

Sex Differences in Neurophysiological Changes Following Voluntary Exercise in Adolescent Rats

Lindsay Ferguson, Christopher C. Giza, Rebecka Serpa, Tiffany Greco, Hannah Robert, Michael Folkerts, Mayumi L. Prins

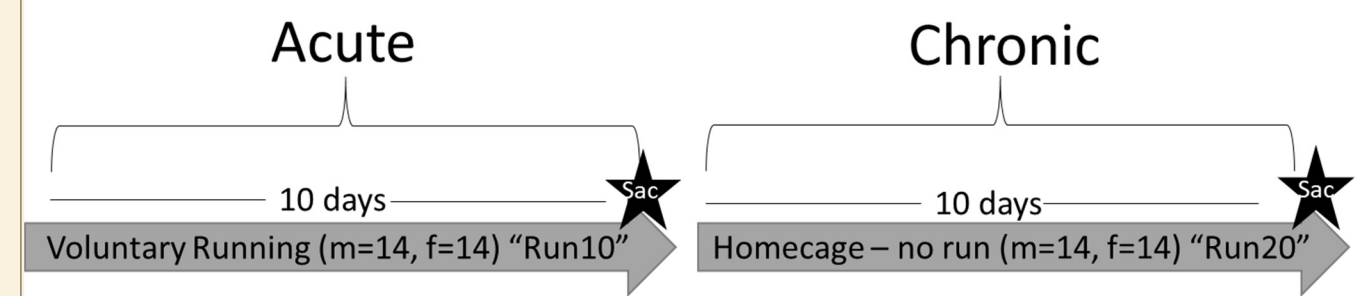
Department of Neurosurgery, UCLA, Los Angeles, CA



Purpose

Adolescence includes physical, cognitive, and social development. Exercise and sex can influence each of these processes. Pre-clinical studies do not represent these groups. Differences between active and sedentary groups may influence response to stressors. Thus, the neurophysiological changes are important to characterize.

Rathlete Model



Experimental Model

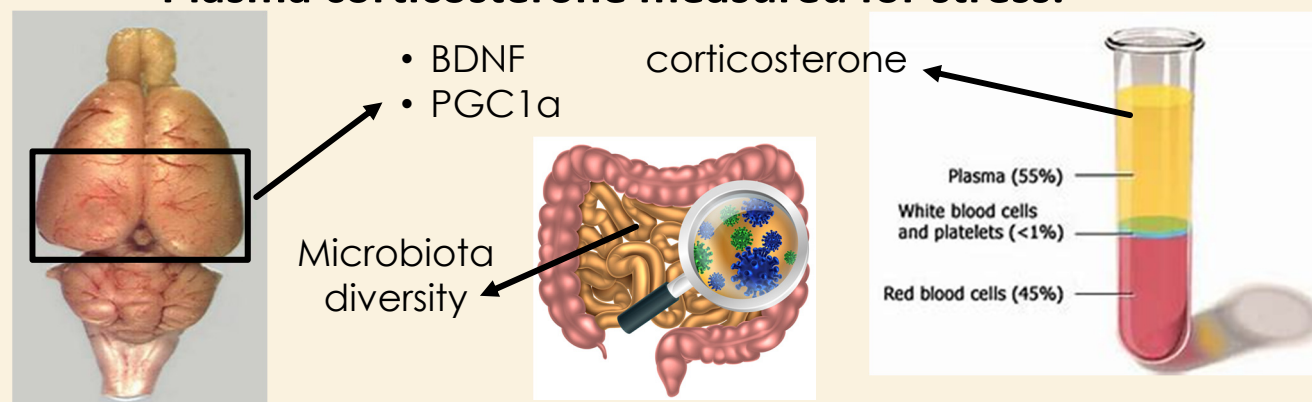
- Male and female Sprague Dawley (age 35d) voluntary run (rathlete) or sedentary 10 days. Some rested in homecages an additional 10 days.
- Analyzed acute (10 day) and chronic (20 day) changes due to exercise
- Carried out at 2 sites:



