# Network processing of taste

The Benjamin & Mae Volen National Center for Complex Systems

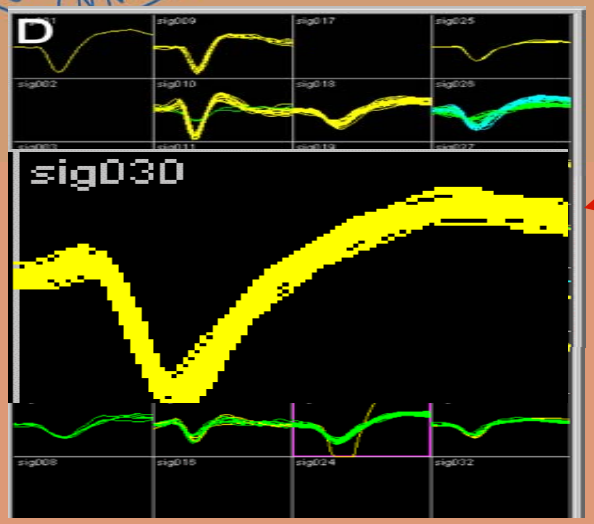
Brandeis University

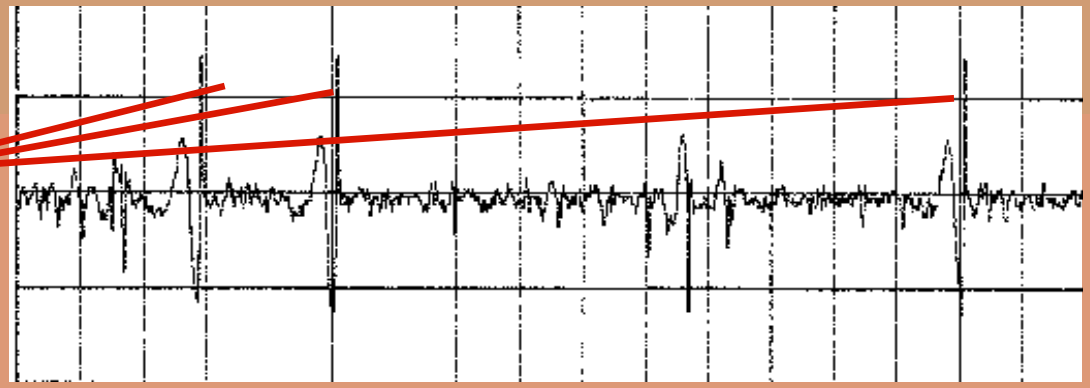
# Sequence of 3 Talks

- Framework: recap of last year—single-neuron and ensemble dynamics (**Katz**)
- Relating these to cognitive dynamics (**Fontanini**)
- Modeling ensemble dynamics (**Miller**)

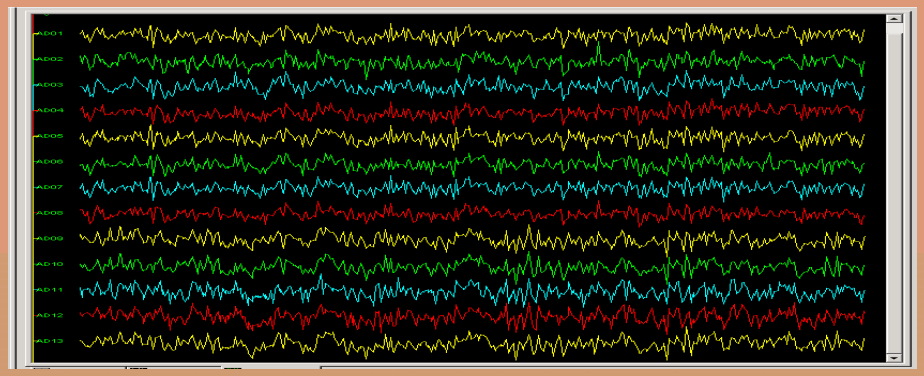
# Methods for investigating gustatory networks in actively tasting rats.

