Kevin Ung, Ph.D.

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Education

Baylor College of Medicine, Houston, TX
Ph.D. Program in Developmental Biology (2021)

Georgia Institute of Technology, Atlanta, GA
B.S. Biomedical Engineering (2009)

Research Experience

Postdoctoral Associate, Baylor College of Medicine, Houston, TX
Advisor: Jeffrey Yau, Ph.D. (2021-present)

- Discovering a relationship between gaze and somatosensory feedback through the feature space of dexterous motor behavior using **generalized linear mixed modeling**.
- Investigating the neural encoding of multisensory integration. **Behavioral training of non-human primates** to perform the LRBN task with visual and tactile cues during acute electrode recordings.

Doctoral Candidate, Baylor College of Medicine, Houston, TX
Thesis Advisor: Benjamin R. Arenkiel, Ph.D. (2012-2020)

- Investigating a role for SOX9 in mature astrocytes in the adult mouse olfactory bulb. Conditional knock out of SOX9 in OB astrocytes revealed an important role in transcriptional regulation of adult astrocytes as shown through **RNA-seq**. **Whole-cell patch clamp electrophysiology** and **ex vivo 2-photon imaging** show cell intrinsic changes in astrocyte properties, leading to cell extrinsic changes in principle pyramidal neurons. Olfactory behavior assays showed an impairment in olfactory discrimination tasks. Overall results revealed that transcriptional dysregulation in astrocytes lead to olfactory deficits due to reduced glutamate uptake.
- Investigating a role for local astrocytes in olfactory bulb circuit processing. Used **pharmacogenetic** approaches in conjunction with ***in vivo* widefield imaging** of the mouse olfactory bulb to analyze the effects of astrocyte activity on neuronal behavior in a sensory modality. Imaging results demonstrate that odor-evoked astrocyte activity colocalizes with neuronal activity, and that astrocyte activity affects neuronal behavior. Behavior results demonstrate that astrocyte manipulations affect odor detection threshold.
- Examined the development of inhibitory granule cells during integration into an existing sensory circuit through ***in vivo* widefield imaging**. Demonstrated that sensory maps of inhibitory neurons broaden with maturation. **Go-NoGo operant conditioning behavior** demonstrated that sensory experience and learning enhances sensory map development while sensory deprivation restricts sensory map expansion.
- Investigated circuit properties in the mouse olfactory bulb through **whole-cell patch clamp electrophysiology** utilizing *Channelrhodopsin-2 assisted circuit mapping (CRACM)*. Demonstrated that EPL interneurons display non-plastic, stereotyped patterns not affected by olfactory associative learning. Contrastingly, olfactory associative learning strengthens synaptic connections, enhancing mitral cell input onto granule cells while granule cells make narrower, more specific inhibition onto mitral cells.

Research Technician, Baylor College of Medicine, Houston, TX

Advisor: Benjamin R. Arenkiel, Ph.D. (2011-2012)

- Established a modified protocol for the fabrication of **fiber optic implants** and its permanent fixation onto the cranium for light delivery into the brain for chronic optogenetic studies in awake, behaving mice.
- PCR genotyping of transgenic embryonic stem cells used in tracing synaptic inputs onto embryonic stem cell-derived neurons
- Assisted in viral construct cloning and tissue culture for viral packaging (lentiviruses and adeno-associated viruses)

Research Assistant, Rice University, Houston, TX
Advisor: Jeffrey J. Tabor, Ph.D. (2010-2011)

- Constructed synthetic gene networks using PCR-based cloning techniques to reprogram how cells interact with one another in *Dictyostelium discoideum* model organism.

Publications

Jo J., Woo J., Cristobal C.D., Choi J.M., Wang C.Y., Ye Q., Smith J.A., **Ung K.**, Liu G., Cortes D., Jung S.Y., Arenkiel B.R., Lee H.K. Regional heterogeneity of astrocyte morphogenesis dictated by the formin protein, Daam2, modifies circuit function. EMBO Rep.;22(12):e53200. doi: 10.15252/embr.202153200. Epub 2021 Oct 11. PMID: 34633730; PMCID: PMC8647146 (2021).

Ung, K., Huang, T. W., Lozzi, B., Woo, J., Hanson, E., Pekarek, B., Tepe, B., Sardar, D., Cheng, Y. T., Liu, G., Deneen, B., & Arenkiel, B. R. Olfactory bulb astrocytes mediate sensory circuit processing through Sox9 in the mouse brain. *Nature communications*, *12*(1), 5230. https://doi.org/10.1038/s41467-021-25444-3 (2021).

Ung K., Tepe B., Pekarek B., Arenkiel B.R., Deneen B. Parallel astrocyte calcium signaling modulates olfactory bulb responses. *J Neurosci Res*. 2020;10.1002/jnr.24634. doi:10.1002/jnr.24634

Liu G., Froudarakis E., Patel J.M., Kochukov M.Y., Pekarek B., Hunt P.J., Patel M., **Ung K.**, Fu C.H., Jo J., Lee H.K., Tolias A.S., Arenkiel B.R. Target specific functions of EPL interneurons in olfactory circuits. Nat Commun. doi: 10.1038/s41467-019-11354-y (2019).

Patel, J.M., Swanson, J.L., **Ung, K.**, Herman, A.M., Hanson, E.L., Ortiz-Guzman, J., Selever, J., Tong, Q., Arenkiel, B.R. Sensory perception drives food avoidance through excitatory basal forebrain circuits. eLife, doi: 10.7554/eLife.44548 (2019).

