CAVIN KEITH WARD-CAVINESS

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EDUCATION

Duke University Durham, NC 2009 – 2014
PhD, Computational Biology and Bioinformatics
Dissertation title: Gene-Environment Interactions in Cardiovascular Disease

Tulane University New Orleans, LA
BS, Biological Chemistry and Mathematics 2005 – 2009

RESEARCH EXPERIENCE

Clinical Research Branch, US EPA Chapel Hill, NC Jan, 2017 – present
Principal Investigator (Computational Biology)

- Project Lead for PEP 4 – Translate Research into Actions that Protect Public Health and Wellbeing
- Task lead for PEP 4.2 – Integrating environmental public health principles into the health care system to increase environmental health literacy and promote health and wellbeing
- The overarching goals of my group are: 1) Evaluation of the impacts of air pollutants on the epigenome and metabolome; 2) Identification of individuals with increased sensitivity to air pollutants (due to underlying disease or genetic factors) and the potentially modifiable factors (e.g. socioeconomic factors and 'omics-based biomarkers) associated with sensitivity to air pollution; 3) Causal evaluation of biomarkers for complex diseases; and 4) Integration of genomic, epigenomic, and metabolomic data to understand the mechanisms of wellness and disease and factors that link environmental exposures and health outcomes

Helmholtz Institute Munich, Germany
Postdoctoral Researcher, Institute of Epidemiology II June, 2014 – Dec, 2016

- Integrated genomic, epigenomic, metabolomic, and transcriptomic data to understand the mechanisms underlying myocardial infarction and aging. Advisor: Dr. Annette Peters
- Studied the molecular mechanisms of accelerated aging as well as the clinical and environmental factors associated with accelerated aging
- Associated epigenomic and metabolomics biomarkers and signatures with short and long-term exposure to air pollution
- Performed Mendelian randomization analyses to evaluate the causality of biomarkers for myocardial infarction and coronary heart disease

Duke University Durham, NC
Computational Biology and Bioinformatics Program Aug, 2009 – May, 2014

- Dissertation explored interactions between genetic variants and environmental exposures at a genome wide-scale to better understand the pathogenic links between air pollution and cardiovascular disease. Integrated gene-environment interaction associations with metabolomics and gene expression studies to better contextualize associations within a more systems biology framework. Advisor: Dr. Elizabeth Hauser
- Designed and performed data analyses to examine the interaction between coronary artery disease, chronic kidney disease, and genetic variation using exome sequencing and array-based data from a clinical trial. Mentors: Drs. Elizabeth Hauser & Michelle Winn

GRANTS & AWARDS

Duke University Durham, NC

- Department of Energy, Office of Research and Development - Research Participation Fellowship, 2012 – 2014
- Key researcher on 3-year Health Effects Institute grant to study gene-environment interactions, 2013
- Duke University Graduate School Travel Award; 2011, 2012, 2013
- American Heart Association Functional Genetics and Translational Biology Travel Award, 2012
- International Society of Environmental Epidemiology Travel Award, 2012
- Chancellor's Scholarship, 2009
- Deans Graduate Fellowship, 2009

Tulane University New Orleans, LA

- Distinguished Scholar Award, 2005

PUBLICATIONS

Accepted (in reverse chronological order)

Laura A McGuinn, Alexandra Schneider, …, **Cavin Ward-Caviness,** …, David Diaz-Sanchez, Robert B Devlin (2019). Association of long-term PM2.5 exposure with traditional and novel lipid measures related to cardiovascular disease risk. *Environment International* 122:193-200. doi: 10.1016/j.envint.2018.11.001

Cavin K. Ward-Caviness, Golareh Agha, Brian H Chen, …, Melanie Waldenberger, Annette Peters (2018). Analysis of repeated leukocyte DNA methylation assessments reveals persistent epigenetic alterations after an incident myocardial infarction. *Clinical Epigenetics* 10(1):161 doi: 10.1186/s13148-018-0588-7.

