Lab website design

TABS:

Home

Research

Publications

Team

Contact

**Home**

[Within top image]

Welcome to

the Korb Lab

at the University of Pennsylvania

[With the DNA image on the right

What makes us who we are? How does the world around us interact with our underlying genetic code? Does Nature or Nurture shape us into the people we become?

We now know that it’s not just nature or nurture that’s important but both, and they converge within the realm of epigenetics. Epigenetics, in its broadest sense, explores how our environment can change the expression of our genes. By studying this complex interaction, we hope to explain how our underlying DNA code, or ‘nature’, can be influenced by ‘nurture’, or the experiences we have throughout our lives.

[To go next to Cell cover image]

Our lab works at the intersection of neuroscience and epigenetics. Epigenetics is extremely important in neuronal function and contributes to the creation of new memories, our ability to adapt to our environment, and to the development of neurological disorders. In the lab, we study how the world around us can influence gene regulation in the brain. This research may have far reaching implications, helping us to understand how we become the people we are today as well as the neurological disorders that result when these epigenetic mechanisms are lost.

This image is the journal cover from our recent work examining the important role of epigenetics in neurodevelopmental disorder called Fragile X Syndrome. It shows a brain hemisphere with the contours of the structures outlined with a representation of DNA and the histone proteins that wrap it up into complex structures and are disrupted in numerous neurological disorders.

Created by Alexey Soshnev.

**Research**

In the lab we strive to understand mechanisms of epigenetic regulation in the brain. In particular, we focus on chromatin. Chromatin is the complex of DNA and proteins called histones, which not only package our DNA into complex structures but also control access to our genes. To study histones and how they regulate neuronal function, we combine methods such as microscopy, genome-wide sequencing, bioinformatics, biochemistry, behavioral testing, and more. We have multiple areas of ongoing research in the lab.

The role of **histone modifications** in regulating how neurons respond to the environment:

Histone proteins can be modified by a huge range of posttranslational modifications including phosphorylation, methylation, ubiquitination, and more. These modifications allow histones to respond to different environmental cues and regulate gene expression accordingly. Particularly exciting are several novel modifications only recently discovered on histone proteins. For reasons we don’t yet understand, some of these histone modifications are particularly highly expressed in the brain. We are exploring their regulation and function in neurons and examining how they allow the brain to adapt to a changing environment and new experiences.

The role of different **histone variants** in learning and memory.

Histone proteins can come in different ‘flavors’. Often these variant proteins only differ by a few amino acids, yet they can play very different roles in regulating transcription. To study the role of these histone variants in the brain, we are applying the tools of chromatin biology such as biochemistry techniques and genome-wide sequencing to the field of neuroscience. We hope to understand how these subtle changes can drastically alter the ability of a neuron to activate the right genes at the right times and allow the brain to perform complex tasks such as memory storage and learning new skills.

The role of **chromatin in neurodevelopmental disorders** such as autism:

Recent studies have identified many new genes linked to autism and other neurodevelopmental disorders. Surprisingly, a large number of these genes encode proteins that are involved in epigenetic regulation. However, in most cases we don’t know how these proteins function in the brain or how their loss can lead to neurodevelopmental disorders. We use a combination of cell culture, genome-wide sequencing, bioinformatics, and behavioral testing of animal models to better understand how these disorders occur and, hopefully, how they can be treated.

**Publications** [want to include links to article on pubmed]

**Korb, E.,** Herre, M., Zucker-Scharff, I., Allis, C.D., Darnell, RB. 2017. Excess translation of epigenetic regulators contributes to Fragile X Syndrome and is alleviated by Bd4 inhibition. *Cell*. (PMID: 28823556)

**Korb, E.,** Herre, M., Zucker-Scharff, I., Darnell, RB., Allis, C.D. 2015. BET protein Brd4 activates transcription in neurons and BET inhibitor Jq1 blocks memory in mice. *Nat. Neuro.* (PMID: 26301327)

Inquimbert, P., Moll, M., Latremoliere, A., Tong, C.K., Wang, J., Sheehan, G.F., Smith, B.M., **Korb, E.,** Athie, M.C.P., Babaniyi, O., Ghasemlou, N., Yanagawa, Y., Allis, C.D., Hof, P.R., Scholz, J. 2018. NMDA Receptor activation underlies the loss of spinal dorsal horm neurons and the transition to persistent pain after peripheral nerve injury. *Cell Rep.* (PMID: 29847798)

