

Supplementary Data

Loss of Function HDAC8 Mutations Cause a Phenotypic Spectrum of Cornelia de Lange Syndrome-like Features, Ocular Hypertelorism, Large Fontanelle and X-linked Inheritance.

Frank J. Kaiser¹, Morad Ansari², Diana Braunholz¹, María Concepción Gil-Rodríguez^{1,3,4}, Christophe Decroos⁵, Jonathan J. Wilde⁶, Christopher T. Fincher⁶, Maninder Kaur⁶, Masashige Bando⁷, David J. Amor^{8,9}, Paldeep S. Atwal¹⁰, Melanie Bahlo^{11,12}, Christine M. Bowman⁵, Jacquelyn J. Bradley⁶, Han G. Brunner¹³, Dinah Clark⁶, Miguel del Campo¹⁴, Nataliya Di Donato¹⁵, Peter Diakumis^{11,16}, Holly Dubbs⁶, David A. Dymant¹⁶, Juliane Eckhold¹, Sarah Ernst⁶, Jose C. Ferreira¹⁷, Lauren Francey⁶, Ulrike Gehlken¹, Encarna Guillén-Navarro¹⁹, Yolanda Gyftodimou²⁰, Bryan D. Hall²¹, Raoul Hennekam²², Louanne Hudgins¹⁰, Melanie Hullings⁶, Jennifer M. Hunter², Helger IJntema¹³, A. Micheil Innes²³, Antonie D. Kline²⁴, Zita Krumina²⁵, Hane Lee²⁶, Kathleen Leppig²⁷, Sally Ann Lynch²⁸, Mark B. Mallozzi⁶, Linda Mannini²⁹, Shane McKee³⁰, Sarju G. Mehta³¹, Ieva Micule³², Shehla Mohammed³³, Ellen Moran³⁴, Geert R. Mortier³⁵, Joe-Ann S. Moser⁵, Sarah E. Noon⁶, Naohito Nozaki³⁶, Luis Nunes³⁷, John G. Pappas³⁸, Lynette S. Penney³⁹, Antonio Pérez-Aytés⁴⁰, Michael B. Petersen⁴¹, Beatriz Puisac³, Nicole Revencu⁴², Elizabeth Roeder⁴³, Sulagna Saitta^{6,44}, Angela E. Scheuerle⁴⁵, Karen L. Schindeler⁴⁶, Victoria M. Siu⁴⁷, Zornitza Stark⁸, Samuel P. Strom²⁶, Heidi Thiese²⁷, Inga Vater⁴⁸, Patrick Willems⁴⁹, Kathleen Williamson², Louise C. Wilson⁵⁰, University of Washington Center for Mendelian Genomics⁵¹, Hakon Hakonarson^{6,52,53}, Fabiola Quintero-Rivera²⁶, Jolanta Wierzbza⁵⁴, Antonio Musio²⁹, Gabriele Gillessen-Kaesbach¹, Feliciano J. Ramos^{3,4}, Laird G. Jackson⁵⁵, Katsuhiko Shirahige^{7,56}, Juan Pié^{3,4}, David W. Christianson⁵, Ian D. Krantz^{6,53}, David R. FitzPatrick², Matthew A. Deardorff^{6,53,*}

¹Institut für Humangenetik, Universität zu Lübeck, Lübeck, 23538, Germany

²MRC Human Genetics Unit, IGMM, University of Edinburgh, Edinburgh EH4 2XU, United Kingdom

³Unit of Clinical Genetics and Functional Genomics, ⁴Departments of Pharmacology-Physiology and Pediatrics, Medical School, University of Zaragoza, E-50009 Zaragoza, Spain

⁵Department of Chemistry, University of Pennsylvania, Philadelphia, PA, 19104, USA

⁶Division of Genetics, ⁵²Center for Applied Genomics, Children's Hospital of Philadelphia, Philadelphia, PA, 19104, USA

⁷Laboratory of Genome Structure and Function, Research Center for Epigenetic Disease, Institute of Molecular and Cellular Biosciences, The University of Tokyo, Tokyo 113-0032, Japan