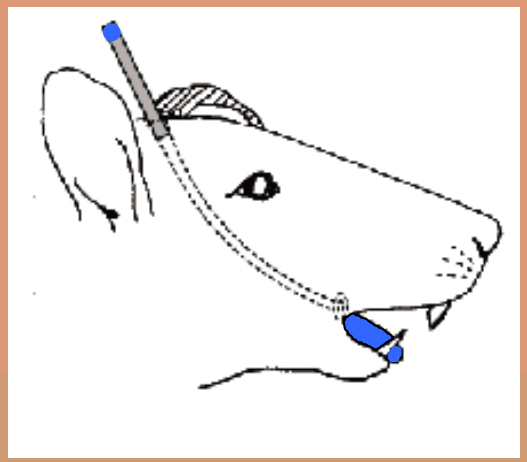
Single neurons



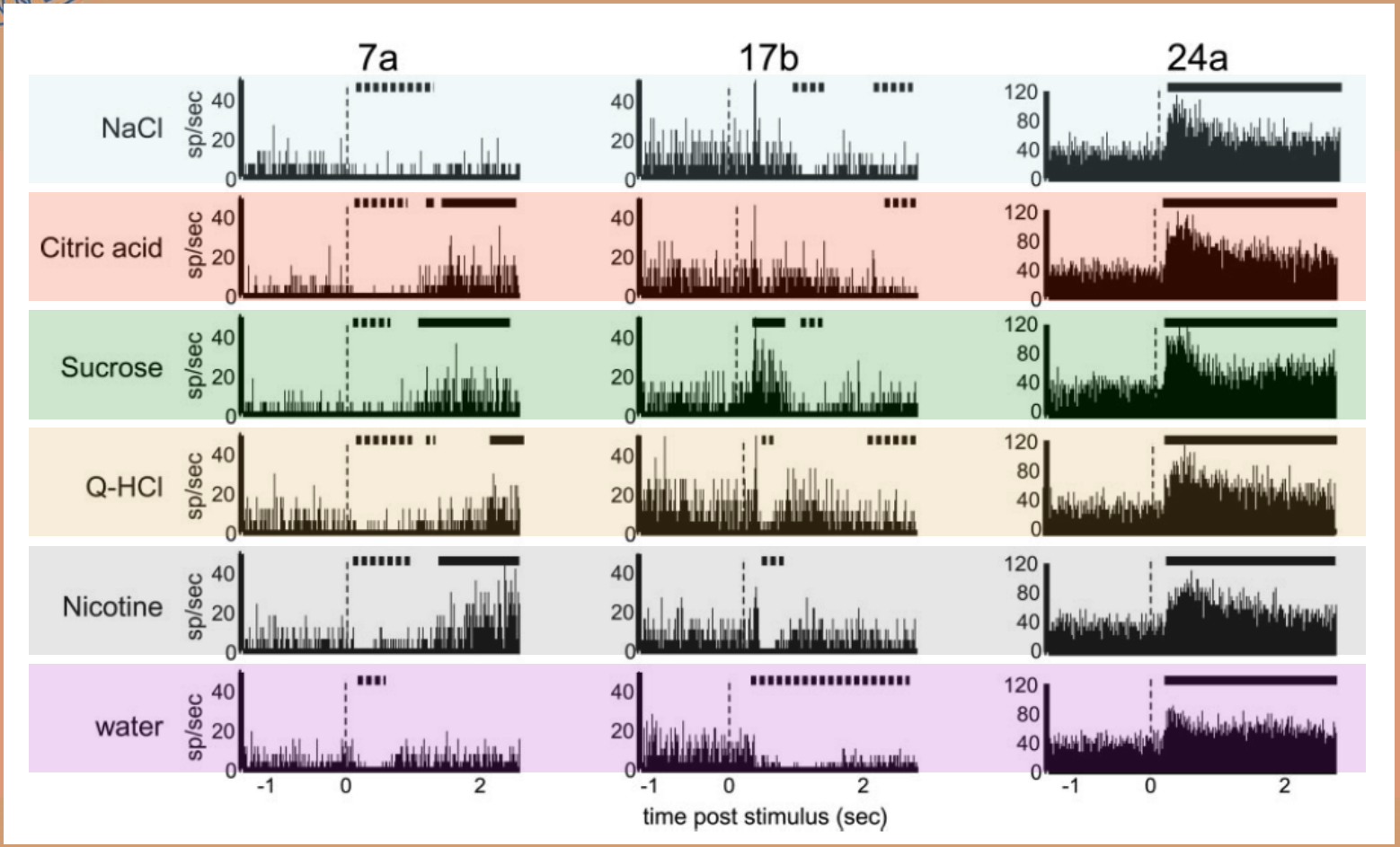



Field potentials



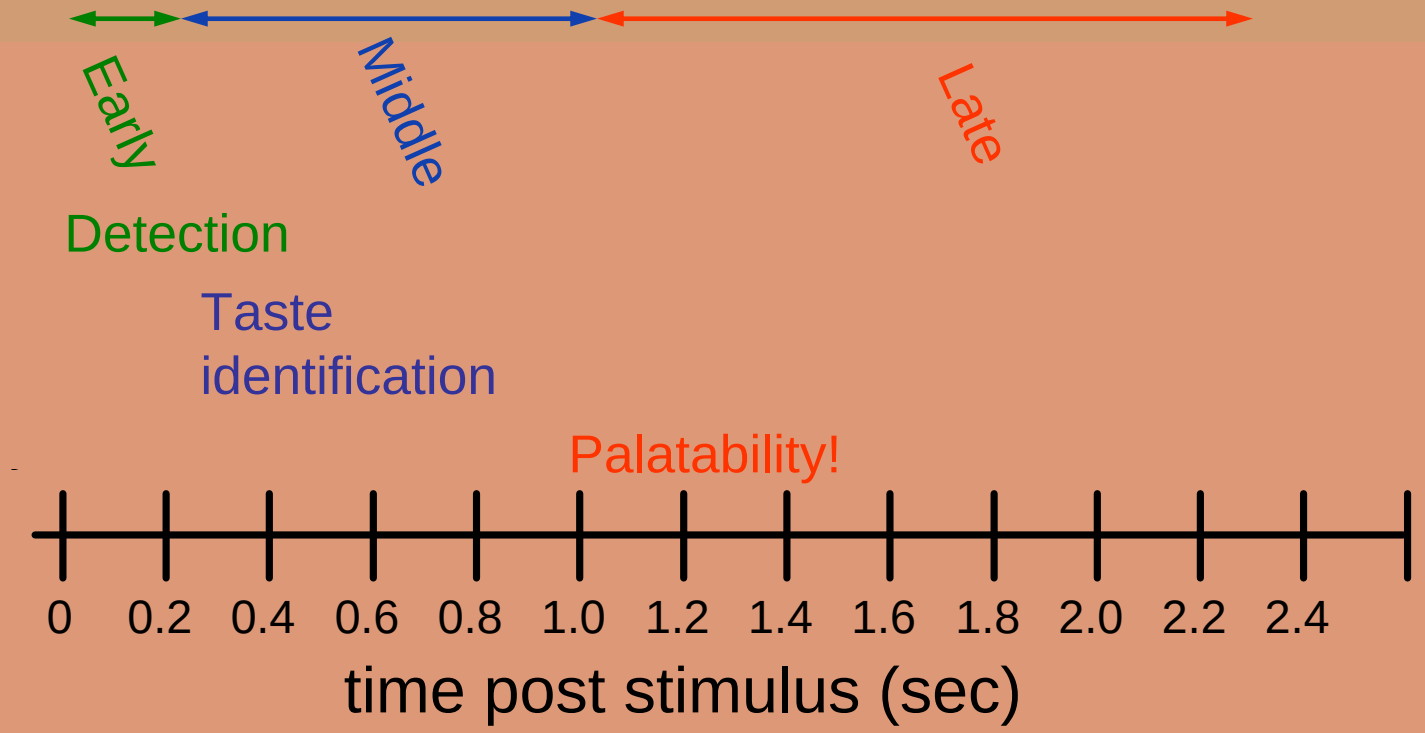


# Within-response complexity: GC temporal