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Sievers Lecture in Computational Neuroscience

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ENIGMA, AI & the Human Brain: Worldwide Neuroimaging and Genetics of 30 Brain Diseases in 100,000 Individuals from 45 Countries

Since 2009, the ENIGMA Consortium has published the largest worldwide neuroimaging studies of over 15 brain diseases and conditions, including Parkinson's disease, epilepsy, ataxia and brain injury, PTSD, substance use disorder, bipolar disorder, and major depression, and neurodevelopmental conditions including OCD, ADHD and ASD. With over 2,000 participating scientists, ENIGMA has cooperatively analyzed data from 45 countries, and leads worldwide imaging genetics studies that discovered over 500 genomic loci that affect brain structure, disease risk, and brain synchrony and connectivity (Grasby et al., Science, 2020). In this lecture, we review ENIGMA's major findings to date, including maps of disease effects on brain MRI, DTI, and functional MRI, as well as factors that influence them. A decade of genomic screens of worldwide multimodal brain images has discovered over 500 common and rare genomic variants influencing brain connectivity, brain function mapped using EEG, and rates of tissue loss in development and old age. We review the major factors influencing brain development and disease worldwide, highlighting novel work in populations of diverse ancestry and using geocoding to capture environmental drivers of disease. We also highlight new directions in AI for automatic diagnosis, disease subtyping, and prognosis based on worldwide brain data, and new efforts in ENIGMA that inform neuromodulation and interventional studies.

Dr. Paul M. Thompson is a Professor of Neurology, Psychiatry, Radiology, Pediatrics, and Engineering, at the University of Southern California (USC) where he directs the Imaging Genetics Center, and is Associate Director for the Stevens Neuroimaging & Informatics Institute. Professor Thompson is also Director of the ENIGMA Center for Worldwide Medicine, Imaging & Genomics, and is Principal Investigator and Co-founder of the ENIGMA Consortium. ENIGMA has cooperatively analyzed data from over 45 countries to publish the largest worldwide neuroimaging studies of over 15 brain diseases and conditions, including Parkinson's disease, epilepsy, ataxia and brain injury, PTSD, substance use disorder, bipolar disorder, and major depression, and neurodevelopmental conditions including OCD, ADHD and ASD. In parallel, the ENIGMA Consortium has led worldwide imaging genetics studies that discovered over 500 common and rare genomic variants that affect brain structure, disease risk, and brain connectivity (Grasby et al., Science, 2020).

Presenter: Prof. THOMPSON, Paul M. (University of Southern California)