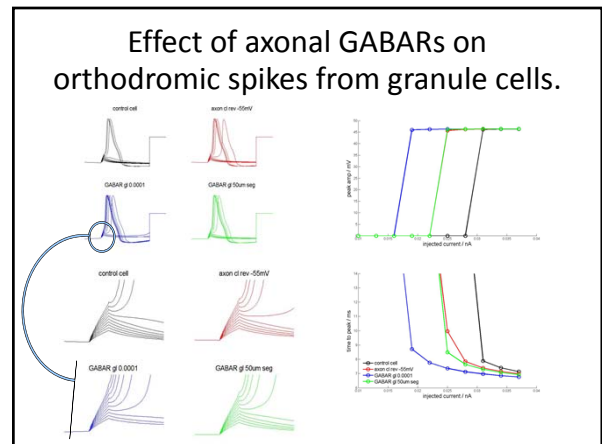
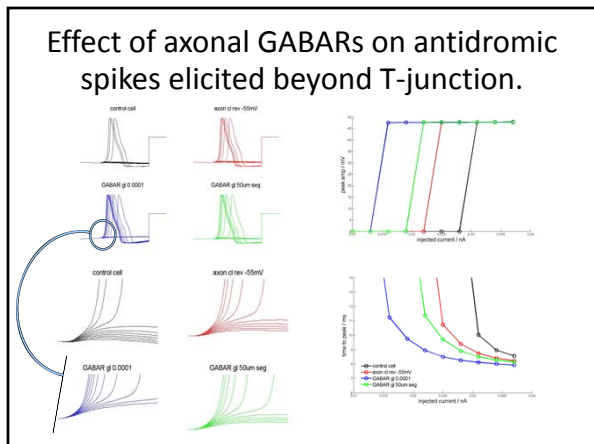
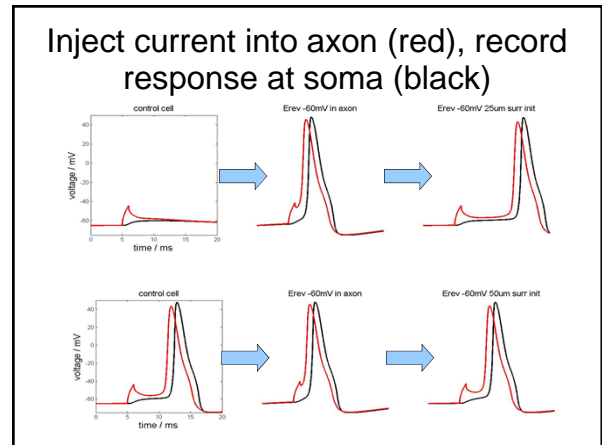


### Granule cell model.

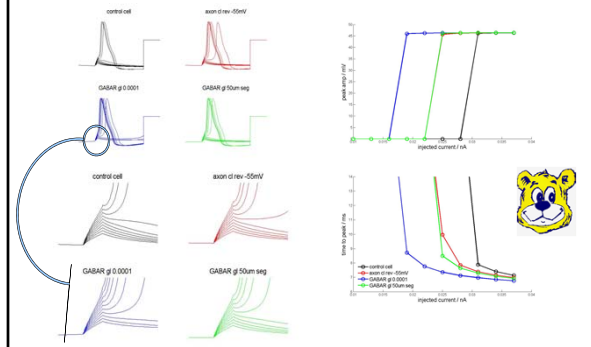
5.8  $\mu\text{m}$  diameter granule cell, 0.3  $\mu\text{m}$  diameter axon, 70  $\mu\text{m}$  ascending branch, 0.5 mm fiber after T-junction segment simulated.

Hodgkin-Huxley dynamics (from Walther), K-A channels, K-mixed-ion leak, chloride leak to maintain Erev-Cl, GABA<sub>A</sub>R high conductance chloride leak.

At 303 K,  $[\text{Cl}]_{\text{out}} = 130 \text{ mM}$ , a change in reversal potential for  $[\text{Cl}]$  of 5 mV results from  $[\text{Cl}]$  in rise from 10.8 to 13 mM (10 mV  $\rightarrow$   $[\text{Cl}]_{\text{in}} = 15.8 \text{ mM}$ ).



## Effect of axonal GABARs on orthodromic spikes from granule cells.



## Future directions (exciting!!!).

- Make predictions on how far chloride conductances have to be away from soma to induce effect.
- Can you have inhibition (shunting) v. excitation based on Cl conductance relative to other conductances?
- Local application of muscimol (50-100  $\mu$ m) - gradient of effects on fiber segments.
- Use trains of input to see effect on firing frequency.
- Vary E<sub>rev</sub> for Cl to see if effect on spiking is linear and calculate chloride concentration change expected.
- Synchronization by depol on type II neurons?
- Inhibition -> desynchronized? Bistable?

## References.

- Granule cell (5.8  $\mu$ m diameter, 228 compartments with axon total) [Palay & Chan-Palay, 1974].
- Basic morphology (minus dendrite, hillock) [Diwakar & ... & D'Angelo, J. Neurophys 101, 2009].
- Parallel fiber length (3mm either direction, 70 $\mu$ m ascending branch) and morphology [Huang & Huang, Brain Research 801, 1998].
- Networks and confirmation – simplified model [Maex & De Schutter, J. Neurophys 80, 1998].