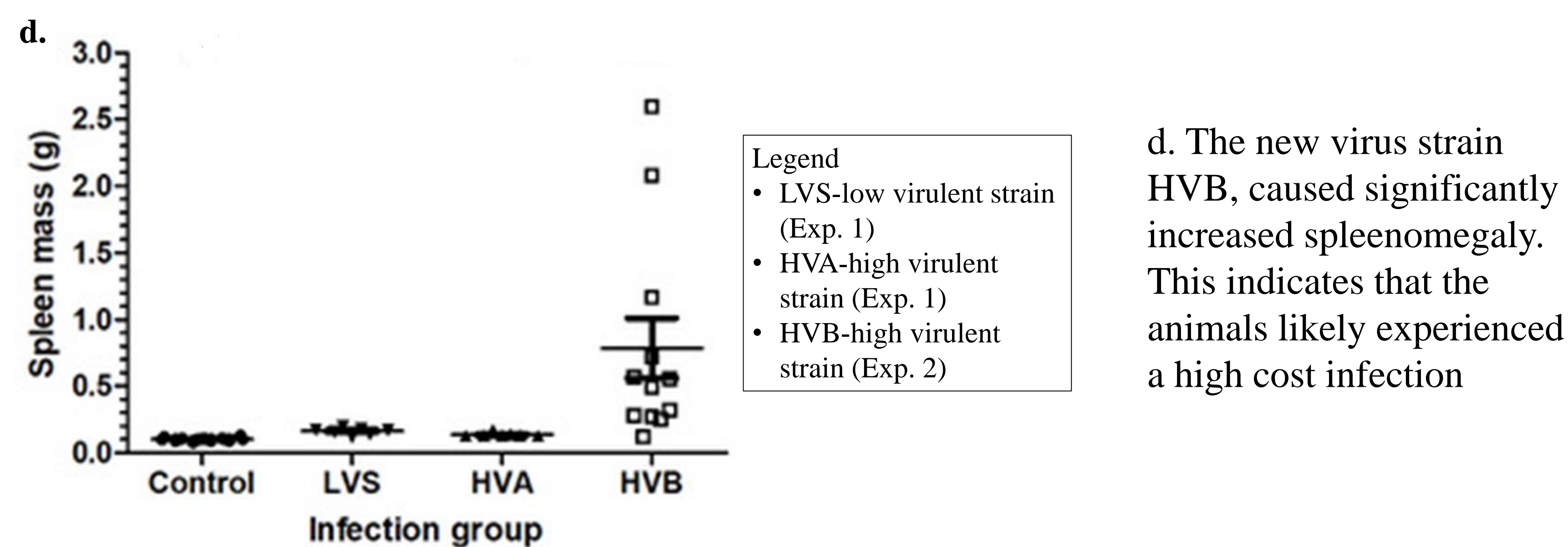
## Results: Experiment One

a. Infected mice had significantly larger spleens (t-test;  $t_{17}=4.94$ ,  $P=0.0001$ ). b. Example of a severely infected animal illustrating an extreme and costly infection (3). c. But MUPs were not altered by infection (Lm;  $R^2=0.1346$ ,  $df=19$ ,  $p=0.2533$ ,  $n=10$ ; c.)



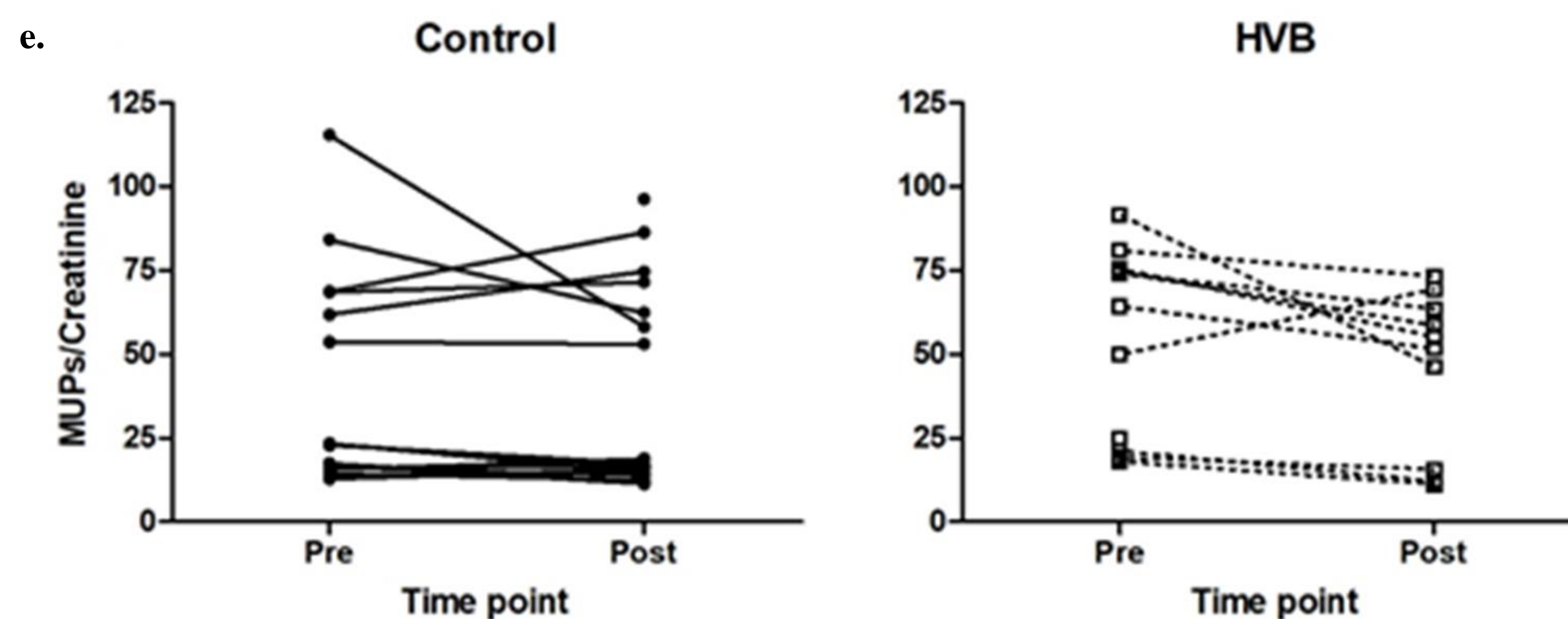
These results were not expected. We suspected the animals did not experience a high enough level of infection to need to shift energy allocated for MUPs to fighting off the infection. Consequently we repeated the experiment with an even higher virulent FVC strain.

