

Ruth Heller

Department of Statistics and Operations Research
School of Mathematical Sciences
Tel Aviv University

CURRICULUM VITAE

March 2022

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EDUCATION

1992-1996	B. Sc.	Mathematics McGill University Date of award: 1996
1996-1998	M. Sc.	Biostatistics University of Washington Date of award: 1998
2002-2007	Ph. D.	Statistics Tel-Aviv University Date of award: 2008 Title of Doctoral Dissertation: Statistical issues related to fMRI experiments Name of Supervisor: Professor Yoav Benjamini

ACADEMIC AND PROFESSIONAL EXPERIENCE

1997-1998	Research Assistant of Professor Peter Guttorp and Professor Paul Sampson, National Research Center for Statistics and the Environment, University of Washington
1998-1999	Statistical consultant with the Statistics Consulting Laboratory, Industrial engineering and management faculty, Technion
1999-2000	Research Assistant of Professor Nahum Kiryati, Electrical Engineering-Systems, Tel-Aviv University
2000-2002	Software Engineer, DSP group, Comverse
2002-2007	Teaching Assistant, Department of Statistics and Operations Research, Tel-Aviv University
2007-2009	Mark O. Winkelman Distinguished Scholar in Residence Visiting Lecturer of Statistics, Department of Statistics, University of Pennsylvania
2009-2011	Senior Lecturer, Industrial engineering and management faculty, Technion

- 2011-2015 Senior Lecturer, Department of Statistics and Operations Research, Tel-Aviv University
- 2015-2016 Senior Visiting Fellow, National Cancer Institute Division of Cancer Epidemiology & Genetics, Biostatistics Branch, MD, USA
- 2015-present Associate Professor, Department of Statistics and Operations Research, Tel-Aviv University

INVITED TALKS

- May 2007 Invited lecture at the Israeli Statistical Association Annual Meeting, "Screening for Partial Conjunction Hypotheses", Shefayim, Israel.
- July 2008 Invited lecture at the 7th World Congress in Probability and Statistics, "Testing Many Families of Hypotheses using Partial Conjunctions and the FDR", Singapore.
- July 2008 Invited lecture at the IPAM/CCB Summer School Program, "Advances in FDR for fMRI", UCLA, Los Angeles, CA.
- Aug 2010 Invited lecture at the 28th European Meeting of Statisticians, "Replicability analysis, with application to genome-wide association studies", University of Piraeus, Greece.
- Dec 2011 Invited lecture at the special meeting on Clinical Trials and Clinical Research, "False discovery rate controlling procedures for discrete tests", TAU, Israel.
- May 2012 Invited lecture at the Israeli Statistical Association Annual Meeting, "A consistent multivariate test of association based on ranks of distances", TAU, Israel.
- Apr 2013 Invited lecture at the 7th Meeting of the Eastern Mediterranean Region International Biometric Society (EMR-IBS), "Replicability analysis for genome-wide association studies", Tel-Aviv, Israel.
- July 2013 Invited lecture at the 8th International Conference on Multiple Comparison Procedures (MCP), "Replicability analysis for genome-wide association studies", Southampton, England.
- Sep 2013 Invited lecture at the International Conference on Simultaneous Inference, "Discovering findings that replicate from a primary study of high dimension to a follow-up study", Hannover, Germany.

- March 2014 Invited lecture at the ENAR Spring Meeting, "Estimating the evidence of replicability in 'omics' research", Baltimore, Maryland, USA.
- June 2014 Invited lecture at the Israeli Statistical Association Annual Meeting, "Assessing Replicability Across Studies", The Open University, Raanana, Israel.
- Aug 2014 Invited lecture at the Joint Statistical Meeting (JSM), "Assessing Replicability Across Studies: The R-Value", Boston, Massachusetts, USA.
- Nov 2014 Invited lecture at the 2nd meeting of Israeli Biostatistics Forum (IBF), "Replicability analysis for "omics" research", Tel-Hashomer, Israel.
- Jan 2015 Invited lecture at the Replicability and Reproducibility of Discoveries in Animal Phenotyping Conference, "Assessing replicability across laboratories: the r-value", Tel-Aviv University, Israel.
- May 2016 Invited lecture at the Statistical Society of Canada (SSC) annual meeting, "Assessing replicability across two high-dimensional studies", Brock University, Ontario, Canada.
- March 2017 Invited lecture at the ENAR Spring Meeting, "Inference following aggregate level hypothesis testing in large scale genomic data", Washington D.C., USA.
- April 2017 **Keynote** lecture at the 30th Panhellenic Conference in Statistics, "Multivariate tests of associations based on univariate tests", Larnaka, Cyprus.
- July 2017 Invited lecture at the CIRM conference on Mathematical Methods of Modern Statistics, "Inference following aggregate level hypothesis testing", Luminy, France.
- July 2017 Invited lecture at the Joint Statistical Meeting (JSM), "Inference following aggregate level hypothesis testing", Baltimore, USA.
- January 2018 **Keynote** lecture at the workshop "smpgd2018: Statistical Methods for Post Genomic Data", "Estimation and testing following aggregated association tests", Montpellier, France.
- February 2018 Invited lecture at the workshop "Post-selection Inference and Multiple Testing", "Inference following aggregated association tests", Toulouse, France.
- July 2019 Invited lecture at the 7th Channel Network Conference, "Post-selection inference for genetic association studies", Rothamsted, UK.