codes



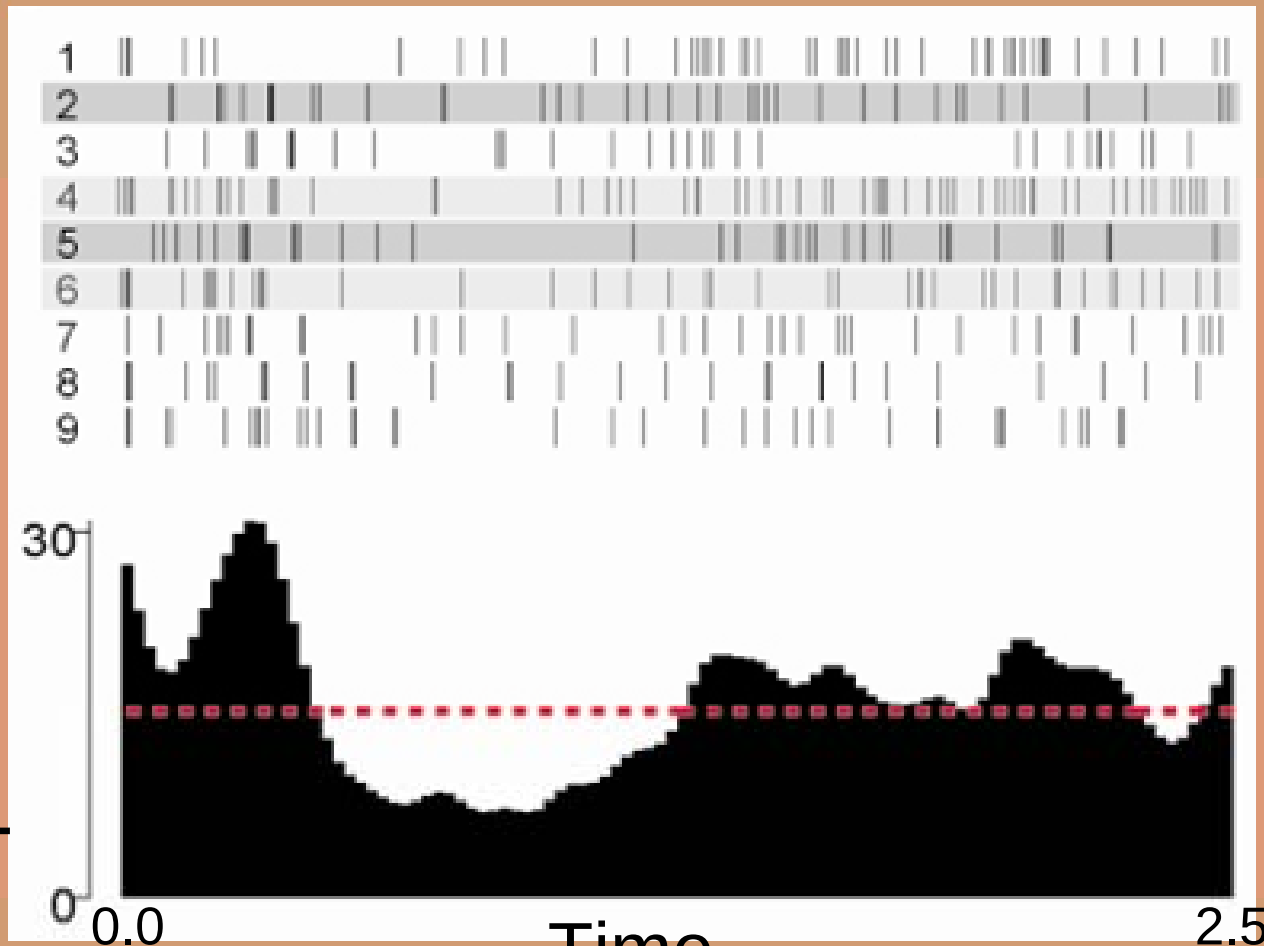

Katz *et al*, 2001

# GC temporal codes “multiplex” information about the taste stimulus



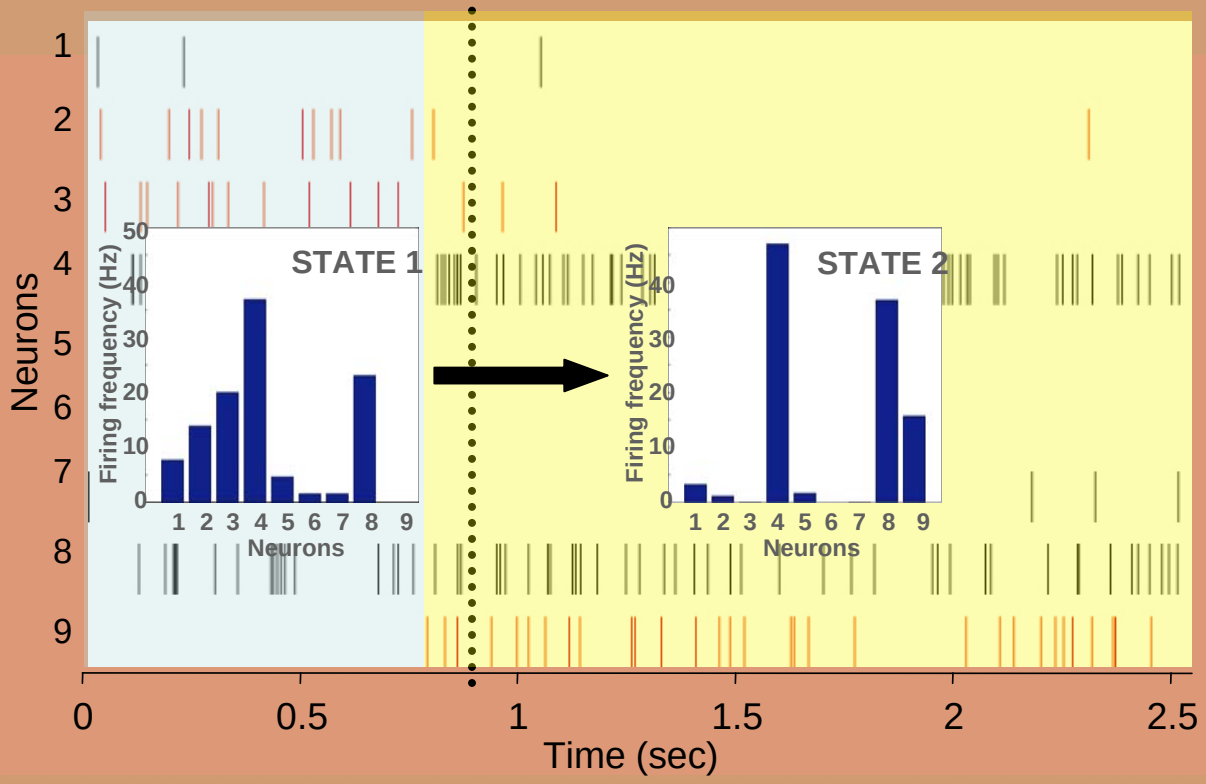

Katz *et al*, 2001

# Responses appear to change gradually in PSTHs




Jones, Fontanini, et al, submitted

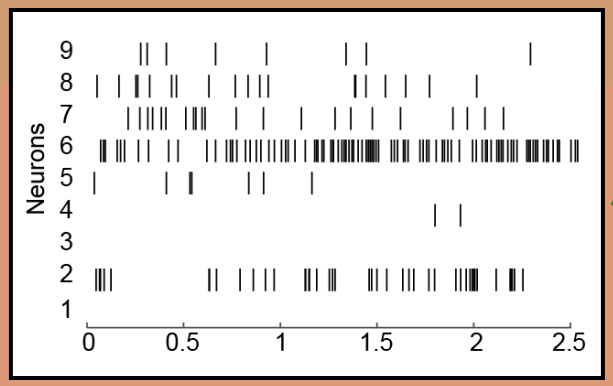
# When looked at as a population, however, single trials look much more . . . orderly