Quast, K. B., **Ung, K.**, Froudarakis, E., Huang, L., Herman, I., Addison, A.P., Ortiz-Guzman, J., Cordiner, K., Saggau, P., Tolias, A.S., Arenkiel, B.R. Developmental broadening of inhibitory sensory maps. *Nat Neurosci* 20, 189-199, doi:10.1038/nn.4467 (2017).

Herman, A. M., Ortiz-Guzman, J., Kochukov, M., Herman, I., Quast, K.B., Patel, J.M., Tepe, B., Carlson, J.C., **Ung, K.**, Selever, J., Tong, Q., Arenkiel, B.R. A cholinergic basal forebrain feeding circuit modulates appetite suppression. *Nature* 538, 253-256, doi:10.1038/nature19789 (2016).

Huang, L.*, **Ung, K.***, Garcia, I., Quast, K.B., Cordiner, K., Saggau, P. & Arenkiel, B.R. Task learning promotes plasticity of interneuron connectivity maps in the olfactory bulb. *J Neuroscience* 36, 8856-8871, doi:10.1523/JNEUROSCI.0794-16.2016 (2016).

Lee, H. K., Laug, D., Zhu, W., Patel, J.M., **Ung, K.**, Arenkiel, B.R., Fancy, S.P., Mohila, C. & Deneen, B. Apcdd1 stimulates oligodendrocyte differentiation after white matter injury. *Glia* 63, 1840-1849, doi:10.1002/glia.22848 (2015).

Ung, K. & Arenkiel, B. R. Fiber-optic implantation for chronic optogenetic stimulation of brain tissue. *J Vis Exp*, e50004, doi:10.3791/50004 (2012).

Garcia, I., Huang, L., **Ung, K.** & Arenkiel, B. R. Tracing synaptic connectivity onto embryonic stem cell-derived neurons. *Stem Cells* 30, 2140-2151, doi:10.1002/stem.1185 (2012).

Selected Posters Presentations

Ung, K., Yau J.M., Nordmark, P.F. Compensatory motor and visual changes follow somatosensory feedback loss in a dexterous motor task. TIRR Foundation Mission Connect, November 2022.

Ung, K., Huang, T.W., Tepe, B., Woo, J., Lozzi, B., Sardar, D., Cheng, Y.T., Pekarek, B.T., Deneen, B., Arenkiel, B.R. Local astrocytes modulate neuronal signaling and processing in the olfactory bulb. Neuroscience 2017, Society for Neuroscience, November 2018.

Ung, K., Tepe, B., Hanson, E., McClard, C., Liu, G., Arenkiel, B.R. Local calcium-dependent astrocyte signaling modulates primary olfactory neuron signaling. Society for Neuroscience, November 2017.

Quast, K.B., **Ung, K.**, Huang, L., Garcia, I. & Arenkiel, B.R. Developmental broadening of inhibitory sensory maps. Rush and Helen Record Forum, Baylor College of Medicine, January 2017.

Ung, K., Quast, K.B. & Arenkiel, B.R. A role for local astrocytes in olfactory bulb neuronal circuit processing. Poster, Neuroscience Research Center 22nd Annual Neuroscience Poster Session. December 2015.

Ung, K., Quast, K.B. & Arenkiel, B.R. A role for local astrocytes in olfactory bulb neuronal circuit processing. Poster, Graduate School of Biomedical Science Symposium, Baylor College of Medicine, October 2015.

Oral Presentations

Ung, K. Calcium-dependent vesicular release from astrocytes modulates olfactory neuron odor responses. Baylor College of Medicine Graduate Student Symposium selected speaker. October 2017. 3rd place

Ung, K. A role for local astrocytes in olfactory bulb refinement and processing. Program in Developmental Biology Retreat. February 2016

Ung, K. The role of local astrocytes in olfactory bulb circuit refinement and processing. Program in Developmental Biology Retreat. February 2015

Teaching and Mentoring

2016-19 *McNair Science Education Collaborative Teaching Fellow* – Large group presentation and taught individual classes at Chase High School and RS Central Middle and High Schools in Rutherford County, NC as part of a scientific advocacy and outreach program to rural high schools.

2016 *Rotation Mentor* – Mentored 1st year student for *in vivo* widefield calcium imaging

2015 *Rotation Mentor* – Mentored 1st year student in generating primary neuronal cultures, transfections, and qRT-PCR

2014 *Rotation Mentor* – Mentored 1st year student in developing and cloning a vector for viral packaging

2013 *Rotation Mentor* – Mentored 1st year student in characterizing a transgenic mouse line

Academic and Professional Honors

2017	3rd place, selected speaker for Baylor College of Medicine Graduate Student Symposium
2016-19	McNair Science Education Collaborative Teaching Fellow
2014-17	NIH Ruth L. Kirschstein National Research Service Award Predoctoral Fellow F31NS089178

References

Jeffrey M. Yau Associate Professor Neuroscience Baylor College of Medicine (713) 798 – 5150 Jeffrey.Yau@bcm.edu	Benjamin R. Arenkiel, Ph.D. Professor Molecular and Human Genetics Baylor College of Medicine (713) 798 – 1960 arenkiel@bcm.edu	Benjamin Deneen Professor Ctr Stem Cell & Regen Baylor College of Medicine (713) 798 – 7897 deneen@bcm.edu