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Enabling Epigenetics Research

ADVANCEMENTS IN NEUROEPIGENETICS RESEARCH

a practical reference guide of current publications highlighting recent advancements in various areas of neuroepigenetics

Advancements in Neuroepigenetics Research

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The emerging field of Neuroepigenetics, or the study of the impact of epigenetics on neurological processes and disease, has recently come to the forefront as epigenetic regulatory mechanisms have been identified to play a significant role in neurodevelopmental, neurodegenerative and psychiatric disorders. Epigenetic modifications are heritable changes not related to DNA sequence that control gene activity and expression. These modifications include DNA methylation, histone modifications and non-coding RNAs and represent an important link between our external environment and our genome.

Active Motif provides an extensive portfolio of products for epigenetic research, including antibodies, kits, reagents and services, to help neuroscientists looking to transition into, or expand their studies of, epigenomic processes related to the Central Nervous System.

To also aid in the introduction and understanding of the field of Neuroepigenetics, this reference piece presents a selection of recently published high-impact articles focused on various aspects of Neuroepigenetics research.

GENERAL REVIEWS

Bennett, D. A. *et al.* (2014) Epigenomics of Alzheimer's disease. *Transl Res.* doi: 10.1016/j.trsl.2014.05.006.

Saab, B. J., Mansuy, I. M. (2014) Neurobiological disease etiology and inheritance: an epigenetic perspective. *J Exp Biol.* 217, 94–101.

Lipsky, R. H. (2013) Epigenetic mechanisms regulating learning and long-term memory. *Int J Dev Neurosci.* 31, 353–358.

Sweatt, J. D. (2013) The emerging field of neuroepigenetics. *Neuron.* 80, 624–632.

Jakovcevski, M., Akbarian, S. (2012) Epigenetic mechanisms in neurological disease. *Nat Med.* 18, 1194–1204.

NEURAL DEVELOPMENT

Berko, E. R. *et al.* (2014) Mosaic epigenetic dysregulation of ectodermal cells in Autism Spectrum disorder. *PLoS Genet.* 10:e1004402. doi: 10.1371/journal.pgen.

Irier, H. *et al.* (2014) Environmental enrichment modulates 5-hydroxymethylcytosine dynamics in hippocampus. *Genomics.* doi: 10.1016/j.ygeno.2014.08.019.

Kubota, T. *et al.* (2013) Role of epigenetics in Rett syndrome. *Epigenomics.* 5, 583–592.

Lilja, T. *et al.* (2013) Novel alterations in the epigenetic signature of MeCP2-targeted promoters in lymphocytes of Rett syndrome patients. *Epigenetics.* 8, 246–251.

MENTAL HEALTH

Dias, B. G., Ressler, K. J. (2014) Parental olfactory experience influences behavior and neural structure in subsequent generations. *Nat Neurosci.* 17, 89–96.

Diwadkar, V. A. *et al.* (2014) Epigenetics, stress, and their potential impact on brain network function: A focus on the schizophrenia diatheses. *Front Psychiatry.* 5, 71.

Kwapis, J. L., Wood, M. A. (2014) Epigenetic mechanisms in fear conditioning: implications for treating post-traumatic stress disorder. *Trends Neurosci.* doi: 10.1016/j.tins.2014.08.005.

Subbanna, S. *et al.* (2014) Ethanol induced acetylation of histone at G9a exon1 and G9a-mediated histone H3 dimethylation leads to neurodegeneration in neonatal mice. *Neuroscience.* 258, 422–432.

Anier, K. *et al.* (2010) DNA methylation regulates cocaine-induced behavioral sensitization in mice. *Neuropsychopharmacology.* 35, 2450–2461.

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MEMORY AND LEARNING

Jarome, T. J., Lubin, F. D. (2014) Epigenetic mechanisms of memory formation and reconsolidation. *Neurobiol Learn Mem.* doi: 10.1016/j.nlm.2014.08.002.

Stilling, R. M. *et al.* (2014) K-Lysine acetyltransferase 2a regulates a hippocampal gene expression network linked to memory formation. *EMBO J.* 33, 1912–1927.

Zovkic, I. B. *et al.* (2014) Histone H2A.Z subunit exchange controls consolidation of recent and remote memory. *Nature.* doi: 10.1038/nature13707.

Barrett, R. M. *et al.* (2011) Hippocampal focal knockout of CBP affects specific histone modifications, long-term potentiation, and long-term memory. *Neuropsychopharmacology.* 36, 1545–1556.

Lesburguères, E. *et al.* (2011) Early tagging of cortical networks is required for the formation of enduring associative memory. *Science.* 331, 924–928.

Miller, C. A. *et al.* (2010) Cortical DNA methylation maintains remote memory. *Nat Neurosci.* 13, 664–666.

Levenson, J. M. *et al.* (2004) Regulation of histone acetylation during memory formation in the hippocampus. *J Biol Chem.* 279, 40545–40559.

NEURODEGENERATIVE DISEASES

Södersten, E. *et al.* (2014) Dopamine signaling leads to loss of polycomb repression and aberrant gene activation in experimental Parkinsonism. *PLoS Genet.* 10:e1004574.

Ammal Kaidery, N. *et al.* (2013) Epigenetic landscape of Parkinson's disease: emerging role in disease mechanisms and therapeutic modalities. *Neurotherapeutics.* 10, 698–708.

Hwang, J.-Y. *et al.* (2013) Epigenetic mechanisms in stroke and epilepsy. *Neuropsychopharmacology.* 38, 167–182.

Koch, M. W. *et al.* (2013) Epigenetics and miRNAs in the diagnosis and treatment of multiple sclerosis. *Trends Mol Med.* 19, 23–30.

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Masliah, E. *et al.* (2013) Distinctive patterns of DNA methylation associated with Parkinson disease: identification of concordant epigenetic changes in brain and peripheral blood leukocytes. *Epigenetics.* 8, 1030–1038.

Wang, F. *et al.* (2013) Genome-wide loss of 5-hmC is a novel epigenetic feature of Huntington's disease. *Hum Mol Genet.* 22, 3641–3653.

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Foret, M. R. *et al.* (2014) Molecular targets of chromatin repressive mark H3K9me3 in primate progenitor cells within adult neurogenic niches. *Front Genet.* 5, 252.

Han, X. *et al.* (2014) Destabilizing LSD1 by Jade-2 promotes neurogenesis: An antibraking system in neural development. *Mol Cell.* 55, 482–494.

Burney, M. J. *et al.* (2013) An epigenetic signature of developmental potential in neural stem cells and early neurons. *Stem Cells.* 31, 1868–1880.

Hahn, M. A. *et al.* (2013) Dynamics of 5-hydroxymethylcytosine and chromatin marks in mammalian neurogenesis. *Cell Rep.* 3, 291–300.

Yu, Y. L. *et al.* (2013) Smurf2-mediated degradation of EZH2 enhances neuron differentiation and improves functional recovery after ischaemic stroke. *EMBO Mol Med.* 5, 531–547.

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