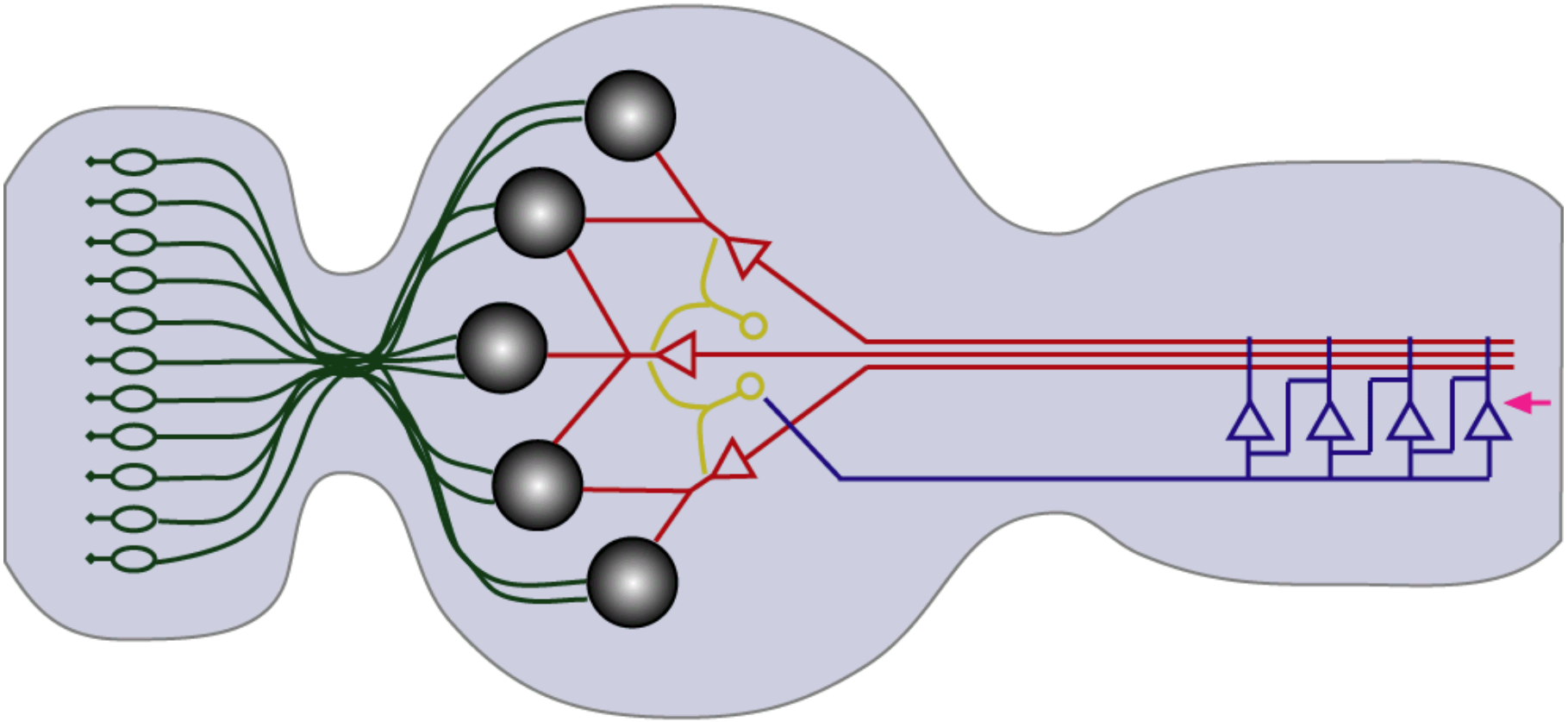
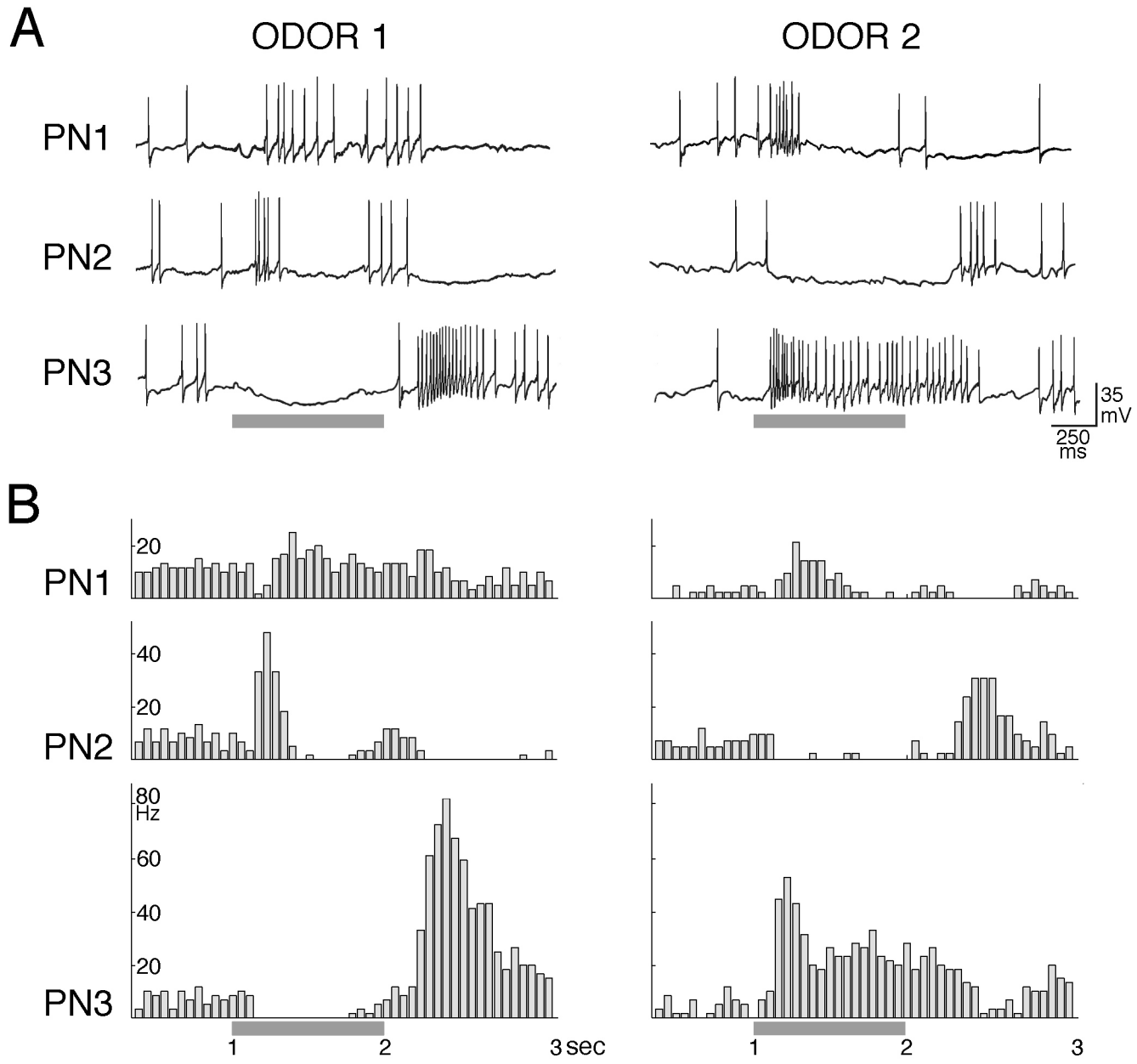