⁸Victorian Clinical Genetics Services, Murdoch Childrens Research Institute, Parkville, Victoria 3052, Australia Departments of Paediatrics⁹, Mathematics and Statistics¹², and Medical Biology¹⁶ University of Melbourne, Melbourne, Victoria 3010, Australia

¹⁰Division of Medical Genetics, Department of Pediatrics, Stanford University, Stanford, CA 94305-5208, USA

¹¹Bioinformatics Division, Walter and Eliza Hall Institute, Parkville, Victoria 3052, Australia

¹³Department of Human Genetics 855, Radboud University Medical Center, 6525GA Nijmegen, the Netherlands

¹⁴Department of Genetics, Hospital Vall d'Hebron, E-08015 Barcelona, Spain

¹⁵Institut für Klinische Genetik, Technische Universität Dresden, 01307 Dresden, Germany

¹⁷Genetics, Children's Hospital of Eastern Ontario, Ottawa, Ontario, K1H 8L1, Canada

¹⁸Human Genetics Lab and Obstetrics and Gynecology Department, Jacobi Medical Center, Bronx, NY 10461 USA

¹⁹Unit of Medical Genetics and Dysmorphology, Division of Pediatrics, Virgen de la Arrixaca University Hospital, E-30120 Murcia, Spain

²⁰Department of Genetics, Institute of Child Health, GR-11527 Athens, Greece

²¹Department of Pediatrics, University of Kentucky, Lexington, KY, 40536, USA

²²Department of Pediatrics, Academic Medical Center, Amsterdam 1105 AZ, The Netherlands

²³Department of Medical Genetics, Alberta Children's Hospital, Calgary, Alberta, T3B 6A8 Canada

²⁴The Harvey Institute for Human Genetics, Greater Baltimore Medical Center, Baltimore, MD 21204, USA

²⁵Medical Genetics, Children's University Hospital, Riga LV-1067, Latvia

- ²⁶Department of Pathology and Laboratory Medicine, David Geffen School of Medicine at UCLA and the UCLA Clinical Genomics Center, University of California Los Angeles, Los Angeles, CA, 90024, USA
- ²⁷Genetic Services, Group Health Cooperative, Seattle WA 98112, USA
- ²⁸National Centre for Medical Genetics, Our Lady's Children's Hospital, Dublin, Ireland
- ²⁹Istituto di Ricerca Genetica e Biomedica, C.N.R., 56124 Pisa, Italy
- ³⁰Department of Genetic Medicine, Belfast City Hospital, Belfast, Ireland
- ³¹Department of Clinical Genetics, Addenbrookes Hospital, Cambridge, Cambridge CB2 0QQ, United Kingdom
- ³²Department of Medical Genetics and Biology, Riga Stradins University, LV-1007 Riga, Latvia
- ³²Clinical Genetics Service, Guy's Hospital, London, SE1 9RT, United Kingdom
- ³⁴NYU Hospital for Joint Diseases, New York, NY 10003 USA
- ³⁵Department of Medical Genetics, Antwerp University Hospital and University of Antwerp, B-2650 Antwerp (Edegem), Belgium
- ³⁶Bio-Frontier Research Center, Tokyo Institute of Technology, Yokohama 226-8503, Japan
- ³⁷Medical Genetics Department, Dona Estefânia Hospital, CHLC and Medical Sciences Faculty of Lisbon, UNL, 1100 Lisboa, Portugal
- ³⁸Department of Pediatrics, NYU School of Medicine, New York, NY 10016, USA
- ³⁹Department of Pediatrics, Dalhousie University, Halifax, Nova Scotia, B3H 4R2 Canada
- ⁴⁰Unidad de Dismorfología y Genética Reproductiva, Grupo de Investigación en Perinatología, Instituto de Investigación Sanitaria Hospital Universitario LA FE, 46026 Valencia, Spain
- ⁴¹Aalborg Hospital, Aarhus University Hospital, 9000 Aalborg, Denmark
- ⁴²Center for Human Genetics, Cliniques Universitaires St Luc, Université Catholique de Louvain, Brussels, Belgium
- ⁴³Division of Genetics, University of Texas San Antonio, San Antonio, Texas 78229, USA
Medical Genetics Institute, Cedars-Sinai Medical Center, Los Angeles, CA 90048 USA
- ⁴⁴Division of Genetics, Departments of Pediatrics and Pathology and Laboratory Medicine, Cedars-Sinai Medical Center, Los Angeles, CA 90048, USA
- ⁴⁵Tesserae Genetics, Dallas TX 75230 USA
- ⁴⁶Maritime Medical Genetics Service, IWK Health Centre, Halifax, Nova Scotia, B3K 6R8 Canada
- ⁴⁷Division of Medical Genetics, Department of Pediatrics, Western University, London, Ontario, N6A 3K7, Canada
- ⁴⁸Institute of Human Genetics, University Hospital Schleswig-Holstein Campus Kiel/Christian-Albrechts University, Kiel, Germany
- ⁴⁹Gendia, 2020 Antwerp, Belgium
- ⁵⁰Department of Clinical Genetics, Great Ormond Street Hospital, London, WC1N 3JH United Kingdom
- ⁵¹see the full listing of authors from the University of Washington Center for Mendelian Genomics in the supplemental materials.
- ⁵³Department of Pediatrics, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, 19104, USA
- ⁵⁴Departments of Pediatrics, Hematology, Oncology, Endocrinology, and General Nursery, Medical University of Gdansk, Gdansk, Poland
- ⁵⁵Department of Obstetrics and Gynecology, Drexel University School of Medicine, Philadelphia, PA, 19102 USA
- ⁵⁶CREST, JST, K's Gobancho, 7, Gobancho, Chiyoda-ku, Tokyo, 102-0076 Japan