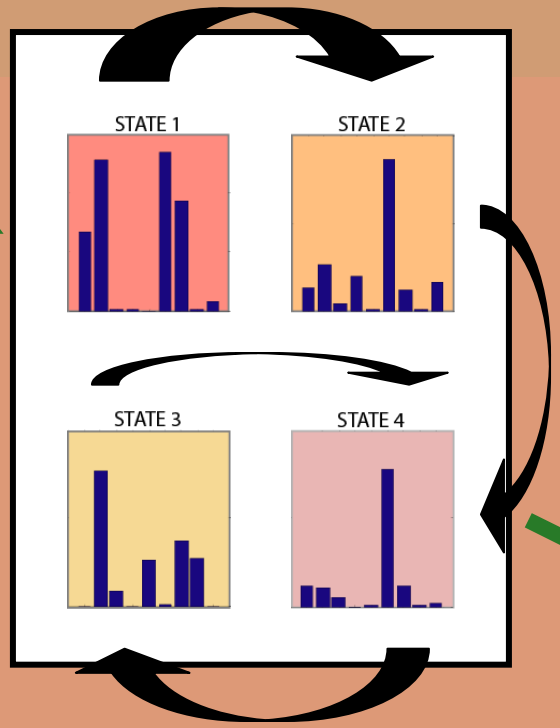

Jones, Fontanini, et al, submitted

# Hidden Markov Model (HMM)—the tool for this job

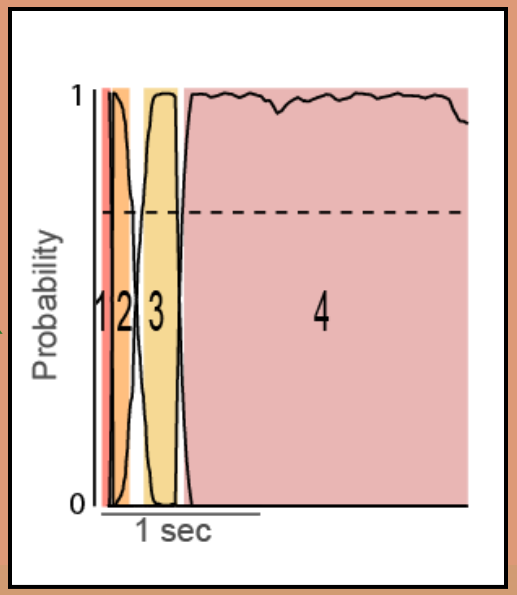
**INPUT**




**HMM**

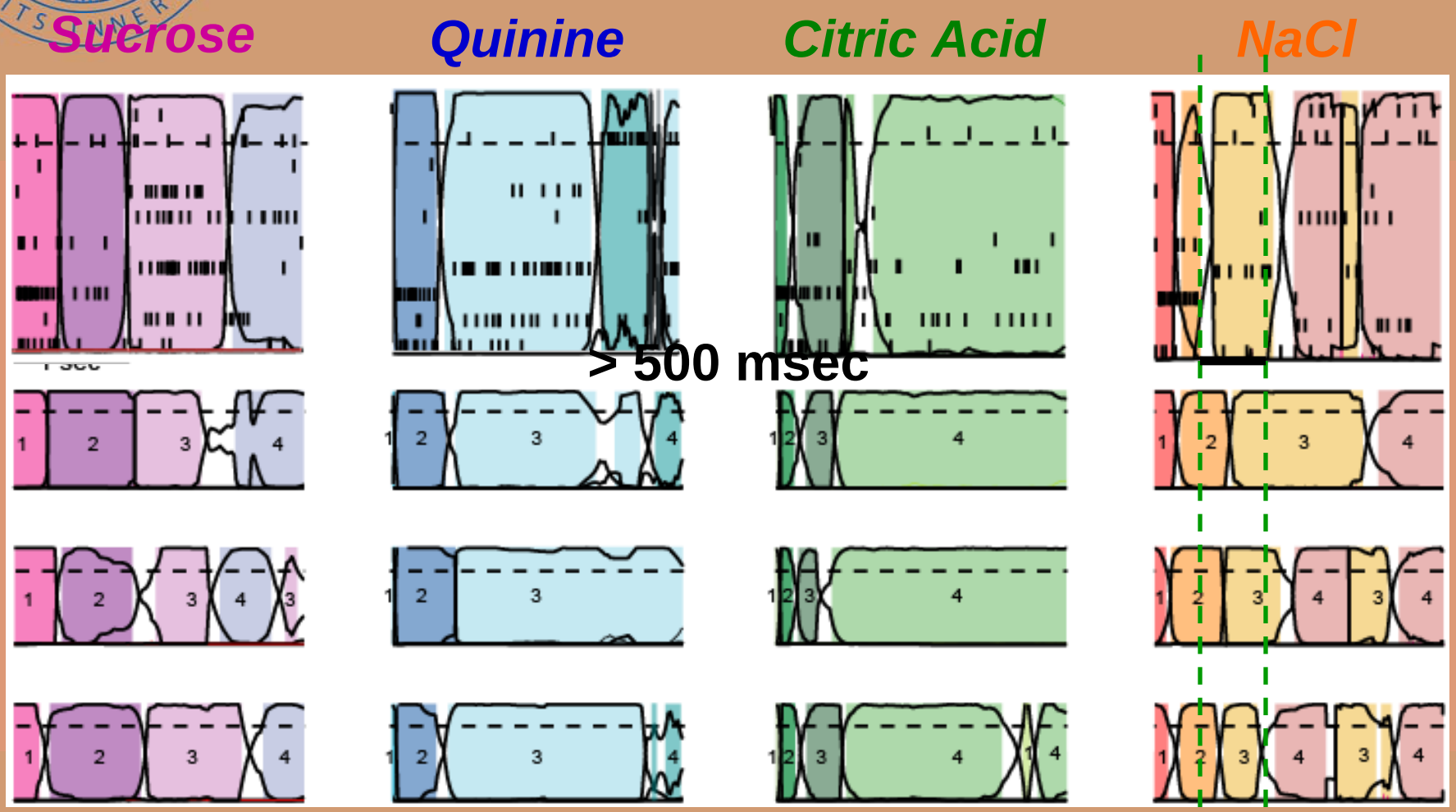



