

Richard Border
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Research statement

I study problems at the intersections of human genetics, statistical inference, quantitative psychology, and numerical mathematics. My primary research foci include:

1. Efficient algorithms for the analysis and simulation of genome-wide data.
2. Performance of genomic variance component estimators in structured populations.
3. Metascience, falsifiability, and the identification of spurious findings.

Education

- 2019 Doctor of Philosophy
 Behavioral, Psychiatric, and Statistical Genetics
 Advised by Matthew C. Keller
 Department of Psychology and Neuroscience, University of Colorado Boulder
- 2018 Master of Science
 Applied Mathematics
 Advised by Stephen Becker
 Department of Applied Mathematics, University of Colorado Boulder
- Master of Arts
 Behavioral, Psychiatric, and Statistical Genetics
 Advised by Soo Hyun Rhee
 Department of Psychology and Neuroscience, University of Colorado Boulder
- 2011 Bachelor of Arts
 Japanese Language and Literature
 Advised by Terry Kawashima
 Department of East Asian Studies, Wesleyan University

Peer-reviewed publications

- 2019 **Border, R.** and Becker, S.. Stochastic Lanczos estimation of genomic variance components for linear mixed-effects models. *BMC Bioinformatics*. doi.org/10.1186/s12859-019-2978-z
- Border, R.**, Johnson, E.C., Evans, L.M., Berley, N., Sullivan, P.F., Keller, M.C.. No support for historic candidate gene or candidate gene-by-interaction hypotheses for major depression across multiple large samples. *American Journal of Psychiatry*. doi.org/10.1176/appi.ajp.2018.18070881
- Border, R.**, Johnson, E.C., Evans, L.M., Keller, M.C.. Measurement error cannot account for failed replications of historic candidate gene-by-environment hypotheses: response to Vrshek-Schallhorn et al.. *American Journal of Psychiatry*. doi.org/10.1176/appi.ajp.2019.19040374r

- Border, R.**, Smolen, A., Corley, R., Stallings, M., Brown, S., Conger, R., Derringer, J., Donnellan, B., Haberstick, B., Hewitt, J., Hopfer, C., Krauter, K., McQueen, M., Wall, T., Keller, M., Evans, L.. Imputation of behavioral candidate gene repeat polymorphisms in 486,551 publicly-available UK Biobank individuals. *European Journal of Human Genetics*. doi.org/10.1038/s41431-019-0349-x
- 2018 **Border, R.**, Corley, R.C., Brown, S.A., Hewitt, J.K., Hopfer, C.J., Williams, S.K., Rhea, S., Shriver, C.L., Stallings, M.C., Wall, T.L., Woodward, K.E., Rhee, S.H.. “Independent predictors of mortality in adolescents ascertained for conduct disorder and substance use problems, their siblings, and community controls.” *Addiction*. doi.org/10.1111/add.14366
- Border, R.**, Corley, R.C., Brown, S.A., Hewitt, J.K., Hopfer, C.J., Stallings, M.C., Wall, T.L., Young, S.E., Rhee, S.H.. “Predictors of adult outcomes in clinically- and legally-referred youth with antisocial behavior.” *PLOS ONE*. doi.org/10.1371/journal.pone.0206442
- 2017 Johnson, E.C., **Border, R.**, Melroy-Greif, W.E., de Leeuw, C., Ehringer, M.A., Keller, M.C.. “No evidence that schizophrenia candidate genes are more associated with schizophrenia than non-candidate genes.” *Biological Psychiatry*. doi.org/10.1016/j.biopsych.2017.06.033
- Border, R.** and Keller, M.C.. “Fundamental problems with candidate gene-by-environment interaction studies.” *Journal of Child Psychology and Psychiatry*. doi.org/10.1111/jcpp.12669

Manuscripts under review

- Ip, H.F., van der Laan, C.M., Brikell, I., ..., **Border, R.**, ..., Bartels, M., Nivard, M.G., Boomsma, D.. “Genetic association study of childhood aggression across raters, instruments and age.”

Dissertation and master’s thesis

- **Border, R.**. "Topics in the quantitative analysis of complex trait genetic architectures". Psychology and Neuroscience Graduate Theses & Dissertations. *In press*.
- **Border, R.**. "Stochastic Lanczos likelihood estimation of genomic variance components". Applied Mathematics Graduate Theses & Dissertations. 120. scholar.colorado.edu/appm_gradetds/120

Presentations

- 2019 **Border, R.**, Becker, S.. (Poster). “Randomized algorithms for genomic variance components estimation in mixed models”. Presented at the 2019 *International Workshop on Statistical Genetic Methods for Human Complex Traits*, Boulder, CO.
- 2018 **Border, R.**, Johnson, E.C., Evans, L.M., Berley, N., Sullivan, P.F., Keller, M.C. (Paper presentation). “Quantitative reconciliation of GWAS and candidate gene findings: measurement error, nonlinearity, and artifactual results”. *Accepted* for the 48th meeting of the Behavior Genetics Association in Boston, MA. (Talk delivered by M.C. Keller due to illness)
- Border, R.**, Johnson, E.C., Berley, N., Medland, S.E., Sullivan, P.F., Keller, M.C. (Poster). “Examining the relevance of canonical candidate genes for major depression”. *Accepted* for the 48th meeting of the Behavior Genetics Association in Boston, MA.