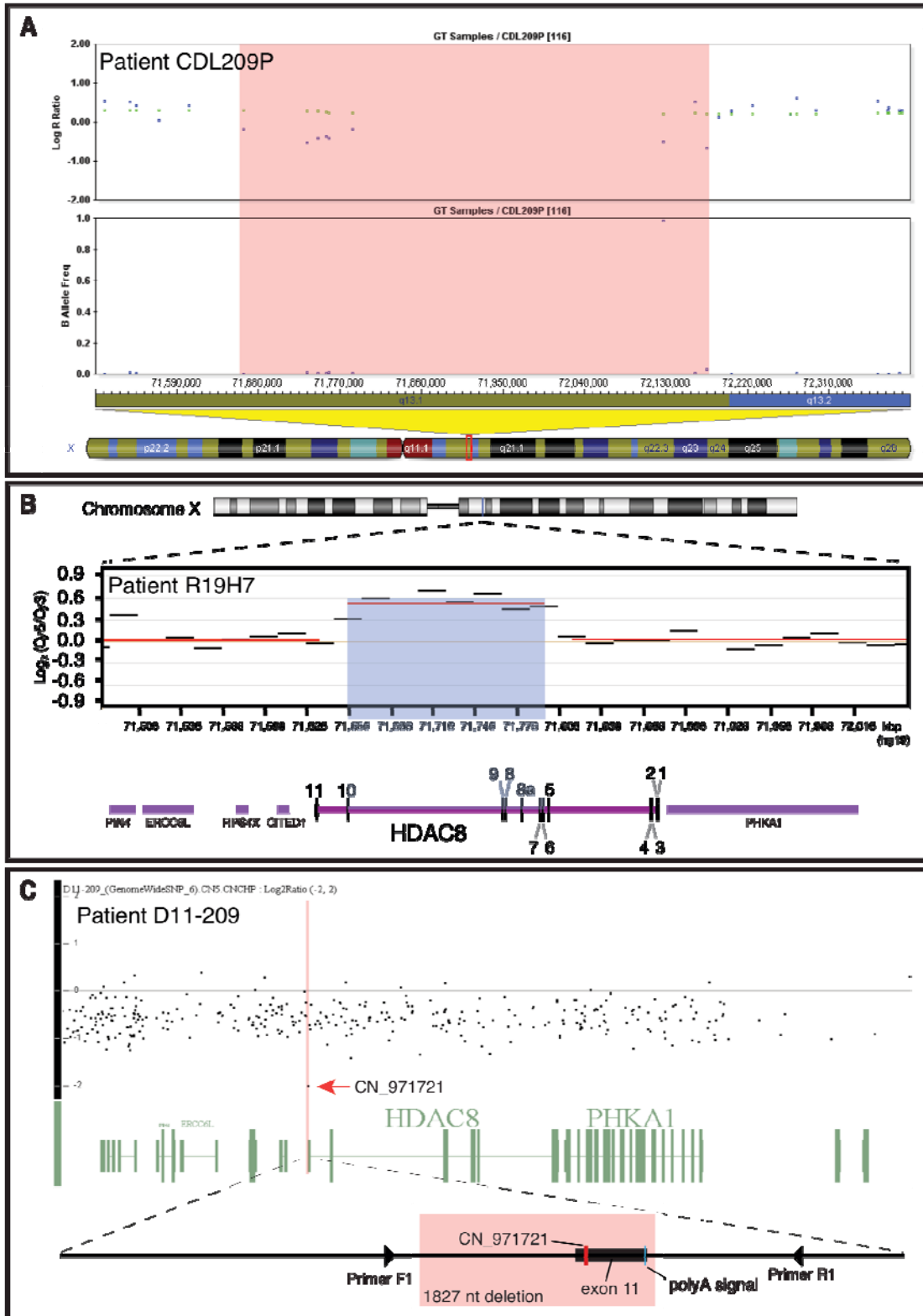


Figure S1. Chromosomal microdeletions and duplications disrupting the *HDAC8* locus. Raw data for Illumina SNP array (A), oligonucleotide array (B) and Affymetrix SNP array (C) is demonstrated. The region of chromosome or gene(s) included are shaded for the deletions (red, A,C) and duplication (blue, B).

Variant	HDAC8 activity (nmol product. $\mu\text{mol enzyme}^{-1}.\text{min}^{-1}$)	Relative activity (%)
Wild-type	1390 \pm 60	100 \pm 4
I19S	255 \pm 4	18.3 \pm 0.3
H71Y	2 \pm 1	0.1 \pm 0.1
P91L	1220 \pm 20	87.8 \pm 1.4
G117E	93 \pm 2	6.7 \pm 0.1
C153F	34 \pm 2	2.4 \pm 0.1
H180R	0 \pm 1	0 \pm 0.1
A188T	384 \pm 30	27.6 \pm 2.2
D233G	416 \pm 5	29.9 \pm 0.4
D237Y	439 \pm 6	31.6 \pm 0.4
Δ K239-Y240N	0 \pm 2	0 \pm 0.1
I243N	475 \pm 20	34.2 \pm 1.4
G304R	0 \pm 1	0 \pm 0.1
T311M	158 \pm 7	11.4 \pm 0.5
G320R	234 \pm 10	16.8 \pm 0.7
H334R	1056 \pm 40	76.0 \pm 2.9

Table S1. Specific Activities and Relative Activities of HDAC8 Missense Mutations.

