A synaptic and circuit basis for corollary discharge in the auditory cortex

David M. Schneider, Anders Nelson & Richard Mooney

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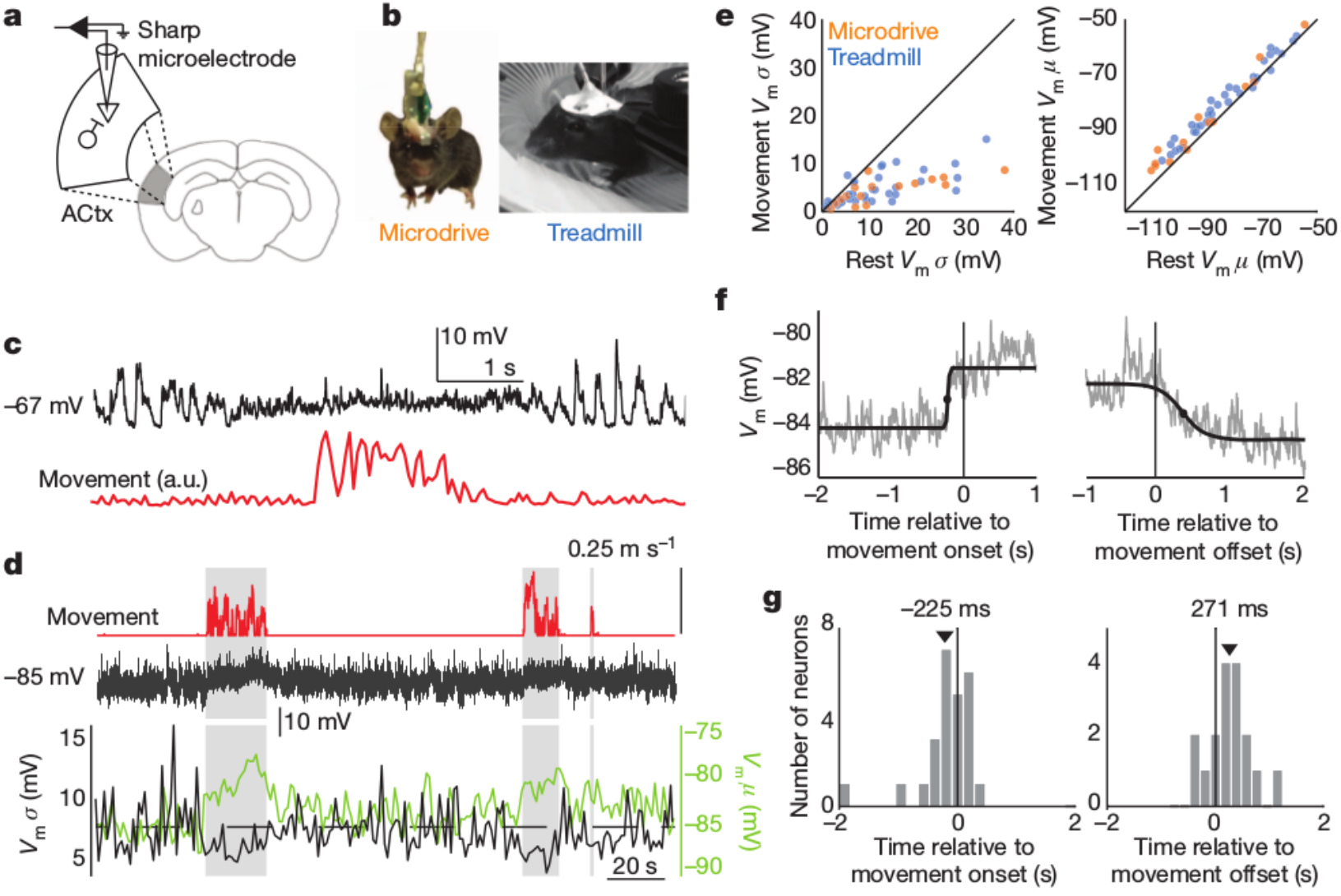
Introduction

