

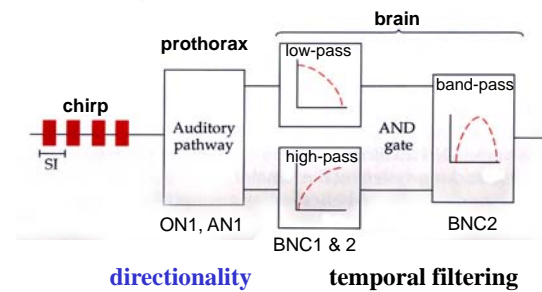
The function of auditory neurons in cricket phonotaxis.

Klaus Schildberger & Michael Hörner, (1988) J Comp Physiol 163:621-631

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1

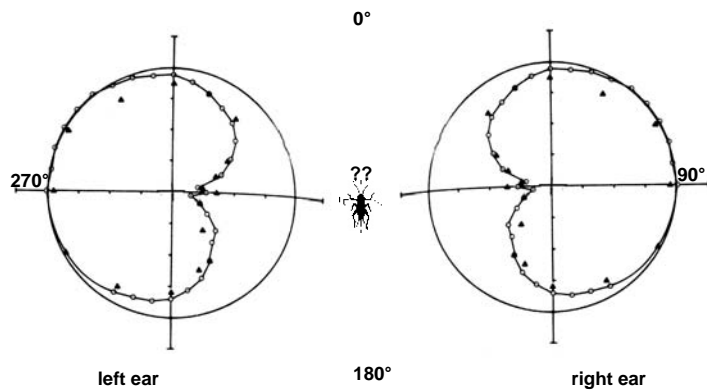
Ok, you're a male of my species, but where are you?



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2

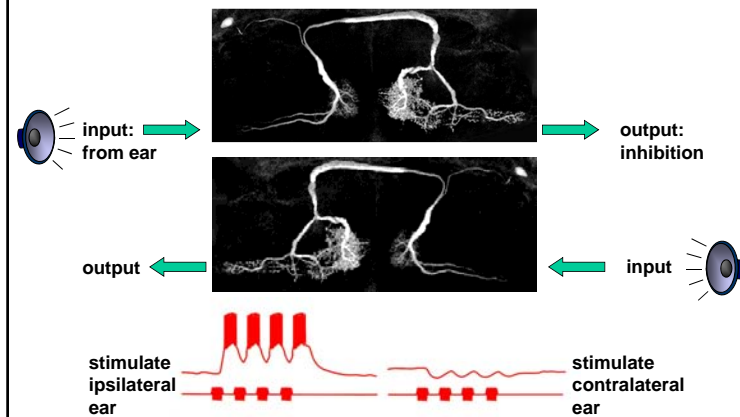
Peripheral directionality



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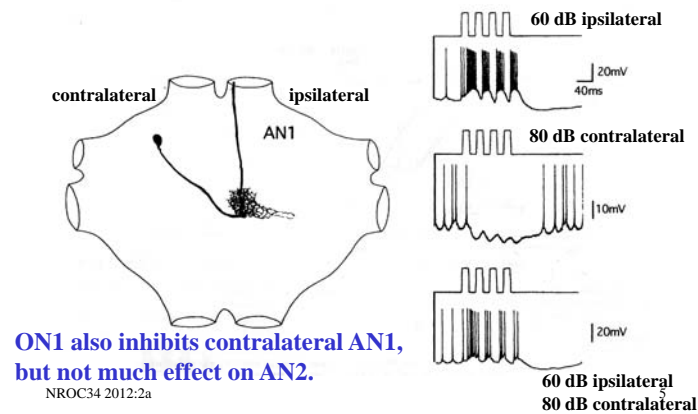
Reciprocal Inhibition



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Contralateral Inhibition of AN1



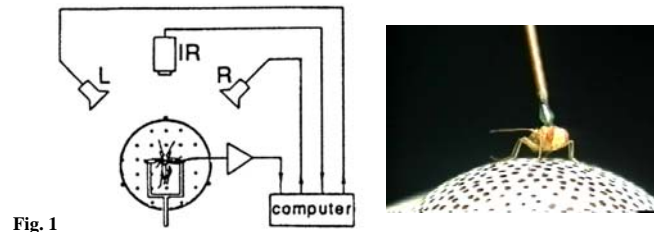
Directionality in Prothoracic Interneurons

- Inhibitory interactions among prothoracic interneurons enhance peripheral auditory directionality.
- Among neurons carrying information to the brain, biggest effect is on AN1.

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Non-compensating Treadmill



Intracellular physiology from a behaving animal.

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Methods

- Restrained cricket on a spherical treadmill.
- Prothoracic ganglion exposed for electrode insertion.
- Record and manipulate activity of identified neurons during phonotaxis.
 - therefore must place electrode near enough to spike initiating zone
 - animal must behave continuously
- Manipulation: hyperpolarize to shut off neuron during behaviour.

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Behave normally when dissected

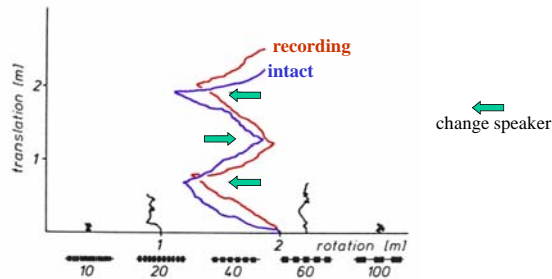


Fig. 2

and show normal song discrimination on the treadmill.