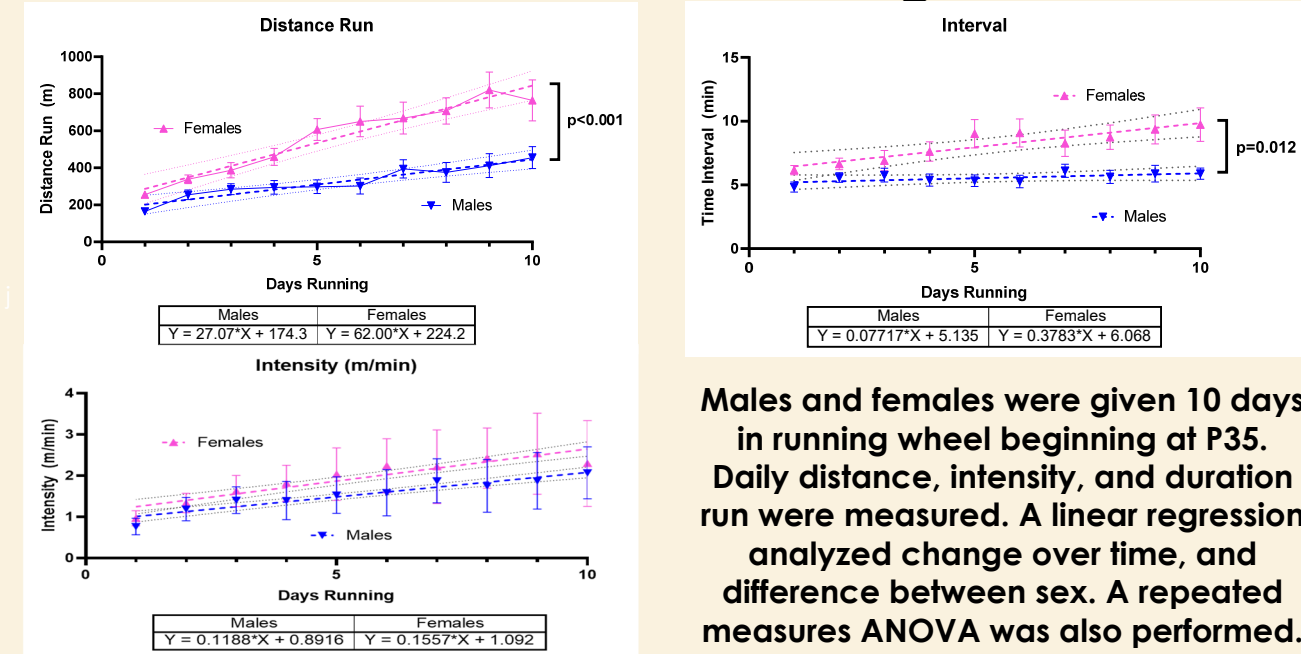
Males = 32
Females = 31

Males = 12
Females = 12

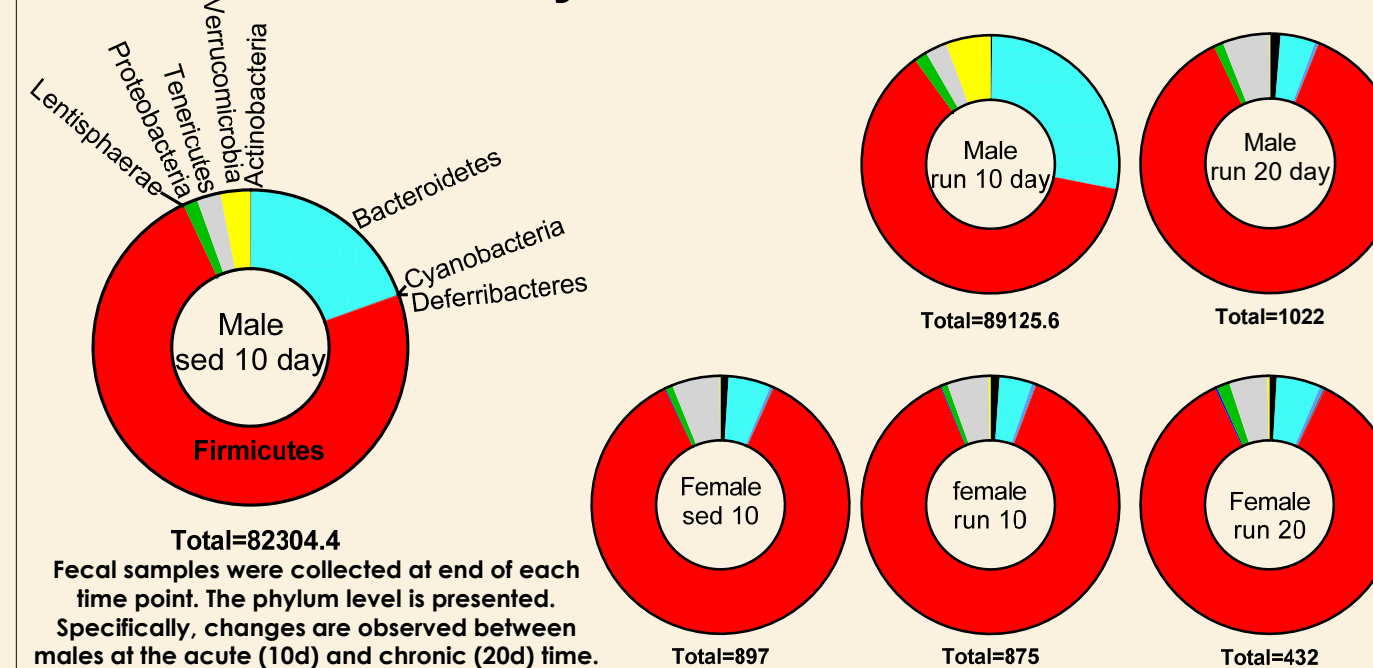
- Tissue Analysis:
 - Parietal cortex and hippocampus analyzed for BDNF and PGC1 α expression.
 - Fecal samples analyzed for microbiota changes.
 - Plasma corticosterone measured for stress.