- motor-related signals may modulate auditory cortex (ACtx)
  - during vocalization periods auditory cortex activity is suppressed in marmosets and in mice
  - heightened motor cortical activity correlates with auditory cortical suppression in humans
- this study shows that ACtx is suppressed by motor cortex signals through activation of inhibitory neurons in ACtx
- why do we care?
  - other recent studies show that animals engaged in tasks have suppressed responses in barrel and ACtx
  - suppression of cortex may actually be *increasing* the sensitivity of cortex to stimuli by removing background activity

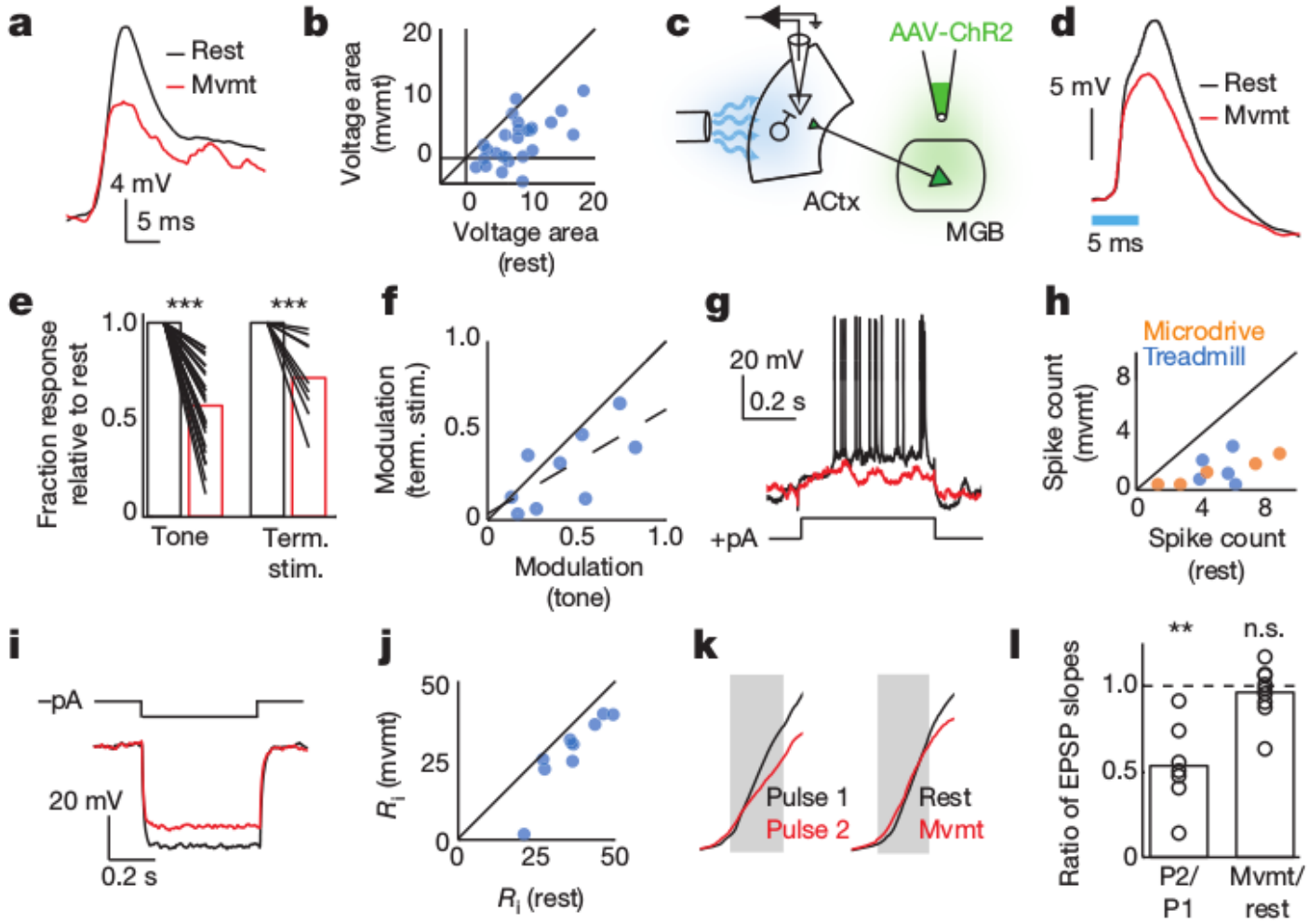
Movement modulates A1

effects preceded movement by >200 ms and outlasted locomotion ~200 ms



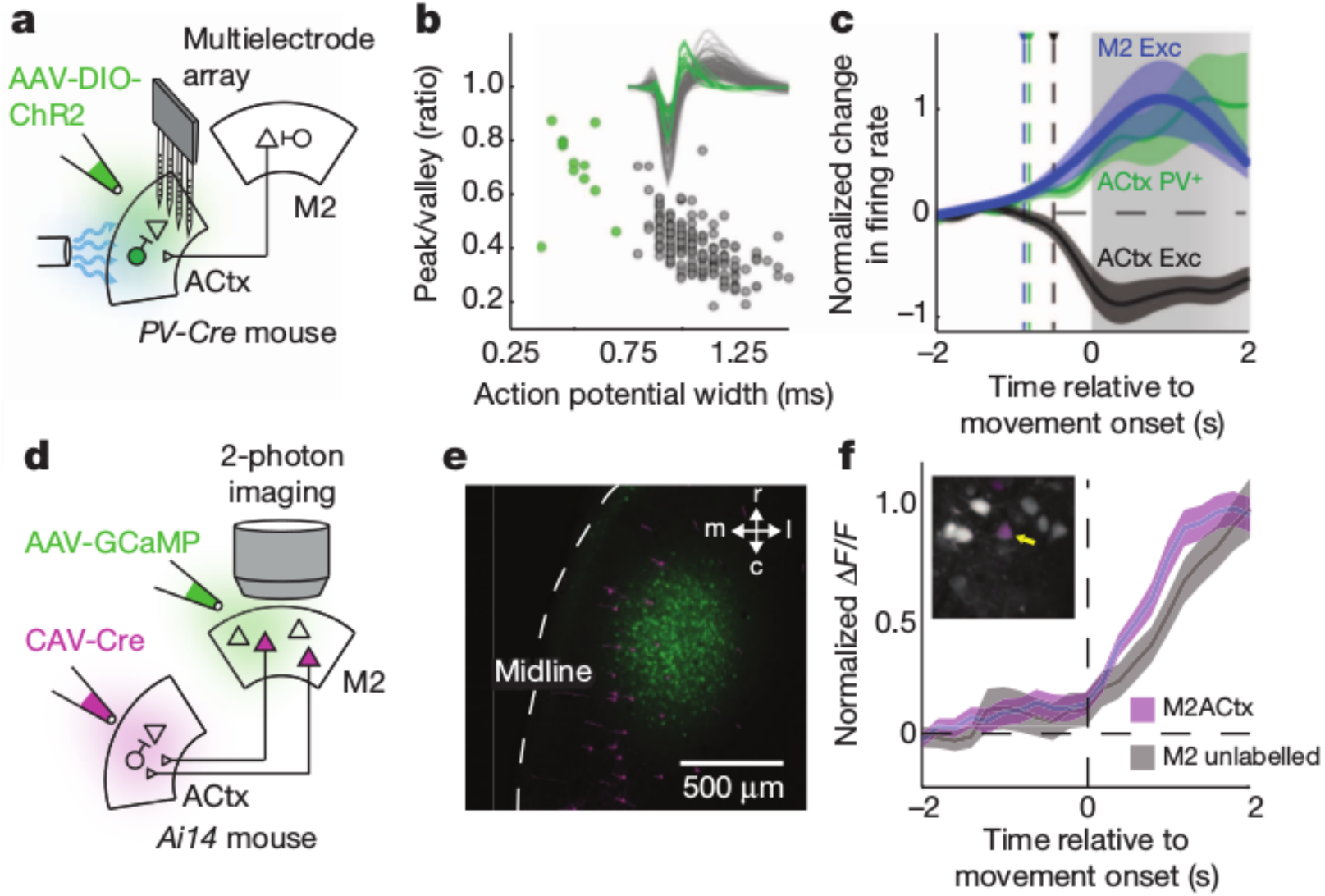
Suppression of excitatory neurons during movement

postsynaptic or presynaptic locus of inhibition?



