



Seewiesen Colloquia

Speaker invited by: Department Gahr

Thursday, March 30, 2017, 13h, in House 4, Lecture Room

Inhibition Protects Acquired Song Segments During Vocal Learning In Zebra Finches

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The process by which we learn through observation of others has been associated with the acquisition of a range of complex skilled behaviors in humans as well as some animal species. Zebra finches, for instance, learn to produce their songs by listening to and trying to imitate a tutor, usually their father. What are the changes in the songbird brain that occur throughout development in order to shape the song learning process? It has been shown that a forebrain cortical region called HVC is centrally important for song learning and production. HVC contains premotor neurons that ultimately influence song-related musculature as well as a range of local circuit inhibitory interneurons.

We recorded from premotor neurons in juvenile zebra finches while the birds were listening to their tutor's song while carefully tracking the learning trajectory of those birds over several weeks. In inexperienced birds, we found that simply hearing the father's song activates the same premotor neurons that the zebra finch will eventually use to produce his own song. Once the song had been mastered, however, premotor neurons stopped responding to the tutor song. In further experiments, we found that the responses to the tutor song were being actively suppressed by synaptic inhibition.

To learn more about this inhibitory suppression, we directly measured the activity of inhibitory interneurons within HVC. The suppression of the tutor song through HVC inhibition was more strongly correlated with learning rather than developmental age. As the bird acquires his song and establishes his ideal motor program, this circuit became increasingly protected from any outside influences. This new insight not only completely redefines the role of inhibition in developing neural circuits, but also leads to the question about the origin of the auditory evoked inputs.

Who is Daniela Vallentin?

- 2005 - 2010 PhD student with Andreas Nieder at Universität Tübingen
- 2010 - 2016 Postdoctoral Fellow with Michael Long at New York University
- Since 2016 Emmy Noether Independent Junior Research Group Leader at Freie Universität Berlin

Selected publications:

- Vallentin D*, Kosche G*, Lipkind D, Long MA (2016) Inhibition protects acquired song segments during vocal learning in zebra finches. *Science* Vol.352: pp. 267-271
- Kosche G*, Vallentin D*, Long MA (2015) Interplay of inhibition and excitation shapes a premotor neural sequence. *Journal of Neuroscience* Vol. 35, pp. 1217-1227
- Vallentin D, Long MA (2015) Motor origin of precise synaptic inputs onto forebrain neurons driving a skilled behavior. *Journal of Neuroscience* Vol. 35, pp. 299-307