## Results: Experiment Two



d. The new virus strain HVB, caused significantly increased splenomegaly. This indicates that the animals likely experienced a high cost infection

e. When MUPs-Creatinin Ratio was analyzed infected mice had significantly decreased MUPs at the post-infection time point compared to the pre infection time point (LMM:  $t = -2.168$ ,  $p = 0.040$ ), while control animals did not (LMM;  $t = -1.15$ ,  $p = 0.260$ ). However the rate of change of MUPs across time was not significantly different between control and infected mice (LMM;  $t = -0.99$ ,  $p = 0.334$ )



## Conclusion

Our results from the second experiment did find support for our hypothesis as male mice did appear to downregulate their MUPs in response to infection. By downregulating their MUPs a male mouse increase his chances of survival, but also honestly advertises to females he is of poor health and possibly poor genetic quality.

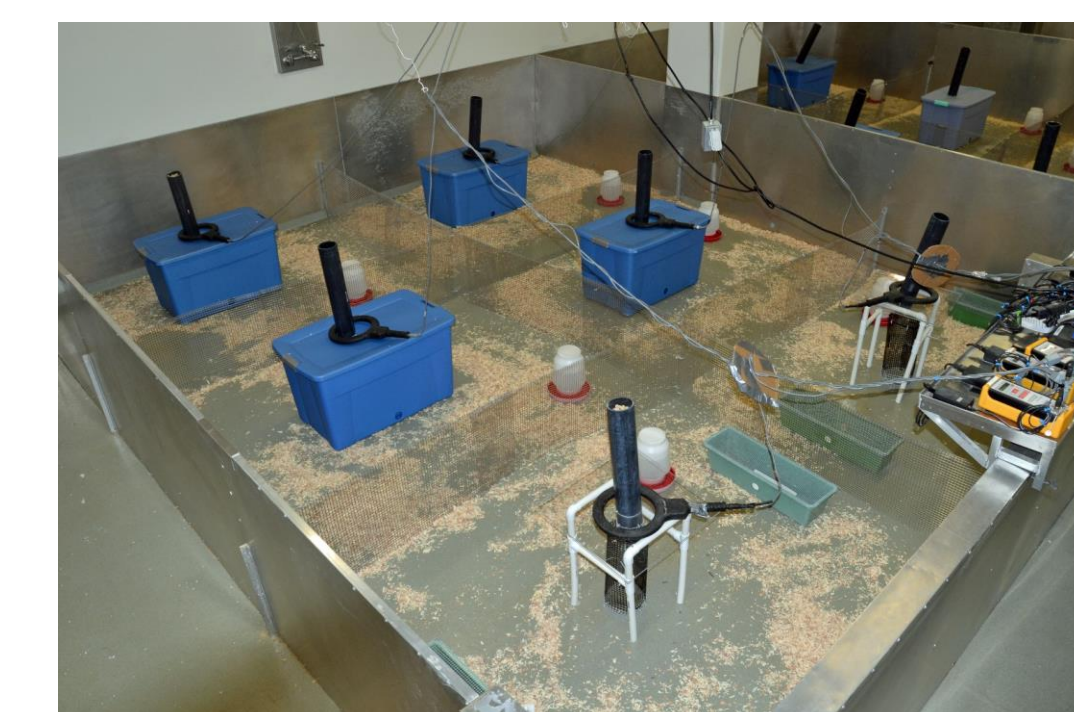
However because the change in MUPs was not significantly different from controls we can't definitively say they downregulate their MUPs solely in response to infection.



## Future Directions

To further understand how male mice balance the cost of their MUPs and the cost of infection this experiment needs to be performed in the context of social competition where there are many more natural stressors. Thus we propose performing the experiment in a semi-natural habitat (barn). In the barn animals are forced to compete for resources, territories and females.

The experiment would be conducted as the first two experiments were, but we would include three housing conditions: 1. single housing 2. breeding cages 3. the barn



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## References

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