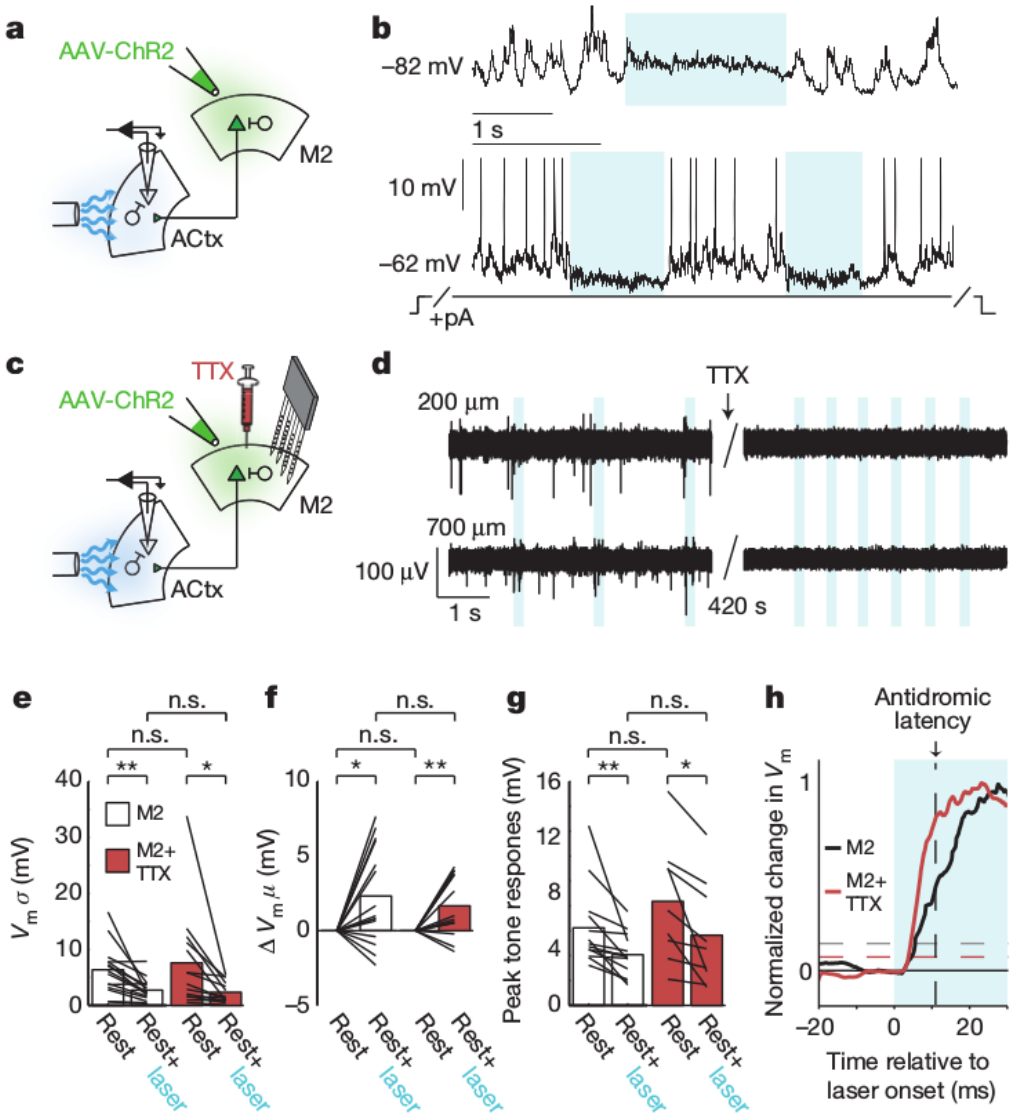
NOT thalamus $\Rightarrow$ inhibition is within cortex... which interneurons are activated?

