

# Odor Representations in Olfactory Cortex: Distributed Rate Coding and Decorrelated Population Activity

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Tea talk #V  
June 29, 2012

# In a nutshell

- ▶ Population coding in the primary olfactory cortex (rat)
  - ▶ Input: Diverse and reliable temporal patterns
  - ▶ Output: Rate coding

Different odour coding in olfactory cortex  
as opposed to olfactory bulb

- ▶ Near zero noise-correlations among neurons

Zero noise-correlations among similarly tuned neurons:  
efficient decoding

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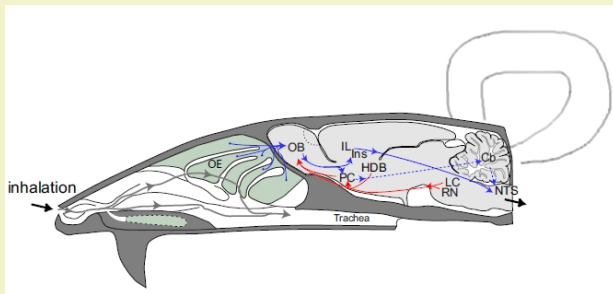
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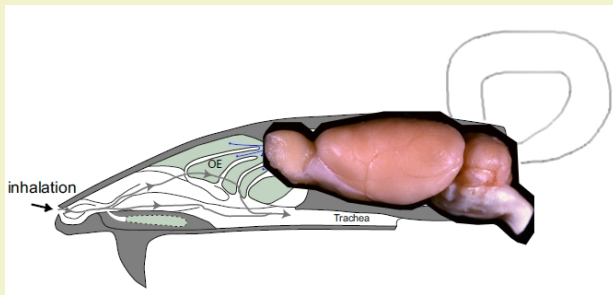
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# Experiment: Where?



Olfactory Epithelium  $\Rightarrow$  Olfactory Bulb  $\Rightarrow$  anterior Piriform Cortex

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# Experiment: How?

- ▶ Chronically implanted multielectrodes,  
6 tetrodes moving independently
- ▶ 1–2 weeks, 3 + 5 rats (pooled), 179 neurons
- ▶ Temperature sensor in the nostril records sniffing



# Experiment: What?

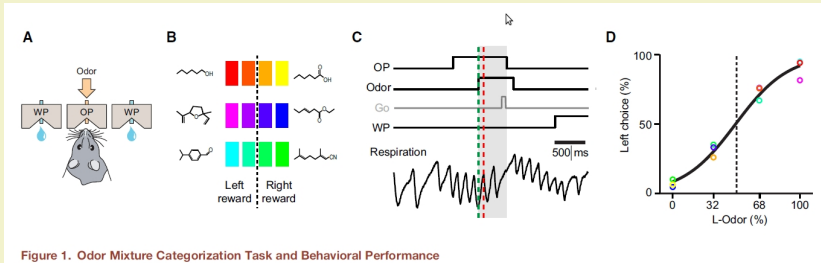


Figure 1. Odor Mixture Categorization Task and Behavioral Performance

- ▶ Odour categorisation (6 odours, left/right)
- ▶ Decision:  
Self-paced (1–2 sniffs) or Delayed (3–4 sniffs)

# Spiking response vs sniffing

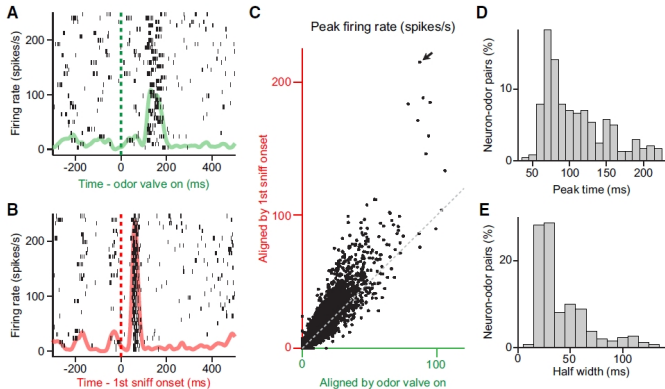


Figure 2. Sniffing of Odors Triggers Transient Spike Bursts Tightly Locked to Inhalation Onset

- ▶ Sniffing: active sampling of the world ( $\sim 7$  Hz rhythm)
- ▶ Short bursts locked (somewhat) to sniffing

# Most efficient coding of odours?

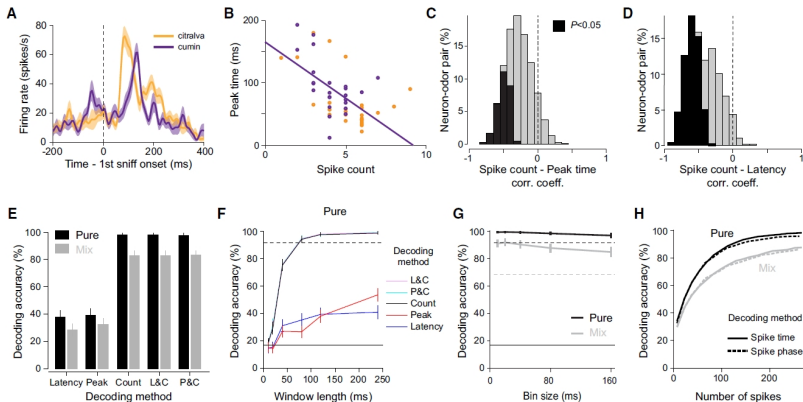


Figure 4. Rapid and Accurate Readout of Odor Information Based on Spike Counts in First Sniff