Sun, H., Damez-Werno, D.M., Scobie, K.M., Shao, N., Dias, C., Rabkin, J., Koo, J.W., **Korb, E.,** Bagot, R.C., Ahn, F.H., Cahill, M., Labonte, B., Mouzon, E., Heller, E.A., Cates, H., Golden, S.A., Gleason, K., Russo, S.J., Andrews, S., Neve, R., Kennedy, P.J., Maze, I., Dietz, D.M., Allis, C.D., Turecki, G., Varga-Weisz, P., Tamminga, C., Shen, L., Nestler. E.J. 2015. ACF chromatin remodeling complex mediates stress-induced depressive-like behavior. *Nat. Med.* (PMID: 26390241)

**Korb, E.,** Wilkinson, C. L., Delgado, R.N., Lovero, K.L., Finkbeiner, S. 2013. Arc in the nucleus regulates PML-dependent GluA1 transcription and homeostatic plasticity. *Nat. Neuro.* 16(7), 874-83. (PMID: 23749147)

**Korb, E.,** Finkbeiner, S. 2011. Arc in synaptic plasticity: from gene to behavior. *Trends Neurosci*. 34, 591-8. (PMID: 21963089)

**Korb, E.,** Finkbeiner, S. 2013. PML in the Brain: From Development to Degeneration. *Frontiers in Molecular and Cellular Oncology.* 17, 242. (PMID: 2406991)

Barmada, S.J., Skibinski, G., **Korb, E.,** Rao, E.J., Wu, J.Y., Finkbeiner, S. 2009. Cytoplasmic mislocalization of TDP43 is toxic to neurons and enhanced by a mutation associated with familial ALS. *J. Neuroscience.* 30, 639-49. (PMID: 20071528)

Androutsellis-Theotokis, A., Rueger, M.A., Park, D.M., Mkhikian, H., **Korb, E.**, Chenoweth, J.G., Poser, S.W., Boyd, J.D., Munasinghe, J., Padmanabhan, R., Koretsky, A.P., and McKay, R.D.G., 2009. Targeting neural precursors in the adult brain rescues injured dopamine neurons. *PNAS* 106, 13570-5. (PMID: 19628689)

Androutsellis-Theotokis, A., Rueger, M.A., Mkhikian, H., **Korb, E.**, and McKay, R.D.G., 2008. Signaling pathways controlling neural stem cells slow progressive brain disease. Cold Spring Harbor Symposia on Quantitative Biology, Volume LXXIII. (PMID: 19022746)

Jones, K.J., **Korb, E.**, Kundel, M.A., Kochanek, A.R., Kabraji, S., McEvoy, M., Shin, C.Y., and Wells, D.G. 2008. CPEB1 regulates beta-catenin mRNA translation and cell migration in astrocytes. *Glia* 56, 401-13. (PMID: 18618654)

**Team**

Erica Korb, PhD

Principle Investigator

Erica Korb is an Assistant Professor in the Department of Genetics and a member of the Epigenetics Institute. Erica received her B.S. from Yale University in Molecular Biology and worked as a research assistant at both Yale and the NIH. She received her PhD from the University of California, San Francisco in neuroscience where she worked with Dr. Steve Finkbeiner. She then went on to the Rockefeller University for her postdoctoral training under Dr. C. David Allis. She has won several awards for her work over the years including the Gladstone Institutes of Neurological Disease Graduate Student Award, the F31 and F32 Fellowship Awards and the NIH Pathway to Independence Award. Outside of the lab, Erica enjoys playing an eclectic mix of sports including cycling, ultimate Frisbee, and fencing.

**Contact**

We are looking for highly motivated students and postdoctoral scientists who are interested in epigenetics, neuroscience, computational epigenomics, and disorders of the nervous system.

Postdocs: Please email your CV, a brief description of your previous work and your future research interests and arrange for 3 letters of recommendation to be sent to ekorb@penn.med.edu.

Graduate Students: If you are interested in a rotation, then get in touch! The Korb lab welcomes students interested in epigenetics, neuroscience, or related areas of research like cell biology, metabolism, genomics, and developmental biology. Contact us at [ekorb@penn.med.edu](mailto:ekorb@penn.med.edu).