Maria Sabater-Lleal, Jennifer E Huffman, …, **Cavin K Ward-Caviness**, …, Charles J. Lowenstein, Nicholas L. Smith (2018). Genome-wide association trans-ethnic meta-analyses identifies novel associations regulating coagulation Factor VII and von Willebrand Factor plasma levels. *Circulation*

DNA methylation age is associated with an altered hemostatic profile in a multiethnic meta-analysis (2018). **Cavin K Ward-Caviness**, Jennifer E Huffman, Karl Everett, …, Nicholas L Smith, Annette Peters. *Blood* 132(17):1842-1850. doi: 10.1182/blood-2018-02-831347

Laura A. McGuinn, **Cavin Ward-Caviness**, …, David Diaz-Sanchez, Robert B. Devlin (2017). Fine particulate matter and cardiovascular disease: Comparison of assessment methods for long-term exposure. *Environmental Research* 159: 16-23

Matt Buranosky, Elmar Stellenberger, Emily Pfaff, David Diaz-Sanchez, **Cavin Ward-Caviness** (2018). FDTool: a Python application to mine for functional dependencies and candidate keys in tabular data [version 1; referees: 1 approved]. *F1000Research* **7**:1667 (https://doi.org/10.12688/f1000research.16483.1)

Rene Luijk, Haoyu Wu, **Cavin K Ward-Caviness**, …, Erik W. van Zwet, Bastiaan T Heijmans (2018). Autosomal genetic variation is associated with DNA methylation in regions variably escaping X-chromosome inactivation. *Nature Communications* **9**, Article number: 3738

Radhika Dhingra, Jamaji C Nwanaji-Enwerem, Madeline Samet, **Cavin K Ward-Caviness** (2018). DNA Methylation Age – Environmental Influences, Health Impacts, and Its Role in Environmental Epidemiology. *Current environmental health reports* 5(3):317-327

WanYun Cheng, Kelly E Duncan, Andrew J Ghio, **Cavin Ward-Caviness**, …, Rory B Conolly, Robert B Devlin (2018). Changes in Metabolites Present in Lung-Lining Fluid Following Exposure of Humans to Ozone. *Toxicological Sciences* 163(2):430-439

Ana Julia de F.C. Lichtenfels, Diana A. van der Plaat, Kim de Jong, ..., **Cavin K Ward-Caviness**, Marike Boezen, Judith M. Vonk (2018). Long-term Air Pollution Exposure, Genomie-wide DNA methylation and Lung Function in the LifeLines Cohort Study. *Environmental Health Perspectives* https://doi.org/10.1289/EHP2045

Cavin K Ward-Caviness, William E Kraus, Colette Blach, …, Lucas M Neas, Elizabeth R Hauser (2018). Associations between residential proximity to traffic and vascular disease in a cardiac catheterization cohort. *ATVB* 38(1):275-282

Rory Wilson, Simone Wahl, Liliane Pfeiffer, **Cavin K Ward-Caviness**, …, Christian Gieger, Melanie Waldenberger (2017). The dynamics of smoking-related disturbed methylation: a two time-point study of methylation changes in smokers, non-smokers, and former smokers. *BMC Genomics* **18**:805 https://doi.org/10.1186/s12864-017-4198-0

Laura A McGuinn, **Cavin K Ward-Caviness**, …, David Diaz-Sanchez, Robert B Devlin (2017). Fine particulate matter and cardiovascular disease: Comparison of assessment methods for long-term exposure. *Environmental Research* 159:16-23

Cavin K. Ward-Caviness, Lucas M. Neas, …, William E. Kraus, Elizabeth R. Hauser (2017). A genome-wide trans-ethnic interaction study links the PIGR-FCAMR locus to coronary atherosclerosis via interactions between genetic variants and residential exposure to traffic. *PLoS One* doi:10.137/journal.pone.0173880

Cavin K. Ward-Caviness*, Tao Xu*, Thor Aspelund*, …, Rui Wang-Sattler, Annette Peters (2017). Improvement of myocardial infarction risk prediction via inflammation-associated metabolite biomarkers. *Heart* http://dx.doi.org/10.1136/heartjnl-2016-310789

Symen Ligthart, Carola Marzi, …, **Cavin K. Ward-Caviness**, …, Emelia J. Benjamin, Abbas Dehghan (2016). DNA methylation signatures of chronic low-grade inflammation are associated with complex diseases. *Genome Biology* 17(1), 255