- July 2019 Invited lecture at the Joint Statistical Meeting (JSM), "Optimal control of false discovery criteria in the two-group model", Denver, USA.
- June 2020 Invited lecture at the CIRM conference on Mathematical Methods of Modern Statistics, "Optimal control of false discovery criteria in the two-group model ", Luminy, France (virtual)

CONTRIBUTED TALKS

- Aug 2006 Contributed lecture at the Joint Meetings of the American Statistical Association, "False Discovery Rates for Spatial Signals", Seattle, Washington, USA.
- July 2016 Contributed lecture at the International Biometric Conference (IBC), "Consistent distribution-free K-sample and independence tests for univariate random variables", Victoria, BC, Canada.
- December 2016 Poster presentation at the Neural Information Processing Systems (NIPS) Conference, "Multivariate tests of independence based on univariate tests", Barcelona, Spain.
- December 2018 Contributed lecture at the EMR conference, "Optimal procedures for multiple testing problems", Jerusalem, Israel.

INVITED VIRTUAL SEMINARS

- September 2020 Invited lecture at the International Seminar on Selective Inference (ISSI), "Inference following aggregate level hypothesis testing".
- November 2020 Invited lecture at the University of Edinburgh Statistics Seminar, "Optimal control of false discovery criteria in the general two-group model".
- May 2021 Invited lecture at the University of Chicago Statistics Seminar, "Designing optimal multiple testing procedures".
- September 2021 Invited lecture at the workshop on current and future trends in multiple hypothesis testing, MRC Biostatistics Unit, University of Cambridge "Optimal multiple testing procedures".
- October 2021 Invited lecture at the University of Florida Statistics Seminar, "Multiple testing of partial conjunction null hypotheses with conditional p-values based on combination test statistics".
- February 2022 Invited lecture at the University of Bristol Statistics Seminar, "Optimal multiple testing and design in clinical trials".

SHORT COURSES

Apr 2013 Pre-conference course at the 7th Meeting of the Eastern Mediterranean Region International Biometric Society (EMR-IBS).
Course Title: ``Using FDR in practice: where, why and how"
Authors: Yoav Benjamini, Ruth Heller, and Daniel Yekutieli
Location: Tel-Aviv, Israel.

PARTICIPATION IN CONFERENCE ORGANIZATION

July 2016 Organizer of an Invited Session in the International Biometric Conference (IBC), ``Statistical assessment of the replicability of scientific results", Victoria, BC, Canada.

December 2018 Member of the organizing committee for Yoav Benjamini's 70th Birthday celebration at the EMR conference, Jerusalem, Israel.

December 2019 Member of the organizing committee of the 11th ICSA International conference. Organizer of two invited sessions, titled ``False discovery rate methodology" and ``Multiple comparisons theory and applications".

June 2019 Organizer of the scientific program for the annual meeting of the Israel Statistical Association – CANCELLED DUE TO COVID19.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Council member of the Israel Statistical Association 2013-2015

EDITORIAL POSITIONS AND REFEREEING

Associate Editor, Annals of Statistics, 2016 - 2021.

Referee for Annals of Applied Statistics; Annals of Statistics; Biometrika; Biostatistics; Briefings in Bioinformatics; Journal of the American Statistical Association; Journal of machine learning research; Journal of multivariate analysis; Journal of the Royal Statistical Society Series B; Journal of Statistical Planning and Inference; Neuroimage; Technometrics; Statistical Science

