**Potassium Channels**

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**Relevant Journal Articles**

Bernal Sierra, Y. A., Rost, B. R., Pofahl, M., Fernandes, A. M., Kopton, R. A., Moser, S.,

Holtkamp, D., Masala, N., Beed, P., Tukker, J. J., Oldani, S., Bönigk, W., Kohl, P., Baier, H., Schneider-Warme, F., Hegemann, P., Beck, H., Seifert, R., & Schmitz, D. (2018). Potassium channel-based optogenetic silencing. Nature communications, 9(1), 4611. <https://doi.org/10.1038/s41467-018-07038-8>

* In this paper, the authors develop an inhibitory optogenetic tool using SthK potassium channels coupled with photoactivated adenylyl cyclases (Pac), together called PAC-K. Here they go through the development and validation of the technique, in vivo and in vitro, in multiple tissue types, to confirm that this method satisfies the requirements for an effective optogenetic inhibitor.

Dantzler, H. A., & Kline, D. D. (2020). Exaggerated potassium current reduction by oxytocin in

visceral sensory neurons following chronic intermittent hypoxia. Autonomic neuroscience : basic & clinical, 229, 102735. <https://doi.org/10.1016/j.autneu.2020.102735>

* This paper looks at the effects of chronic, intermittent hypoxia on oxytocin receptor expressing neurons of the basal ganglia. Mice receive chronic, intermittent low oxygen or are “normal”, or control, mice. Whole-cell patch clamp of nodose ganglia neurons records cellular response to oxytocin. Cells that respond to oxytocin, called OT-sensitive, are compared across normal and hypoxic groups. Consistent low-oxygen does not alter oxytocin receptor expression but it does decrease potassium currents, depolarizing the membrane potential.

Glazebrook, P. A., Ramirez, A. N., Schild, J. H., Shieh, C. C., Doan, T., Wible, B. A., & Kunze,

D. L. (2002). Potassium channels Kv1.1, Kv1.2 and Kv1.6 influence excitability of rat visceral sensory neurons. The Journal of physiology, 541(Pt 2), 467–482. <https://doi.org/10.1113/jphysiol.2001.018333>

* This paper looks at two types of nodose ganglion neurons, A and C. Modeled responses of these neurons in the presence of potassium blockers, broad and specific, are compared to the obtained experimental data. The purpose of this paper is to determine 1) the function of these potassium channels on A and C type neuronal electrophysiological properties 2) does the experimental data validate the modeled data, 3) how do these cells alpha dendrotoxin sensitive and 4) to link these potassium channels to hippocampal activity of kv1.1 knockout transgenic mice.

Hafez, O. A., & Gottschalk, A. (2020). Altered neuronal excitability in a Hodgkin-Huxley model

incorporating channelopathies of the delayed rectifier potassium channel. Journal of computational neuroscience, 48(4), 377–386. <https://doi.org/10.1007/s10827-020-00766-1>

* This paper looks at known channelopathies of the delayed rectifier potassium channel Kv1.1. Here, using advanced mathematics, they model responses to current or voltage injections following the original Hodgkin-Huxley model. While this paper is quite advanced, they do a good job of explaining the science and mathematics behind their calculations.

Johannesen, L., Vicente, J., Mason, J. W., Erato, C., Sanabria, C., Waite-Labott, K., Hong, M.,

Lin, J., Guo, P., Mutlib, A., Wang, J., Crumb, W. J., Blinova, K., Chan, D., Stohlman, J., Florian, J., Ugander, M., Stockbridge, N., & Strauss, D. G. (2016). Late sodium current block for drug-induced long QT syndrome: Results from a prospective clinical trial. Clinical pharmacology and therapeutics, 99(2), 214–223.

<https://doi.org/10.1002/cpt.205>

* This paper goes through electrocardiogram data in response to hERG potassium channel blocking drugs, with and without the addition of late sodium or calcium channel blocking drugs. This is the clinical application of potassium channel blockers in human subjects.