**OUTPUT**



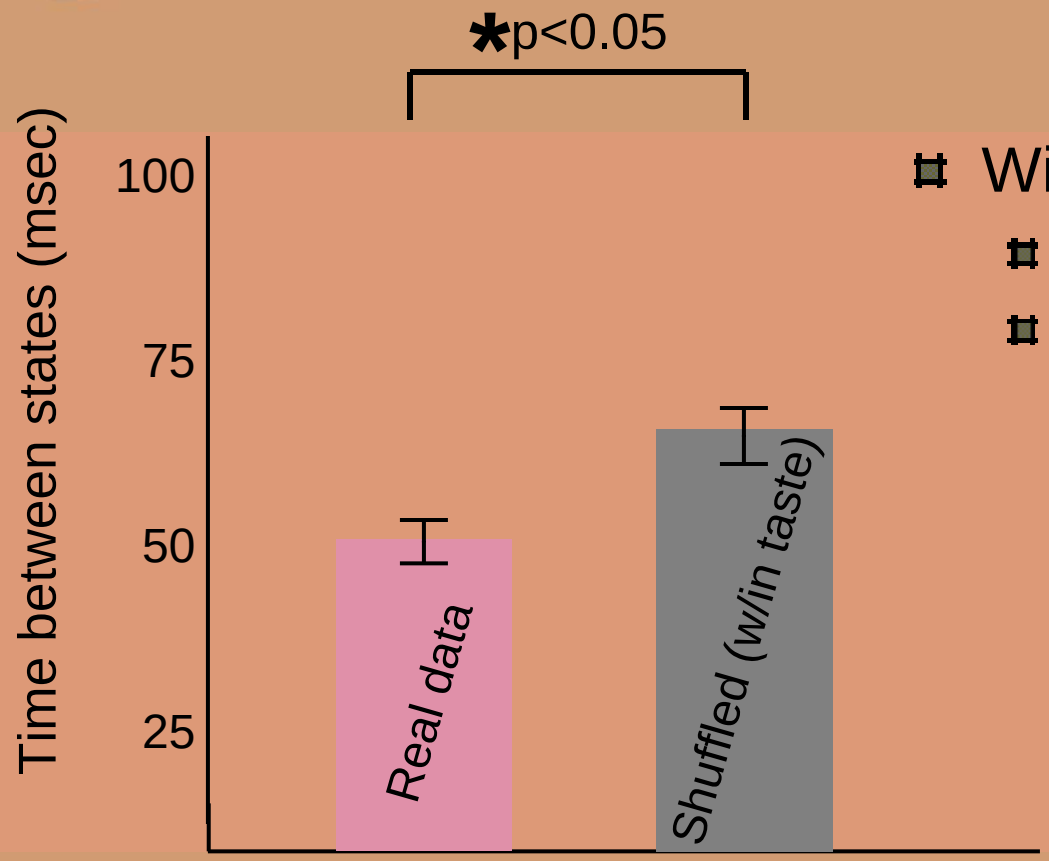

Jones, Fontanini, et al, submitted

# Ensembles go through taste-specific state sequences




Jones, Fontanini, et al, submitted