LIST OF PUBLICATIONS

REFEREED PUBLISHED RESEARCH PAPERS

1. R. Grossmann (my maiden name), N. Kiryati, R. Kimmel
Computational surface flattening: a voxel-based approach.
IEEE Transactions on Pattern Analysis and Machine Intelligence
(PAMI) 24 (2002), 433-441.
2. F. Abramovich, R. Heller
Local functional hypothesis testing.
Mathematical Methods of Statistics 14 (2005), 253-266.
3. R. Heller, D. Stanley, D. Yekutieli, N. Rubin, Y. Benjamini
Cluster-based analysis of fMRI data.
NeuroImage 33 (2006), 599-608.
4. Y. Golland, B. Shlomo, H. Gelbard, Y. Benjamini, R. Heller, Y. Nir,
U. Hasson, R. Malach
Extrinsic and intrinsic systems in the posterior cortex of the human
brain.
Cerebral Cortex 17 (2007), 766-777.
5. R. Heller, Y. Golland, R. Malach, Y. Benjamini
Conjunction group analysis: an alternative to mixed/random effect
analysis
NeuroImage 37 (2007), 1178-1185.
6. Y. Benjamini, R. Heller
False discovery rates for spatial signals
Journal of the American Statistical Association 102 (2007), 1272-1281.
7. Y. Benjamini, R. Heller
Screening for partial conjunction hypotheses
Biometrics 64 (2008), 1215-1222.
8. R. Heller, E. Manduchi, D. Small
Matching methods for observational microarray studies
Bioinformatics 25 (2009), 904-909.
9. R. Heller, E. Manduchi, G. Grant, W. Ewens
A flexible two-stage procedure for identifying gene sets that are
differentially expressed
Bioinformatics 25 (2009), 1019-1025.
10. R. Heller, P. Rosenbaum, D. Small
Split samples and design sensitivity in observational studies
Journal of the American Statistical Association 104 (2009), 1090-1101.
11. Y. Benjamini, R. Heller, D. Yekutieli

- Selective inference in complex research
Philosophical Transactions of the Royal Society 367 (2009), 4255-71.
12. R. Heller, S. Jensen, P. Rosenbaum, D. Small
Sensitivity analysis for the cross-match test with applications in genomics
Journal of the American Statistical Association 105 (2010), 1005-1013.
 13. R. Heller, P. Rosenbaum, D. Small
Using the cross-match test to appraise covariate balance in matched pairs
The American Statistician 64 (2010), 299-309.
 14. R. Heller, M. Gorfine, Y. Heller
A class of multivariate distribution-free tests of independence based on graphs
Journal of Statistical Planning and Inference 142 (2012), 3097–3106.
 15. R. Heller, Y. Heller, M. Gorfine
A consistent multivariate test of association based on ranks of distances
Biometrika 100 (2013), 503-510.
 16. M. Bogomolov, R. Heller
Discovering findings that replicate from a primary study of high dimension to a follow-up study
Journal of the American Statistical Association 108 (2013), 1480-1492.
 17. R. Heller, D. Yekutieli
Replicability analysis for genome-wide association studies
Annals of Applied Statistics 8 (2014), 481-498.
 18. R. Heller, S. Yaacoby, D. Yekutieli
repfdr: A tool for replicability analysis for genome-wide association studies
Bioinformatics 30 (2014), 2971-2972.
 19. R. Heller, M. Bogomolov, Y. Benjamini
Deciding whether follow-up studies have replicated findings in a preliminary large-scale omics study
Proceedings of the National Academy of Sciences of the United States of America (PNAS) 111 (2014), 16262-16267.
 20. M. Gorfine, B. Goldstein, A. Fishman, R. Heller, Y. Heller, A. Lamm
Function of cancer associated genes revealed by modern univariate and multivariate association tests
PLOS ONE 10 /5 (2015), doi: 10.1371/journal.pone.0126544.
 21. C. Angelini, R. Heller, R. Volkinshtein, D. Yekutieli
Is this the right normalization? A diagnostic tool for ChIP seq normalization.