Cavin K. Ward-Caviness, Jamaji C. Nwanaji-Enwerem, …, Alexandra Schneider, Annette Peters (2016). Long-term exposure to air pollution is associated with biological aging. *Oncotarget* 7(46): 74510-74525

Susanne Breitner, Alexandra Schneider, Robert B Devlin, **Cavin K. Ward-Caviness**, …, Svati H Shah, William E Kraus (2016). Associations between plasma metabolite levels and short-term exposure to $PM_{2.5}$ and ozone in a cohort of cardiac catheterization patients. *Environment International* 97: 76-84

Chen BH, Marioni RE, Colicino E, Peters MJ, **Ward-Caviness CK**, …, Ferrucci L, Horvath S (2016). Blood-based epigenetic measures of age that predict all-cause mortality: a meta-analysis. *Aging* 8(9):1844–1865. doi:10.18632/aging.101020

Cavin K Ward-Caviness, Suanne Breitner, …, Alexandra Schneider, Annette Peters (2016). Short-term NO_2 exposure is associated with long-chain fatty acids in prospective cohorts from Augsburg, Germany: results from an analysis of 138 metabolites and three exposures. *International Journal of Epidemiology* 45(5): 1528-1538 doi: 10.1093/ije/dyw247

Regina Hampel, Susanne Breitner, …, **Cavin K Ward-Caviness**, …, Annette Peters, Alexandra Schneider (2016). Short-term effects of air temperature on plasma metabolites in patients undergoing cardiac catheterization. *Environmental Research* 151:224–232 doi: 10.1016/j.envres.2016.07.010

Cavin K. Ward-Caviness, Lucas M. Neas, …, William E. Kraus, Elizabeth R. Hauser (2016). Genetic variants in the Bone Morphogenic Protein gene family modify the association between residential exposure to traffic and peripheral arterial disease. *PLoS One* 11(4):e0152670

Laura A. McGuinn, **Cavin K. Ward-Caviness**, …, Petros Koutrakis, Robert B. Devlin (2016). Association Between Satellite-based Estimates of Long-term $PM_{2.5}$ Exposure and Coronary Artery Disease. *Environ Res.* 145:9-17. DOI: 10.1016/j.envres.2015.10.026

Andrew J Simpkin, Gibran Hemani, …, **Cavin Ward-Caviness**, …, Caroline L Relton, George Davey Smith (2015). Prenatal and early life influences on epigenetic age in children: A study of mother-offspring pairs from two cohort studies. *Hum. Mol. Genet.* 25(1):191–201 doi: 10.1093/hmg/ddv456

Majorlein J. Peters, Roby Joehanes, … **Cavin K. Ward-Caviness** … Joyce B.J. van Meurs, Andrew D. Johnson (2015). The transcriptional landscape of age in human peripheral blood. *Nature communications*. 6:8570 doi: 10.1038/ncomms9570

Cavin Ward-Caviness, William E. Kraus, …, Elizabeth R. Hauser, Lucas Neas (2015). Association of Traffic-Related Air Pollution with Fasting Plasma Glucose and Metabolic Risk Factors for Cardiovascular Disease. *Environmental Health Perspectives.* 123(10): doi:10.1289/ehp.1306980

Cavin Ward-Caviness, Carol Haynes, …, William E. Kraus, Elizabeth R. Hauser (2013). Gene-smoking interactions in multiple Rho-GTPase pathway genes in an early onset coronary artery disease cohort. *Human Genetics.* 132(12):1371-1382

Saunders KO, **Ward-Caviness C**, …, Kepler TB, Tomaras GD (2011). Secretion of MIP-1β and MIP-1α by CD8(+) T-lymphocytes correlates with HIV-1 inhibition independent of coreceptor usage**.** *Cellular Immunology.* 266(2):154-164

CONFERENCE PUBLICATIONS

Selected Oral Presentations

Cavin K Ward-Caviness, Wayne E Cascio, Robert B Devlin, Lucas M Neas, David Diaz-Sanchez (2017). Use of large electronic health record databases for environmental epidemiology studies. Accepted to International Society of Environmental Epidemiology 2017 Annual Meeting – Sydney, Australia