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Distributions of Angular Velocity

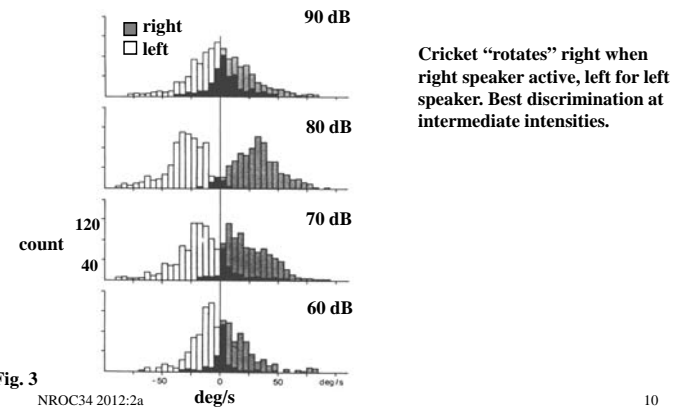


Fig. 3

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Neuronal Responses

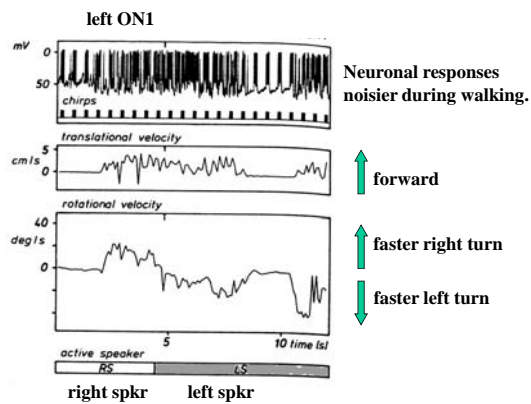


Fig. 4

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Neuronal Responses

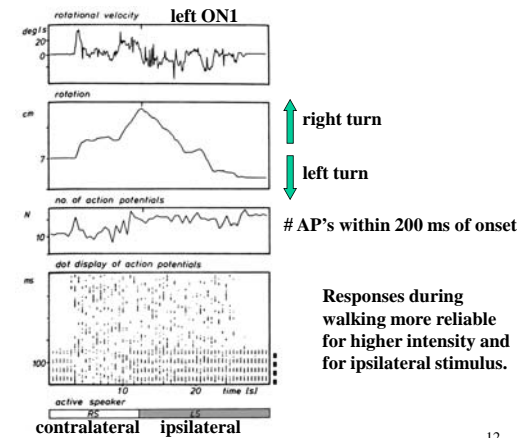
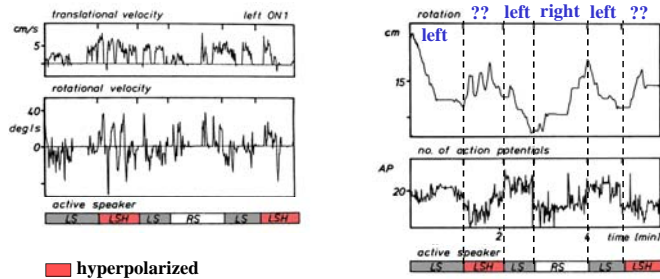


Fig. 5

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Left ON1



Reduced turning velocity if ON1 hyperpolarized during ipsilateral stimulation. But cricket still turns to speaker.

Fig. 6

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Left ON1

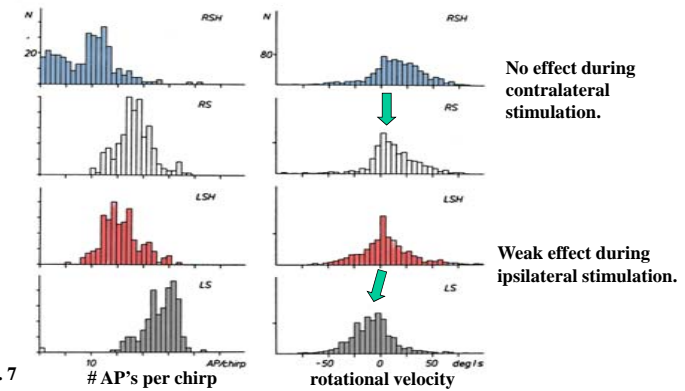
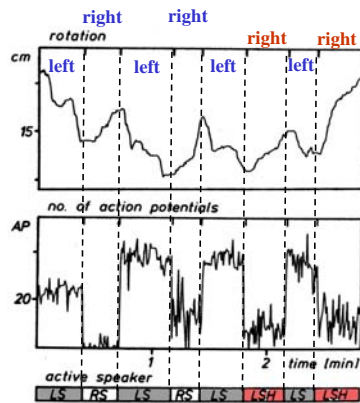


Fig. 7

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Left AN1

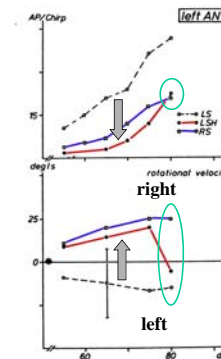


Hyperpolarizing AN1 reverses direction of phonotactic response.

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AN1 side-to-side activity difference



Hyperpolarizing reduces response to less than contralateral partner (except at 80 dB).

Cricket turns toward side with most active AN1.

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Phonotaxis

- Peripheral directionality enhanced by omega cell (ON1) contralateral inhibition.
- AN1 copies temporal pattern of acoustic stimulus and relays this to brain.
- Directional effects cause ipsilateral AN1 to have a stronger response (more AP's).
- If AN1 activity matches temporal filter in brain (BNC2), cricket makes a phonotactic turn towards that side.

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Putting it all together

