SOCR 725, Quantitative Inheritance in Plant Breeding

Spring 2012

Instructor: Pat Byrne
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Time and place:
Lecture, Tuesday & Thursday 11-11:50 pm, W212 Plant Science Bldg.
Computer lab, Wednesday 2–3:40 pm, Shepardson 218

Credits: 3

Consultation hours: by arrangement

Objectives: Successful students who take this course will

1. Become aware of the historical development of quantitative genetics.1
2. Understand the principles of traditional quantitative genetic analysis and be able to analyze data based on those methods.
3. Understand the principles of molecular marker-based quantitative genetic analysis and be able to analyze data based on those methods.
4. Become competent in the use of several software programs for quantitative genetic analysis: SAS JMP, Excel, QTL mapping software, maybe R.
5. Be able to discuss the practical uses of quantitative genetic methods in plant breeding programs.
6. Gain experience in written and oral communication on quantitative inheritance in plants.

Text: There is no required text for the course. However, two books we will use (both available in Morgan Library) are

M.J. Kearsey and H.S. Pooni. 1996 (or 2nd ed., 1998, both out of print). Genetical analysis of quantitative traits. London; New York. Chapman & Hall.

J. Hill, H.C. Becker, and P.M.A. Tigerstedt. 1998. Quantitative and ecological aspects of plant breeding. London; New York. Chapman & Hall.

There will be assigned readings, either handed out in class or posted on RamCT.

Some other potentially useful references are

Bernardo, Rex. 2002. Breeding for quantitative traits in plants. Stemma Press, Woodbury, MN.

Falconer, D.S., and T.F.C. MacKay. 1996. Introduction to quantitative genetics, 4th ed. Longman, London.

Hallauer, A.R., M. J. Carena, and J.B. Miranda Filho. 2010. Quantitative genetics in maize breeding. Springer. Available as an Ebook through Morgan Library.

Lynch, M., and B. Walsh. 1998. Genetics and analysis of quantitative traits. Sinauer Assoc., Inc., Sunderland, MA.

Meksem, K., and G. Kahl (ed.). 2005. The handbook of plant genome mapping. Genetic and physical mapping. Wiley-VCH, Weinheim, Germany.

Oraguzie, N.C., et al. 2007. Association mapping in plants. Springer, New York.

Paterson, A.H. (ed.) 1997. Molecular dissection of complex traits. CRC Press, Boca Raton, FL.

Salsburg, D. 2002. The lady tasting tea: How statistics revolutionized science in the twentieth century. Owl Books.

Grading:	12 weekly homework assignments	60%
	Take-home final exam	20%
	Class participation (including presentations)	20%

Schedule

Jan. 17-19	History and introduction to quantitative genetics
Jan. 24-26	Review of segregation, frequency distributions, basic statistics, Excel, SAS JMP.
Jan. 31-Feb. 2	Basic generations -- means analysis
Feb. 7-9	Basic generations -- variance analysis
Feb. 14-16	Heritability estimates by parent-offspring regression and variance components; correlation
Feb. 21-23	Index selection
Feb. 28-Mar. 1	Diallel analysis; North Carolina designs
Mar. 6	Guest lecture: Mark Brick, CSU bean breeder

Mar. 8	QTL I: Basic concepts; marker evaluation; linkage maps
Mar. 12-16	Spring break week
Mar. 20-22	QTL II: Analysis of variance; Interval mapping
Mar. 27-29	QTL III: Epistatic interactions; QTL x Environment interaction
Apr. 3-5	Association mapping; Marker-assisted selection principles
Apr. 10-12	Student presentations
April 17-19	Student presentations
April 24-26	Student presentations;
May 1-3	Response to selection; miscellaneous topics
May 7-11	Final exam week

Potential student presentation topics (just examples):

- Genetic mechanisms of heterosis
- Long-term selection experiments
- Genotype x environment interaction
- Genomic selection
- Marker-assisted selection in practice
- Evaluating genetic diversity
- eQTL analysis

Short biographical reports:

Francis Galton
Karl Pearson
R.A. Fisher
G.H. Shull
Jay Lush
Kenneth Mather (*Biographical Memoirs of Fellows of the Royal Society*, Vol. 38, Nov, 1992, pp. 249-266)
Arnel Hallauer
Norman Borlaug
Steven Tanksley

Academic Integrity: From the CSU General Catalog

"The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic dishonesty. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are responsible for and affected by the cooperative commitment to academic integrity."

This course will adhere to the Academic Integrity Policy of the Colorado State University General Catalog, http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf (scroll down to p. 7) and the Student Conduct Code, Article III, http://www.conflictresolution.colostate.edu/conduct-code.

The principles and practices of academic honesty will apply to all components of this course: written assignments, class discussions, and presentations. Plagiarism is of particular relevance. Excerpts from a recent journal editorial addressing the issue are quoted below (Day et al., 2012. Biosystems Engineering 111:1).

"Plagiarism, the practice of taking someone else's work or ideas and passing them off as one's own, and its ancillary self-plagiarism, in which individuals republish work that they have already published, represent significant challenges to scientific journals. Authors have a right to be acknowledged as the source of their own work, and new authors must present their work in their own words."

"... journals expect papers to be written in the author's own words. It is their interpretation of the science that is important, and using their own words demonstrates understanding, so significant strings of words should not appear from other published works. Of course some repetition will arise by chance and some because standard phrases or descriptions of equipment or methods need to be reused. However this is not a justification for extracting text from the introduction, review, results or discussion of other papers. If it is important to use the actual words of another author, they should be put in quotation marks and be clearly referenced."

Some links to information on academic integrity and plagiarism are as follows:

Practicing Academic Integrity: http://learning.colostate.edu/integrity/index.cfm

Ways to Avoid Plagiarism: http://learning.colostate.edu/integrity/ways_to_avoid.cfm

Writing Guide: Understanding Plagiarism:
http://writing.colostate.edu/guides/researchsources/understandingplagiarism/index.cfm

Student Survey, SOCR 725 – Quantitative Inheritance in Plant Breeding

Name _____ Phone _____

Campus address _____

Email address _____

Major Professor _____

Degree sought and expected completion date _____

What do you hope to learn from this course?

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What prior exposure to genetics or plant breeding have you had? Include course work, lab or field experience.

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What prior experience with statistics have you had? Include course work and procedures you've used.

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Please rate your proficiency with these computer software packages:

Software	None	Basic	Intermediate	Advanced
SAS				
SAS JMP				
Spreadsheet (e.g., Excel)				
Genetic mapping (e.g., MapMaker, JoinMap, QTL Cartographer)				
R				