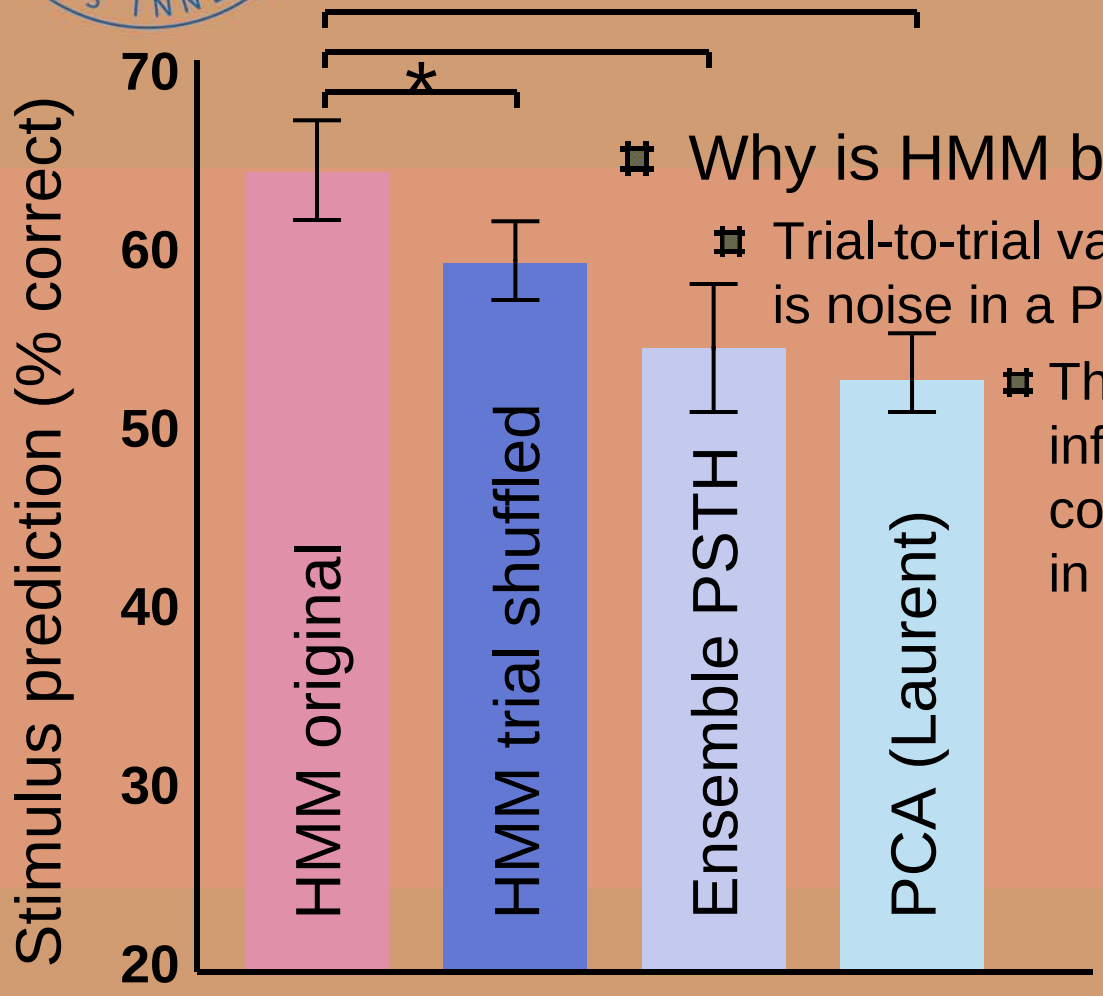
# State sequences are *bona fide*— ***analysis of transitions***




- Within-taste shuffling
  - Destroys coherence
  - Spares <u>all</u> temporal information in PSTHs

