

BIOST/STAT 551. Statistical Genetics II: Quantitative Genetics

Autumn 2020. Tuesday, Thursday 10:00-11:20, Remote.

Instructor Bruce Weir, bsweir@uw.edu.

Catalog Syllabus Statistical basis for describing variation in quantitative traits. Decomposition of trait variation into components representing genes, environment and gene-environment interaction. Methods of mapping and characterizing quantitative trait loci.

Logistics

The course will be offered remotely, with Zoom sessions at the scheduled times.

Course Assessment

- In-class presentations of questions of five selected papers, each worth 10% of grade for course. Work and present in pairs.
- Five genetic data analyses of 1000 Genomes data, worth 50% of grade for course. Work in pairs, submit individual reports.

Suggested Background Reading

Falconer and Mackay, "Introduction to Quantitative Genetics, 4th Edition"

Useful Reference Texts

Lynch and Walsh, "Genetics and Analysis of Quantitative Traits" 1998; Walsh and Lynch, "Evolution and Selection of Quantitative Traits" 2018

Class website

<https://canvas.uw.edu/courses/1396049>

Major Topics

1. Allelic Association
2. Population Structure and Relatedness
3. Quantitative Genetics
4. Heritability and Inbreeding Depression
5. Association Mapping

All these topics will be addressed with 1000 Genomes data.

Major Goals

Obtain a good understanding of

- Graffelman J, Weir BS. 2016. Testing for Hardy-Weinberg equilibrium at bi-allelic genetic markers on the X chromosome. 2016. *Heredity* 116:558-568.
- Weir BS, Goudet J. 2017. A unified characterization of population structure and relatedness. *Genetics* 206:2085-2103.
- Goudet J, Kay T, Weir BS. 2017. How to estimate relatedness. *Molecular Ecology* 27:4121-4135.
- Yang J, Zeng J, Goddard ME, Wray NR, Visscher PM. 2017. Concepts, estimation and interpretation of SNP-based heritability. *Nature Genetics* 49:1304-1311.
- Yengo L, Zhu Z, Wray NR, Weir BS, Yang J, Robinson MR, Visscher PM. 2017. Detection and quantification of inbreeding depression for complex traits from SNP data. *Proceedings of the National Academy of Sciences USA* 114:8602-8607.
- Weir BS. 2008. Linkage disequilibrium and association mapping. *Annual Reviews of Genomics and Human Genetics* 9:129-142.

Obtain experience with these software packages:

- PLINK: zzz.bwh.harvard.edu/plink
- SNPRelate: <https://bioconductor.org/packages/release/bioc/html/SNPRelate.html>
- HardyWeinberg: <https://cran.r-project.org/web/packages/HardyWeinberg/index.html>
- Gaston: <https://cran.r-project.org/web/packages/gaston/index.html>
- hierfstat: <https://github.com/jgx65/hierfstat>

Schedule

TUESDAY		THURSDAY	
Date	Topic	Date	Topic
		Oct 1	1. Allelic Association Hardy-Weinberg Equilibrium
Oct 6	1. Allelic Association Linkage Disequilibrium	Oct 8	1. Allelic Association Paper Presentations
Oct 13	1. Allelic Association Analysis Presentations	Oct 15	2. Population Structure and Relatedness Population Structure
Oct 20	2. Population Structure and Relatedness Inbreeding and Kinship	Oct 22	2. Population Structure and Relatedness Paper Presentations
Oct 27	2. Population Structure and Relatedness Analysis Presentations	Oct 29	3. Quantitative Genetics Partitioning of Variance
Nov 3	3. Quantitative Genetics General Linear Model	Nov 5	3. Quantitative Genetics Paper Presentations
Nov 10	3. Quantitative Genetics Analysis Presentations	Nov 12	4. Heritability and Inbreeding Depression Heritability
Nov 17	4. Heritability and Inbreeding Depression Inbreeding Depression	Nov 19	4. Heritability and Inbreeding Depression Paper Presentations
Nov 24	4. Heritability and Inbreeding Depression Analysis Presentations	Nov 26	Thanksgiving Break
Dec 1	5. Association Mapping Case-control Designs	Dec 3	5. Association Mapping Affected Relative Tests
Dec 8	5. Association Mapping Paper Presentations	Dec 10	5. Association Mapping Analysis Presentations
Dec 15	Exam Week	Dec 17	Final Report Due

Land Acknowledgment

The University of Washington acknowledges the Coast Salish people of this land, the land which touches the shared waters of all tribes and bands within the Duwamish, Suquamish, Tulalip and Muckleshoot nations.

Diversity Statement

Diverse backgrounds, embodiments and experiences are essential to the critical thinking endeavor at the heart of University education. In SPH, students are expected:

1. To respect individual differences, which may include, but are not limited to, age, cultural background, disability, ethnicity, family status, gender, immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status and veteran status.
2. To engage respectfully in the discussion of diverse worldviews and ideologies embedded in course

readings, presentations and artifacts, including those course materials that are at odds with personal beliefs and values.

3. To encourage students with concerns about classroom climate to talk to their instructor, adviser, a member of the departmental or SPH EDI Committee, the Assistant Dean for EDI, or the program's director.

Access and Accommodations

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but are not limited to mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Religious Accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (<https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/>). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (<https://registrar.washington.edu/students/religious-accommodations-request/>).

Bias Concerns

The Office of the Dean has a student concern policy, a faculty concern policy and standard HR procedures for staff concerns. Our 2018 climate survey states that most people in SPH do not report bias incidents because they do not know where to go. Students are encouraged to report any incidents of bias to someone they feel comfortable with, including instructors, advisers or department staff.

They can email dcinfo@uw.edu for immediate follow up. Bias concerns can be anonymously and confidentially reported at this link <https://sph.washington.edu/about/diversity/bias-concerns>. Data is collected by the Assistant Dean for EDI and the Director of Program Operations for Student and Academic Services and tracked for resolution and areas are identified for further training.