PV$^+$ interneurons are active during movement

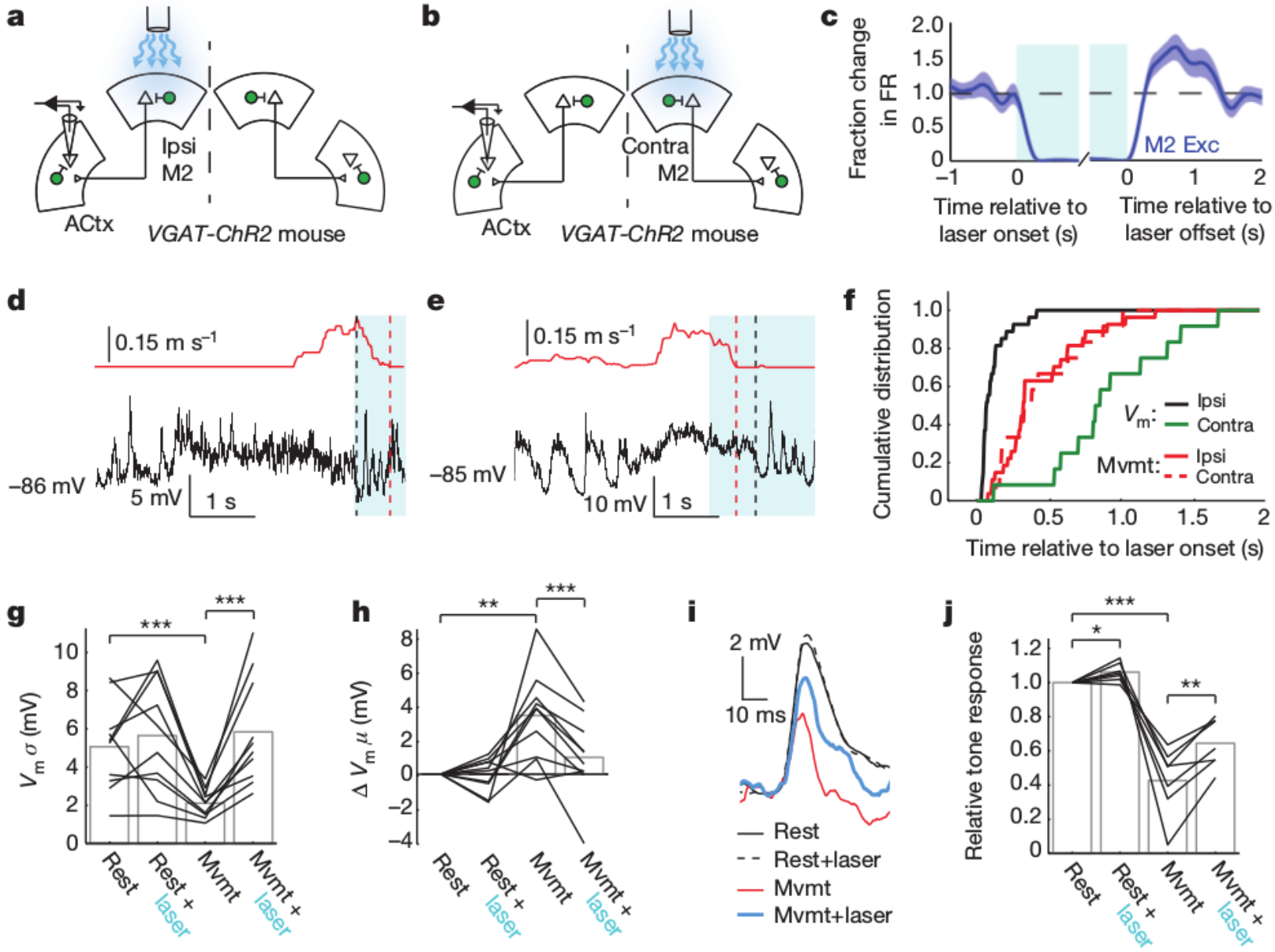


also M2 is active during movement with similar time courses

Activation of M2 axon terminals are sufficient to produce movement-like auditory cortical dynamics during rest



M2 activity is necessary for movement-related dynamics



Conclusions

- M2 projections to PV neurons are both sufficient and necessary for modulation of auditory cortex by movement-related signals
- why suppress responses?
  - may reflect a general strategy where motor-related signals transiently dampen sensitivity to predictable low-intensity sounds, enabling auditory neurons to maintain responsiveness to unexpected high-intensity stimuli
  - suppressed responsiveness serves to increase sensitivity
    - may be shushing all but the most important outputs from ACtx
    - other studies in active animals (in barrel and ACtx) support this view