Cavin Ward-Caviness on behalf of the CHARGE Hemostasis Working Group (2017). Associations between hemostatic factors and epigenetic biomarkers of aging. CHARGE Meeting – New York City, New York

Cavin Ward-Caviness, Kathrin Wolf, Simone Wahl, Josef Cyrys, Christian Gieger, Annette Peters (2016). Long-term air pollution exposure is associated with molecular markers of accelerated molecular ageing. 2016. International Society of Environmental Epidemiology (ISEE) – Rome, Italy

Cavin Ward-Caviness, Alexandra Schneider, … Rui Wang-Sattler, Annette Peters (2015). Short-term air pollution exposure is associated with metabolite levels in two cohorts from Augsburg, Germany. In: Abstracts of the 2015 Conference of the International Society of Environmental Epidemiology (ISEE). Abstract 2289. Research Triangle Park, NC: *Environmental Health Perspectives*; http://dx.doi.org/10.1289/ehp.isee2015

Cavin Ward-Caviness, Lucas Neas, …, Marie Lynn Miranda, Elizabeth R. Hauser (2012). Genetic Variants in the Bone Morphogenic Protein (BMP) Family of Genes Interact with Mobile Source Air Pollution to Increase Risk of Peripheral Arterial Disease. American Heart Association 2012 Scientific Sessions – Los Angeles, CA.

Cavin Ward-Caviness (2011). Analysis of Smoking and Air Pollution Dependent Gene-Environment Interactions. International Congress of Industrial and Applied Mathematics – Vancouver, Canada

Selected Poster Presentations

Cavin K Ward-Caviness, Anne M Weaver, Emily Pfaff, …, Wayne Cascio, David Diaz-Sanchez (2018). Annual Average PM2.5 Exposure is Associated with Mortality in a Heart Failure Cohort: Results from the EPA CARES Study. International Society for Environmental Epidemiology Annual Meeting – Ottawa, Canada

Cavin K Ward-Caviness, Wayne Cascio, Robert Devlin, Lucas Neas, David Diaz-Sanchez (2017). Use of large electronic health record databases for environmental epidemiology studies. International Society for Environmental Epidemiology Annual Meeting – Sydney, Australia

Cavin Ward-Caviness, Lilianne Pfeiffer, …, Melanie Waldenberger, Annette Peters (2016). A multi-omic approach to understanding associations from an epigenome-wide association study for MI in the KORA cohorts. Munich Heart Alliance Summer Meeting – Starnberg, Germany

ACADEMIA & TEACHING

- Adjunct Faculty: Duke University Department of Biostatistics and Bioinformatics
- Adjunct Faculty: University of North Carolina Curriculum in Toxicology
- Mentor: Duke Science & Society, Science Policy Summer Institute (2018)
- Lecturer for Columbia University Epigenetics Boot Camp (June, 2017)
- Lecturer on Cardiovascular Disease Epidemiology at the Helmholtz Zentrum München (2015, 2016)
- Guest Lecturer for Bio 89S "Pathways to Biomedical Research" at Duke University (2012 & 2013)
- Teaching Assistant for Duke University Beaufort Ethics Retreat (2011 & 2012)

LEADERSHIP

Project Leader, Clinical Research Brach, Environmental Public Health Division, US EPA
Project leader for Protecting Environmental Public Health and Well-Being This is a multi-year project that encompasses the development of tools for assessing health impacts of wildfires, development of resources to investigate environmental health effects in large cohorts, and dissemination of environmental health research to the public and health care providers in a way that drives increases awareness and action taking around environmental health research.

Lead role in multiple international consortia
Have brought expertise in statistics and analysis of genomic data to multiple international consortia including CHARGE, e:AtheroSysMed, and CARDIoGRAM.

Integral and founding member of ongoing partnership between the Duke Molecular Physiology Institute, EPA, and Helmholtz Institute of Munich
Led initial contact team for the ongoing and productive partnership between the Center for Human Genetics (CHG) at Duke University (now the Duke Molecular Physiology Institute), Helmholtz Institute of Munich, Germany, and the US Environmental Protection Agency (EPA).