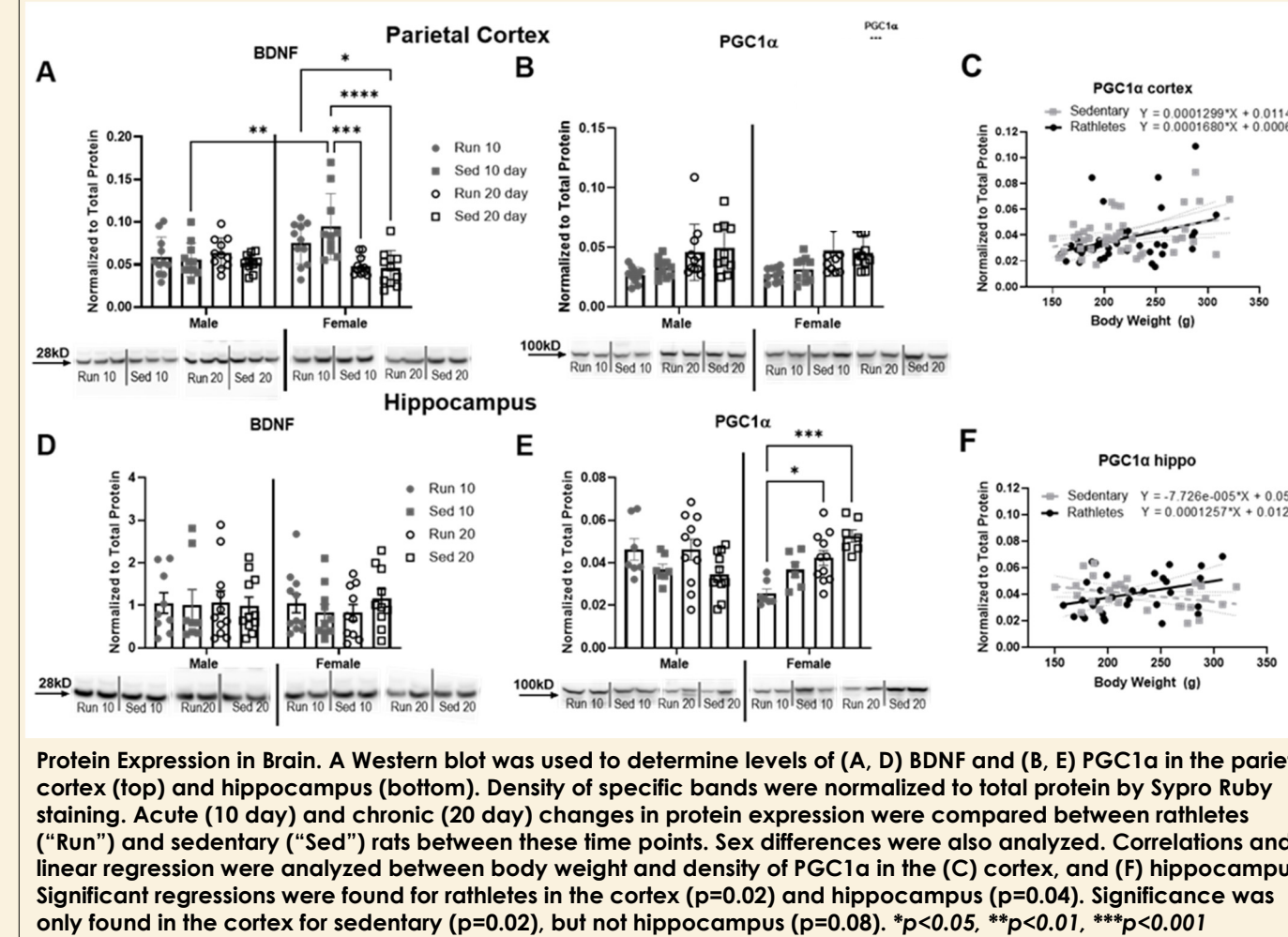
Females ran further and longer than males