Leippe, P., Winter, N., Sumser, M. P., & Trauner, D. (2018). Optical Control of a Delayed

Rectifier and a Two-Pore Potassium Channel with a Photoswitchable Bupivacaine. ACS chemical neuroscience, 9(12), 2886–2891. <https://doi.org/10.1021/acschemneuro.8b00279>

* In this paper, the authors develop a photoswitchable blocker for potassium channels, allowing for light manipulation of potassium channel function. They focus on delayed rectifier Kv2.1 and a two-pore K channel TREK-1. The goal is to block conductance in the absence of light and to potentiate conductance in the presence of light. To do this, they use azobupivacaines AB1-3. This paper goes through the identification, development, and validation of this photoswitchable blocker in the two types of potassium channels.

Shahidullah, M., Reddy, S., Fei, H., & Levitan, I. B. (2009). In vivo role of a potassium

channel-binding protein in regulating neuronal excitability and behavior. The Journal of neuroscience : the official journal of the Society for Neuroscience, 29(42), 13328–13337. <https://doi.org/10.1523/JNEUROSCI.3024-09.2009>

* In this paper, large-conductance calcium-activated potassium channels dSlo and its binding protein Slob are studied in the pars intercerebralis (PI) of drosophila brains. PI neuron excitability is studied across mutation of Slobs and compared to behavioral responses.

Sun, H., Lin, A. H., Ru, F., Patil, M. J., Meeker, S., Lee, L. Y., & Undem, B. J. (2019).

KCNQ/M-channels regulate mouse vagal bronchopulmonary C-fiber excitability and cough sensitivity. JCI insight, 4(5), e124467.

<https://doi.org/10.1172/jci.insight.124467>

* This paper looks at KCNQ/M channels in vagal airway C-fibers. C-fibers relay itching sensation, fibers from the vagal airway relay information from the lungs. Together, this paper looks at potassium channels in cells that induce coughing. They conclude that opening of M-channels in the afferents may be used to relieve chronic coughing.

**Relevant Review Papers**

Benatar M. (2000). Neurological potassium channelopathies. QJM : monthly journal of the

Association of Physicians, 93(12), 787–797.

<https://doi.org/10.1093/qjmed/93.12.787>

* This review paper goes through potassium channel dysfunctions and their role in neurological health issues. This paper goes through what mutations occur that lead to functional deficits leading to the pathophysiology of the condition.

González, C., Baez-Nieto, D., Valencia, I., Oyarzún, I., Rojas, P., Naranjo, D., & Latorre, R.

(2012). K(+) channels: function-structural overview. Comprehensive Physiology, 2(3), 2087–2149. <https://doi.org/10.1002/cphy.c110047>

* This paper is a comprehensive review of different potassium channel subfamilies.

Zemel, B. M., Ritter, D. M., Covarrubias, M., & Muqeem, T. (2018). A-Type KV Channels in

Dorsal Root Ganglion Neurons: Diversity, Function, and Dysfunction. Frontiers in molecular neuroscience, 11, 253. <https://doi.org/10.3389/fnmol.2018.00253>

* This review focuses on A-type potassium channels. This paper looks through the diversity of the family, the functions of the subunits, and dysfunctions and channelopathies associated with these channels.

**Relevant Websites**

<https://www.cvpharmacology.com/antiarrhy/potassium-blockers>

* This website looks at class III antiarrhythmic potassium- channel blockers.

<http://vkcdb.biology.ualberta.ca/>

* This website is a database of sequences for voltage-gated K channels in Eukaryotes, Bacteria, and Archaea. Here, you can search by organism, subfamily, and electrophysiology.

<https://kaliumdb.org/>

* This website is a database of polypeptide ligands of potassium channels. You can sort by different venomous creatures.

<https://www.addgene.org/browse/article/28196734/>

* This website goes to the ordering options for inhibitory optogenetic viruses using potassium channels.

<https://channelpedia.epfl.ch/wiki/ionchannels/188>

* This website is a database of ion channels with a lot of information for each type of potassium channel and family.

<https://go.drugbank.com/categories/DBCAT000519>

* This website catalogs potassium channel blockers and their application to human health.

<https://www.nature.com/subjects/potassium-channels>

* This website has the latest research papers and reviews on potassium channels posted through Nature.

<https://flybase.org/reports/FBgg0000512.html>

* This website is a database of potassium channel genes and sequences in drosophila.

<http://eden.pharmamatrix.ca/>

* This website is a database of ion channel expression in a variety of tissues, including cancer tissues.

<https://research.cchmc.org/LOVD2/home.php?select_db=KCNQ1>

* This website is a database of channel mutations, including potassium channels.