- Evans, L.M., **Border, R.**, du Pont, A., Friedman, N.P., Johnson, E., Yang, J., Visscher, P., Keller, M.C. (Symposium talk). “Exploring the genetic architecture of psychiatric disorders using partitioned heritability approaches”. Presented by Luke Evans at the *World Congress of Psychiatric Genetics*, October 2018, Glasgow, Scotland.
- 2017 **Border, R.**, Johnson, E.C., Berley, N., Sullivan, P.F., Keller, M.C. (Poster). “Discrepancies between candidate gene and genome-wide studies of complex traits and endophenotypes.” Presented at the 25th annual meeting of the World Congress of Psychiatric Genetics, Orlando, Florida, October 13-17, 2017
- Park, A. L., Tsai, K. H., Guan, K., **Border, R.**, and Chorpita, B. F. (Talk). “Unintended consequences of evidence-based treatment policy reform.” In *Use of Evidence in Mental Health Treatment and Clinical Decision-Making*. Symposium held at the 4th Biennial Society for Implementation Research Collaboration Conference, Seattle, WA.
- 2016 Johnson, E.C., Melroy-Greif, W.E., **Border, R.**, Keller, M.C., Ehringer, M.A. (Poster). “Examining 25 classic schizophrenia candidate genes in the context of GWAS data: evidence for relevance?”. Presented at the 2016 meeting of the American Society of Human Genetics in Vancouver, British Columbia.
- 2015 **Border, R.**, Sawaya, S., Huggett, S., Brown, S.A., Wall, T.L., and Stallings, M.C. (Poster). “Sensitivity of random forests algorithm to population stratification in GWAS data”. Presented at the 45th annual meeting of the Behavior Genetics Association in San Diego, CA.

Honors and awards

- 2016–2019 National Institute of Mental Health Trainee *T32 MH016880*
Selected by faculty training committee thrice consecutively (maximum number of times awarded to any graduate student), Institute for Behavioral Genetics, University of Colorado Boulder
- 2018 Behavior Genetics Association Travel Award
Behavior Genetics Association
- Departmental Travel Grant
Department of Psychology and Neuroscience, University of Colorado Boulder
- 2017 United Government of Graduate Students Individual Travel Award
University of Colorado Boulder Graduate School
- 2015–2019 Predoctoral Fellowship
Institute for Behavioral Genetics, University of Colorado Boulder

Peer review

I have refereed for the following journals:

- *Alcoholism: Clinical and Experimental Research*
- *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*
- *American Journal of Psychiatry*
- *BMC Psychiatry*
- *Genes, Brain and Behavior*

- *Journal of Psychiatric Research*
- *Molecular Psychiatry*
- *Psychological Bulletin*
- *Psychoneuroendocrinology*

Teaching positions

- 2019 Statistical Methods and Applications II (Combined Undergraduate and Graduate Sections)
Course Assistant, Department of Applied Mathematics.
- 2018 Mathematical Statistics (Combined Undergraduate and Graduate Sections)
Course Assistant, Department of Applied Mathematics.
- Statistical Methods (Combined Undergraduate and Graduate Sections)
Course Assistant, Department of Applied Mathematics.
- 2016 Statistical Programming with R (Graduate)
Teaching Assistant, Department of Psychology and Neuroscience.
- Statistics II (Graduate)
Teaching Assistant, Department of Psychology and Neuroscience.
- 2015 Introduction to Statistics (Undergraduate)
Teaching Assistant, Department of Psychology and Neuroscience.
- Statistical Programming with R (Graduate)
Teaching Assistant, Department of Psychology and Neuroscience.

Guest lectures

- Mapping genes for complex traits. *Physiological Genetics and Genomics, Department of Integrative Physiology.*
- Randomized algorithms for genomic variance components analyses. *Randomized Algorithms, Department of Applied Mathematics.*
- Statistical power. *Introduction to Statistics, Department of Psychology and Neuroscience.*
- Functional programming concepts in R. *Statistical Programming with R, Department of Psychology and Neuroscience.*
- Methods for reproducible research in R. *Statistical Programming with R. Department of Psychology and Neuroscience.*