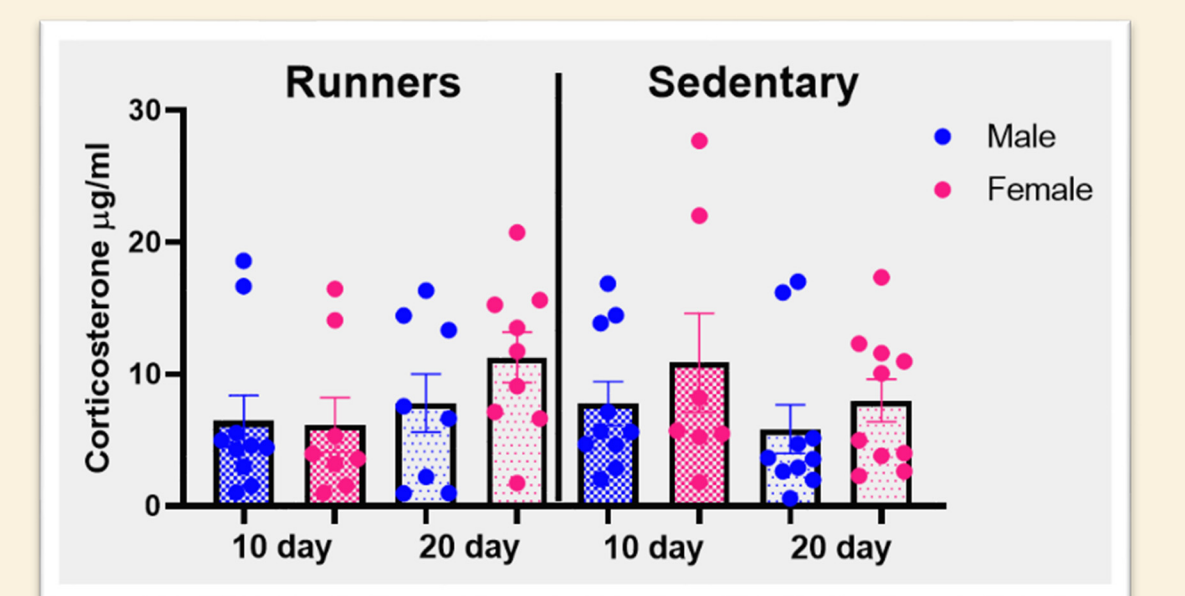
Males showed age-dependent changes in microbiota Phylum, not seen in females.



Sex and Time Differences in BDNF and PGC1 α



No Effect of Sex or Exercise on plasma corticosterone levels



Conclusions

- Data was similar at both sites enhancing reproducibility of data.
- Sex differences are present in adolescent activity whereby females run further and for longer distances than males.
- Age, not exercise during adolescence significantly impact gut microbiota diversity and PGC1 α in the cortex and hippocampus.
- Sex and age impacted BDNF levels in the brain. Females, not males expressed more BDNF in the hippocampus at the acute 10day time point, compared to females at the chronic 20 day time point.
- Adolescence is a unique time period with results differing from adults.

References

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- Leasure, JL, Jones, M (2008) Forced and voluntary exercise differentially affect brain and behavior. *Neuroscience* 156:456-465.