- BMC Bioinformatics 16/150 (2015), doi:10.1186/s12859-015-0579-z.
22. R. Heller, Y. Heller, S. Kaufman, B. Brill, M. Gorfine
Consistent distribution-free K-sample and independence tests for univariate random variables.
Journal of Machine Learning Research, 17 (2016), 1-54.
 23. R. Heller and Y. Heller
Multivariate tests of association based on univariate tests.
Neural Information Processing Systems (NIPS) Proceedings (2016).
 24. N. Karp, R. Heller, S. Yaacoby, J. White, and Y. Benjamini.
Improving the identification of phenotypic abnormalities and sexual dimorphism in mice when studying rare event categorical characteristics.
Genetics (2016), DOI: 10.1534/genetics.116.195388
 25. T. Sofer, R. Heller, M. Bogomolov, C. Avery, M. Graff, K. North, A. Reiner, T. Thornton, K. Rice, Y. Benjamini, C. Lauriee, and K. Kerr.
A Powerful statistical framework for generalization testing in GWAS, with application to the HCHS/SOL.
Genetic Epidemiology (2017), DOI: 10.1002/gepi.22029.
 26. R. Eilenberg and R. Heller
On the use of balancing scores and matching in testing for exposure effect in case-control studies.
Statistics and Its Interface, Vol. 11, No. 1, pp.51-60, 2017.
 27. L. Jiang, A. Amir, J. Morton, R. Heller, E. Arias-Castro, R. Knight
Discrete False-Discovery Rate Improves Identification of Differentially Abundant Microbes.
mSystems (2017), <https://doi.org/10.1128/mSystems.00092-17>.
 28. N. Karp, J. Mason, A. Beaudet, Y. Benjamini, L. Bower, R. Braun, S. Brown, E. Chesler, M. Dickinson, A. Flenniken, H. Fuchs, M. Hrabe de Angelis, X. Gao, S. Guo, S. Greenaway, R. Heller, Y. Herault, M. Justice, N. Kurbatova, C. Lelliott, K. Lloyd, A. Mallon, J. Mank, H. Masuya, C. McKerlie, T. Meehan, R. Mott, S. Murray, H. Parkinson, R. Ramirez-Solis, L. Santos, J. Seavitt, D. Smedley, T. Sorg, A. Speak, K. Steel, K. Svenson, S. Wakana, D. West, S. Wells, H. Westerberg, S. Yaacoby, and J. White
Prevalence of sexual dimorphism in mammalian phenotypic traits.
Nature Communications 8 (2017), article number 15475.
 29. Sun L., Subar A.F., Bosire C., Dawsey S.M., Kahle L.L., Zimmerman T.P., Abnet C.C., Heller R., Graubard B.I., Cook M.B., and Petrick J.L.
[Dietary Flavonoid Intake Reduces the Risk of Head and Neck but Not Esophageal or Gastric Cancer in US Men and Women.](#)(2017)
J Nutr, pii: jn251579. doi: 10.3945/jn.117.251579.

30. R. Heller, N. Chatterjee, A. Krieger, and J. Shi
Post-selection inference following aggregate level hypothesis testing in large scale genomic data.
Journal of the American Statistical Association 113 (524), 2018.
31. J. Sampson, S. Boca, S. Moore, and R. Heller
FWER and FDR control when testing multiple mediators.
Bioinformatics 34 (14), 2018.
32. M. Bogomolov and R. Heller
Assessing replicability of findings across two studies of multiple features.
Biometrika 105 (3), 2018.
33. B. Brill, Y. Heller, and R. Heller
Nonparametric independence tests and K-sample tests for large sample sizes, using package HHG.
R Journal, 2018.
34. B. Karmakar, R. Heller, and D. Small
False discovery rate control for effect modification in observational studies.
Electronic Journal of Statistics 12 (2), 2018.
35. Kafkafi, N; Agassi, J; Chesler, EJ; Crabbe, JC; Crusio, WE; Eilam, D; Gerlai, R; Goiani, I; Gomez-Marin, A; Heller, R; Iraqi, F; Jaljuli, I; Karp, NA; Morgan, H; Nicholson, G; Pfaff, DW; Richter, SH; Stark, PB; Stiedl, O; Stodden, V; Tarantino, LM; Tucci, V; Valdar, W; Williams, RW; Wurbel, H; Benjamini, Y
Reproducibility and replicability of rodent phenotyping in preclinical studies
Neuroscience and behavioral reviews 87, 2018.
36. R. Heller, A. Meir, and N. Chatterjee
Post-selection estimation and testing following aggregated association tests.
Journal of the Royal Statistical Society, Series B, 81 (3), 2019.
37. R. Heller and S. Rosset
Optimal control of false discovery criteria in the two-group model.
Journal of the Royal Statistical Society, Series B, 83 (1), 2021.
38. A. Heifetz, R. Heller, and R. Ostreier
Do Arabian babblers play mixed strategies in a "volunteer's dilemma"?
Journal of Behavioral and Experimental Economics, 91, 2021.
39. S. Rosset, R. Heller, A. Painsky, and E. Aharoni
Optimal and maximin procedures for multiple testing problems

Journal of the Royal Statistical Society, Series B, accepted, 2022.

40. M. Haroush, T. Frostig, R. Heller, D. Soudry
A statistical framework for efficient out of distribution detection in deep neural networks.
The tenth International Conference on Learning Representations (ICLR), accepted, 2022.
41. B. Brill, A. Amir, and R. Heller
Testing for differential abundance in compositional counts data, with application to microbiome studies.
The Annals of Applied Statistics (AOAS), accepted, 2022.
42. I. Jaljuli, Y. Benjamini, L. Shenhav, O. Panagiotou, and R. Heller
Quantifying replicability and consistency in systematic reviews.
Statistics in biopharmaceutical research, accepted, 2022.

