TUM 2017 SPRING SCHOOL "SELECTION THEORY"

Goals: An extensive treatment of the modern theory of selection and selection response with a focus towards applications in plant and animal breeding.

INSTRUCTOR:
Bruce Walsh, Department of Ecology & Evolutionary Biology, University of Arizona
jbwalsh@u.arizona.edu

References
LW = Lynch & Walsh, *Genetics and Analysis of Quantitative Traits*
WL = Walsh & Lynch (Chapter drafts), *Evolution and Selection on Quantitative Traits*

LECTURE SCHEDULE
Additional/background reading listed under each lecture

Saturday 25 March:

14:30-15:30: Welcome and Introduction
15:30-16:00: *Coffee break*
16:00-18:00: **01:** Basic population genetics of selection
WL Chapter 5
18:30-19:30: *Dinner*
19:30-20:30: **02:** How selection on traits translates to selection on QTLs
WL Chapter 5

Sunday 26 March:

09:00-10:30: **03:** Selective sweeps and hitchhiking
WL Chapter 8
10:30-11:00: *Coffee break*
11:00-12:30: **04:** Detecting selection with marker data: 1
WL Chapter 9
12:30-13:30: *Lunch*
13:30-15:30: *Free time*
15:30-16:00: *Coffee break*
16:00-18:00: **05:** Detecting selection with marker data: 2
WL Chapter 10
18:30-19:30: *Dinner*
19:30-20:30: **06:** Intro to Quantitative Genetics

Monday 27 March:

09:00-10:30: **07:** Basic mass selection
WL Chapters 13 - 15
10:30-11:00: *Coffee break*
11:00-12:30: **08:** Basic mass selection (cont)
WL Chapters 13 - 15
12:30-13:30: *Lunch*
13:30-15:30: *Free time*
15:30-16:00: *Coffee break*
16:00-18:00: **09:** Short-term changes in variances (Bulmer effect)
WL Chapter 16
18:30-19:30: *Dinner*
19:30-20:30: **10:** Selection on the environmental variance
WL Chapter 17

Tuesday 28 March:

09:00-10:30: Review and Discussion
10:30-11:00: *Coffee break*
11:00-12:30: **11:** Review of matrices
LW Chapter 8
WL Appendix 4
12:30-13:30: *Lunch*
13:30-15:30: *Free time*
15:30-16:00: *Coffee break*
16:00-18:00: **12:** Multivariate breeder's equation
WL Chapter 30
18:30-19:30: *Dinner*
19:30-20:30: **13:** Introduction to Index Selection
WL Chapter 33

Wednesday 29 March:

09:00-10:30: 1**4:** Introduction to Index Selection (cont)
WL Chapter 33
10:30-11:00: *Coffee break*
11:00-12:30: **15:** Index Selection: Applications
WL Chapter 34
12:30-13:30: *Lunch*
13:30- *Trip to Andechs*

Thursday 30 March:

09:00-10:30: Review and Discussion
10:30-11:00: *Coffee break*
11:00-12:30: Review and Discussion
12:30-13:30: *Lunch*
13:30-15:30: *Free time*
15:30-16:00: *Coffee break*
16:00-18:00: **16:** Linear models
18:30-19:30: *Dinner*
19:30-20:30: **17:** BLUP: Basics

Friday 31 March:

09:00-10:30: **18:** BLUP: Maternal and associative effects
WL Chapter 22
10:30-11:00: *Coffee break*
11:00-12:30: **19:** Genomic selection
12:30-13:30: *Lunch*
13:30-15:30: *Free time*
15:30-16:00: *Coffee break*
16:00-18:00: **20:** Random regressions
18:30-19:30: *Dinner*
19:30-20:30: Discussion

Saturday 1 April:

09:00-10:30: Optional lecture (if time, otherwise, catchup)
10:30-11:00: *Coffee break*
11:00-12:30: Wrap-up and Discussion
12:30-13:30: *Lunch*
13:30 Departure

ADDITIONAL BOOKS ON QUANTITATIVE GENETICS

General

Falconer, D. S., and T. F. C. Mackay. *Introduction to Quantitative Genetics*, 4 th Edition Lynch, M., and B. Walsh. 1998. *Genetics and Analysis of Quantitative Traits*. Sinauer. Roff, D. A. 1997. *Evolutionary Quantitative Genetics*. Chapman and Hall.

Mather, K., and J. L. Jinks. 1982. *Biometrical Genetics*. (3 rd Ed.) Chapman & Hall. Walsh, B., and M. Lynch. 2017. *Evolution and Selection of Quantitative Traits*. Sinauer.

Animal Breeding

Cameron, N. D. 1997. *Selection Indices and Prediction of Genetic Merit in Animal Breeding*. CAB International.

Mrode, R. A. 1996. *Linear Models for the Prediction of Animal Breeding Values.* CAB International. Simm, G. 1998. *Genetic Improvement of Cattle and Sheep*. Farming Press.

Turner, H. N., and S. S. Y. Young. 1969. *Quantitative Genetics in Sheep Breeding*. Cornell University Press.

Weller, J. I. 2001. *Quantitative Trait Loci Analysis in Animals.* CABI Publishing.

Plant Breeding

Wricke, G., and W. E. Weber. 1986. *Quantitative Genetics and Selection in Plant Breeding.* De Gruyter.

Mayo, O. 1987. *The Theory of Plant Breeding.* Oxford.

Stoskopf, N. C. D. T. Tomes, and B. R. Christie. 1993. *Plant breeding: Theory and practice.* Westview, Boulder.

Sleper, D. A., and J. M. Poehlman. 2006. *Breeding Field Crops*. 5 th Edition. Blackwell

Bernardo, R. 2010. *Breeding for Quantitative Traits in Plants,* 2nd Ed Stemma Press.

Hallauer, A. R., M. J. Carena, and J. B. Miranda Filho. 2010. *Quantitative Genetics in Maize Breeding*. Iowa State Press.

Statistical and Technical Issues

Bulmer, M. 1980. *The Mathematical Theory of Quantitative Genetics.* Clarendon Press. Kempthorne, O. 1969. *An Introduction to Genetic Statistics*. Iowa State University Press.

Sorensen, D., and D. Gianola. 2002. *Likelihood, Bayesian, and MCMC Methods in Quantitative Genetics*. Springer.

Saxton, A. M. (Ed). 2004. *Genetic Analysis of Complex Traits Using SAS*. SAS Press.

Wu, R., C.-X. Ma, and G. Casella. 2007. *Statistical Genetics of Quantitative Traits: Linkage, Maps. and QTL*. Springer, N.Y.