# Neurons better than their animal

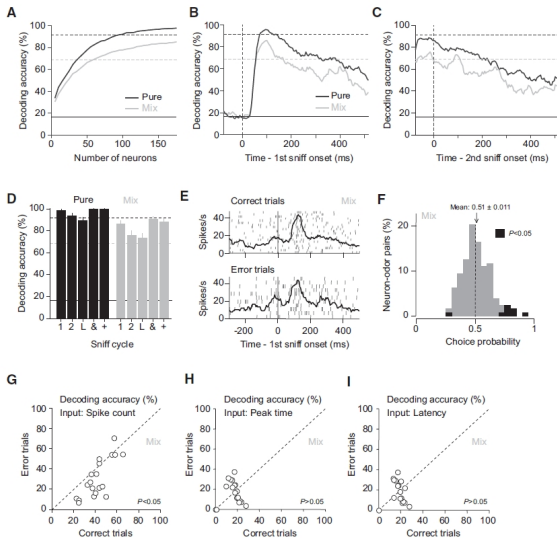
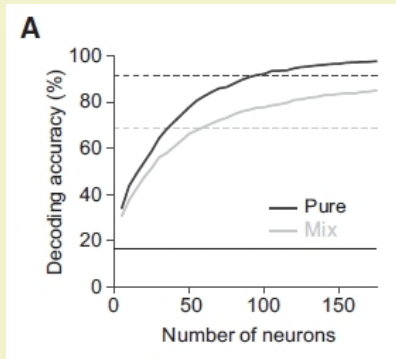


Figure 5. Information Conveyed by the Spike Counts in the Burst Activity Can Account for the Speed and Accuracy of Odor Discrimination

# Neurons better than their animal



# Noise correlations (The lack of)

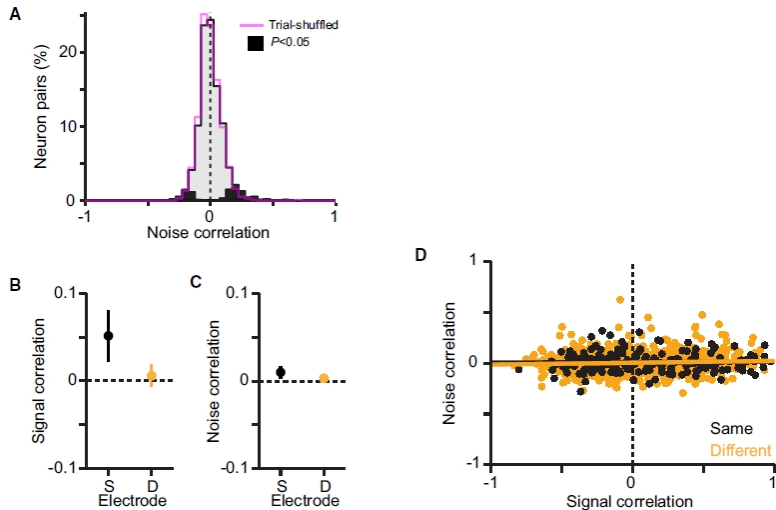
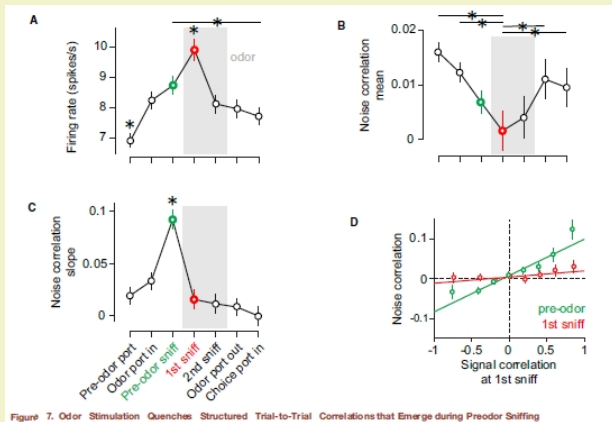


Figure 6. Near-Zero Noise Correlations in aPC

# Noise correlations before sniff



- ▶ Correlations between similarly tuned neurons increase **before** odour onset.

# Wrap-up

- ▶ Different mechanism for odour coding in the anterior piriform cortex as opposed to olfactory bulb, but...
  - ▶ Some improvement in decoding with finer time bins
  - ▶ They introduced noise in latency and peak-timing codes
- ▶ Noise correlations among similarly-tuned neurons increase during anticipation, curbed when stimulus arrives



**Thank you!**

SCHRODINGER'S CAT IS  
DEPRESSED

NO ONE CAME  
TO MY BIRTHDAY  
PARTY/FUNERAL.



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