REFEREED DISCUSSIONS

1. S. Sarkar, R. Heller
Comments on: Control of the False Discovery Rate under Dependence using the Bootstrap and Subsampling
Test 10 (2008), 450-455.
2. R. Heller
Comment: Correlated z-values and the accuracy of large-scale statistical estimates
Journal of the American Statistical Association 105 (2010), 1057–1059.
3. R. Heller
Discussion of "Multiple testing for Exploratory Research" by J.J. Goeman and A. Solari
Statistical Science 26 (2012), 598–600.
4. R. Heller
Comments on: Hierarchical inference for genome-wide association studies: a view on methodology and software
Computational Statistics 35 (1), 2020.
5. O.A. Panagiotou, I. Jaljuli, and R. Heller
Replicability of Treatment Effect in Study of Blood Pressure Lowering with Dementia.
JAMA, 2020; 324(14): 1465-1466. Doi:10.1001/jama.2020.14871
6. O.A. Panagiotou and R. Heller
Inferential Challenges for Real-world Evidence in the Era of Routinely Collected Health Data
Many Researchers, Many More Hypotheses, a Single Database

TECHNICAL REPORTS SUBMITTED OR UNDER REVIEW

1. R. Heller, A. Krieger, and S. Rosset
Optimal multiple testing and design in clinical trials
arXiv: 2104.01346
2. T. Dickhaus, R. Heller, A. Hoang
Multiple testing of partial conjunction null hypotheses with conditional
p-values based on combination test statistics
arXiv: 2110.06692

RESEARCH GRANTS AND AWARDS

- | | |
|-----------|---|
| 2009-2011 | U.S.-Israel Binational Science Foundation (BSF) grant No. 2008049 for 60000\$, Principal Investigator (PI). |
| 2010-2013 | Israel Science Foundation (ISF) grant no. 2012896 for 327000NIS, Principal Investigator (PI). |
| 2010-2011 | The Allon Fellowship, Technion. |
| 2010-2011 | Landau Fellowship of the Taub Foundation, Technion. |
| 2014-2015 | Amazon Web Services (AWS) in Education Research Grant award for 10000\$ in AWS credits. |
| 2014-2015 | TAU Encouragement Grant for 19000NIS. |
| 2015-2016 | TAU Encouragement Grant for 9500NIS. |
| 2016-2020 | Israel Science Foundation (ISF) grant no. 1049/16 for 640000NIS, Principal Investigator (with Daniel Yekutieli). |
| 2017-2019 | TAU-University of Toronto Joint Research Projects in Big Data in Health and Biomedical Research, for 12500\$. Principal Investigator (with Shelley Bull). |
| 2020-2024 | Israel Science Foundation (ISF) grant no. 2180/20 for 992000NIS, Principal Investigator (with Saharon Rosset). |
| 2021-2025 | Malag competitive grant in data science (DS), co-PI with six others, for 4,000,000NIS. |

MASTERS STUDENTS SUPERVISED

- 2010-2012 Hadas Gur, "FDR Controlling Procedures for Discrete Data".
- 2011-2013 Meron Avidan, "Integrated two-stage procedures for multiple comparisons".
- 2011-2014 Rita Volkinshtein, "Normalization in ChIP-seq experiments".
- 2013-2015 Amos Rosenbaum, "A study of parametric and nonparametric tests for the analysis of variance in the 2-way layout".
- 2014-2015 Roni Eilenberg, "On the use of balancing scores in testing for exposure effects in case-referent studies".
- 2012-2016 Liat Shenhav, "Replicability and meta-analysis in systematic reviews for medical research".
- 2014-2016 Barak Brill, "Scalable non-parametric tests of independence".
- 2012-2017 Shay Yaacoby, "Statistical Tools for Replicable and Reproducible Research".
- 2016-2018 Nadav Greifman, "Rare variant testing".
- 2019- 2022 Alice Fridberg, "Assessing the causal effect of a treatment in a design with multiple controls".
- 2019 - 2022 Ron Itzikovich, "Distribution free multivariate tests of independence between two random vectors".
- 2021- Oded Ohana
- 2022- Elinatan Bodinger

PHD STUDENTS SUPERVISED

- 2016-2022 Barak Brill, "Statistical challenges in microbiome research and analysis of discrete compositional data".
- 2018- Tzviel Frostig, "Utilizing hierarchical structure of covariates in medical and genomic data".
- 2022- Rajesh Karmakar