University of Washington Center for Mendelian Genomics (UW CMG)

Michael J. Bamshad^{1,2}, Jay Shendure¹, and Deborah A. Nickerson¹
 Gonçalo R. Abecasis⁴, Peter Anderson¹, Marcus Annable¹, Mallory Beightol¹, Brian L. Browning¹, Kati J. Buckingham¹, Christina Chen¹, Jennifer Chin¹, Jessica X Chong¹, Gregory M. Cooper⁵, Colleen Davis¹, Lindsay Felker¹, Christopher Frazer¹, David Hanna¹, Zongxiao He³, Preti Jain⁵, Gail P. Jarvik¹, Eric Johanson¹, Goo Jun⁴, Martin Kircher¹, Tom Kolar¹, Niklas Krumm¹, Suzanne M. Leal³, Daniel Luksic¹, Margaret J. McMillin¹, Sean McGee¹, Brenton Munson¹, Brian J. O'Roak¹, Bryan Paepers¹, Karynne Patterson¹, Eric Phillips¹, Jessica Pijoan¹, Christa Poel¹, Peggy D. Robertson¹, Regie Santos-Cortez³, Tristan Shaffer¹, Cindy Shephard¹, Deborah L. Siegel¹, Joshua D. Smith¹, Jeffrey C. Staples¹, Holly K. Tabor^{1,2}, Monica Tackett¹, Gao Wang³, and Qian Yi¹

¹University of Washington

²Seattle Children's Hospital

³Baylor College of Medicine

⁴University of Michigan

⁵HudsonAlpha Institute of Technology