Jones, Fontanini, et al, submitted

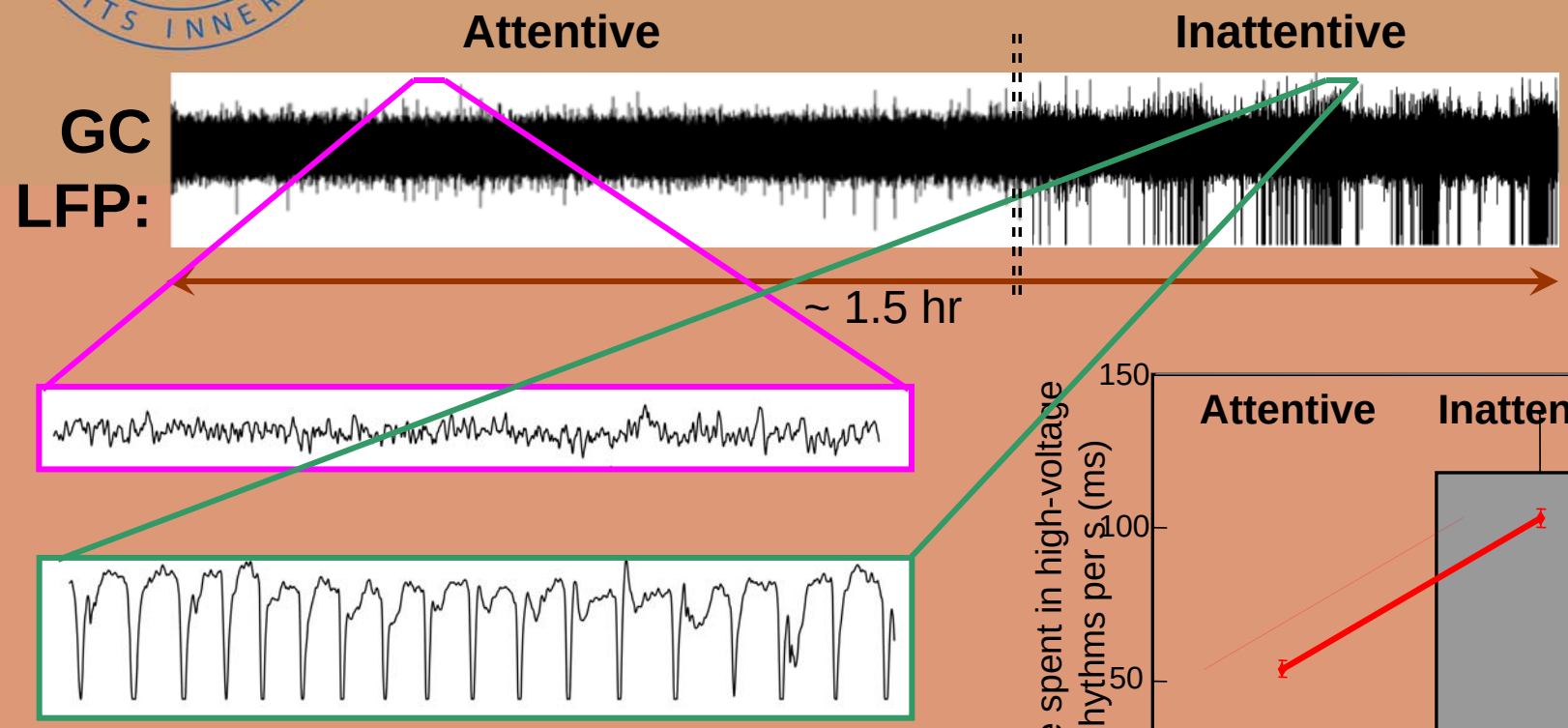
# Taste-related information is degraded by trial-averaging—***jackknife x-validation***

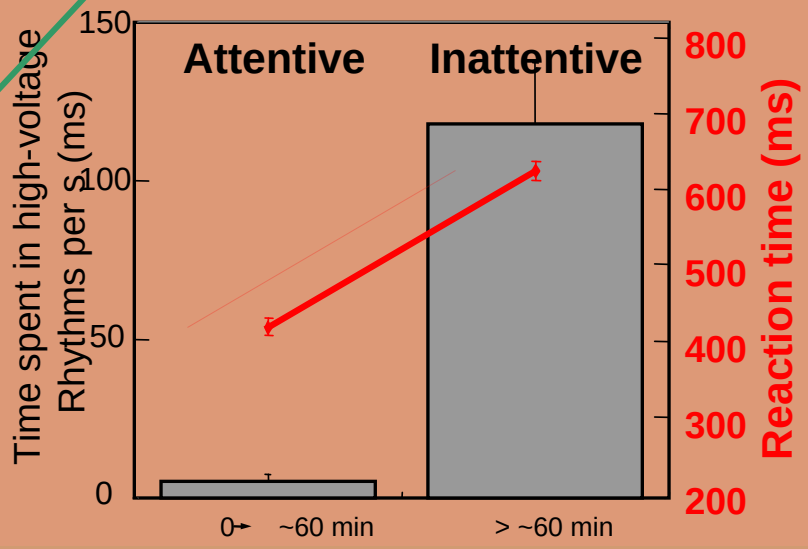



- Why is HMM better?
  - Trial-to-trial variability in response dynamics is noise in a PSTH.
    - This variability is part of the information in an analysis of the coherent hidden states exposed in the HMM.

Jones, Fontanini, et al, submitted

# Cognitive dynamics, long time-scales




- What loss of attention does: changes “taste space” to maximize palatability information.

Fontanini & Katz, 2005, 2006

# Thanks

## Brandeis

**B**ehavior
**L**earning &
**E**lectrophysiology
**C**of
**H**emosensation

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NIDCD
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