

**SYLLABUS**  
**MIXED MODELS IN QUANTITATIVE GENETICS**  
**SISG, Seattle, 17 - 19 July 2019**

**INSTRUCTORS:**

Guilherme Rosa, Department of Animal Sciences, University of Wisconsin, Madison  
[grosa@wisc.edu](mailto:grosa@wisc.edu)

Bruce Walsh, Department of Ecology & Evolutionary Biology, University of Arizona  
[jbwalsh@u.arizona.edu](mailto:jbwalsh@u.arizona.edu)

**LW = Lynch & Walsh: *Genetics and Analysis of Quantitative Traits* (1998)**

**WL = Walsh & Lynch: *Evolution and Selection of Quantitative Traits* (2018)**

**LECTURE SCHEDULE**

**Wednesday, 17 July**

1:30 3:00 pm      1) Introduction to matrix algebra and calculus (Walsh)  
                            Background reading: LW, Chapter 8  
                            Additional reading: LW Appendix 3; WL Appendices 4,5

3:00 3:30 pm      Break

3:30 5:00 pm      2) The *General Linear Model* (Walsh)  
                            Background reading: LW Chapter 8  
                            Additional reading: LW Appendices 3, 4; WL Appendices 2, 3

**Thursday, 18 July**

8:30 10:00 am      3) Overview and Derivation of the mixed model (Rosa)  
                            Additional reading: LW Chapters 26, 27

10:00 10:30 am      Break

10:30 12:00      4) Application: BLUP breeding values (Rosa)

12:00 1:30 pm      Lunch

1:30 3:00 pm      5) Estimation of Variance Components (Rosa)

3:00 3:30 pm      Break

3:30 5:00 pm      6) MCMC - Gibbs Sampling (Rosa)  
                            Additional reading: WL Appendices 2 and 3

**Friday, 19 July**

- 8:30 10:00 am 7) QTL/association mapping (Walsh)  
Additional reading: LW Chapters 14, 16
- 10:00 10:30 am Break
- 10:30 12:00 8) Genomic Selection (Rosa)  
Additional reading: WL Chapter 18
- 12:00 1:30 pm Lunch
- 1:30 3:00 pm 9) Multiple traits, Repeatability, Maternal Effects (Rosa)
- 3:00 3:30 pm Break
- 3:30 5:00 pm 10) Associative effects (Walsh)  
Additional reading: WL Chapter 22

## ADDITIONAL BOOKS ON MIXED MODELS IN QUANTITATIVE GENETICS

- Bernardo, R. (2010) *Breeding for Quantitative Traits in Plants*, 2<sup>nd</sup> Edition, Stemma Press.
- Christou, P., Savin, R., Costa-Pierce, B. A., Misztal, I. and Whitelaw, C. B. A. (eds.) 2013. *Sustainable Food Production*, Vol 1. Springer.
- Gondro, C., van der Werf, J and Hayes, H. (eds.) 2013. *Genome-wide Association Studies and Genomic Prediction*. Humana Press.
- Henderson, C. R. 1984. *Applications of Linear Models in Animal Breeding*. University of Guelph Press.
- Lynch, M. and B. Walsh. 1998. *Genetics and Analysis of Quantitative Traits*. Sinauer.
- Mrode, R. A. 2014. *Linear Models for the Prediction of Animal Breeding Values*, 3<sup>rd</sup> Edition, CAB International.
- Searle, S. R., Casella, G. and McCulloch, C. E. (2006) *Variance Components*. Willey.
- Sorensen, D. and Gianola, D. (2002) *Likelihood, Bayesian and MCMC Methods in Quantitative Genetics*. Springer.
- VanVleck, L. D. (1993) *Selection Index and Introduction to Mixed Model Methods*. CRC Press.
- Walsh, B., and M. Lynch. 2018. *Evolution and Selection of Quantitative Traits*. Oxford.