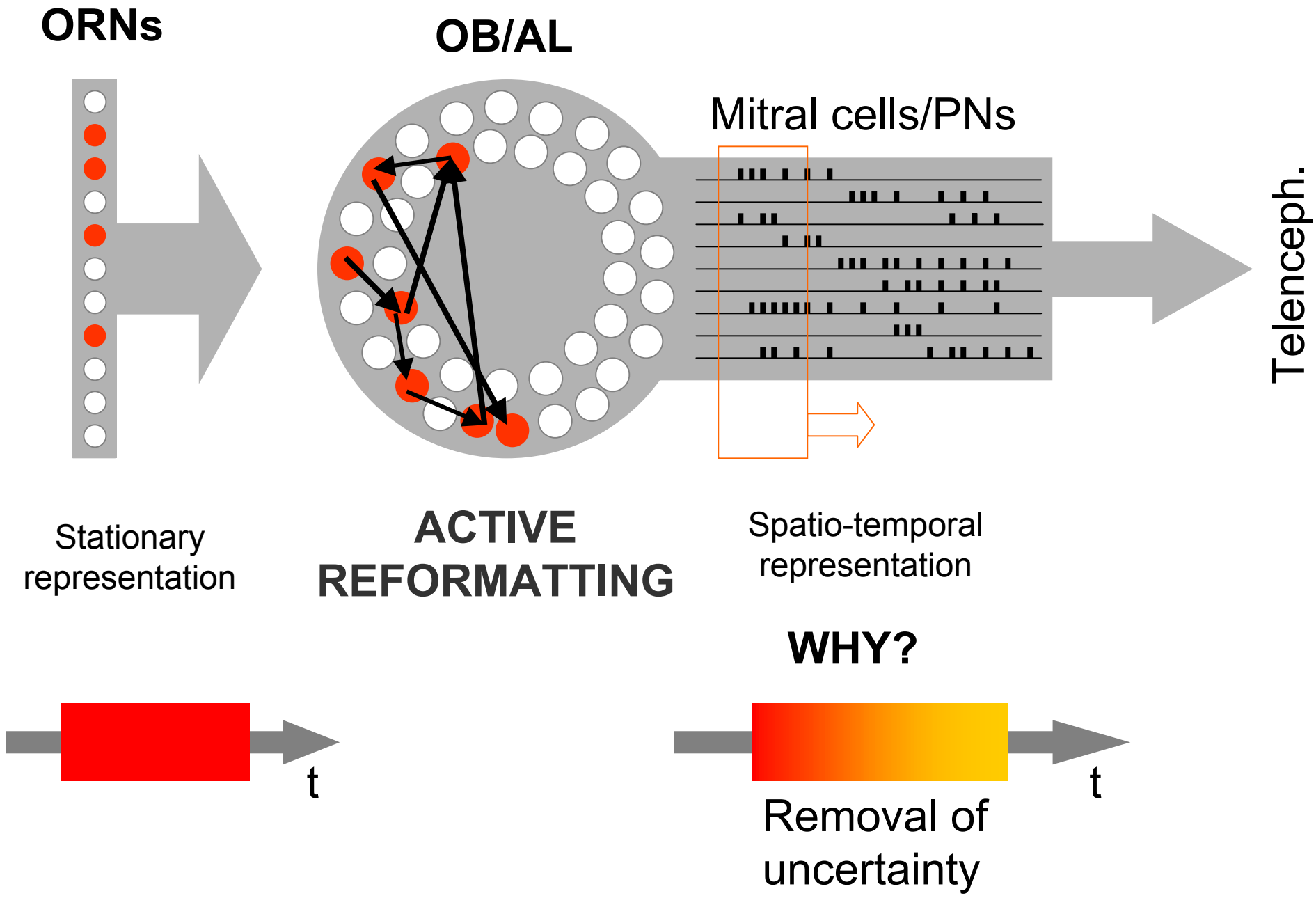
The olfactory pathway

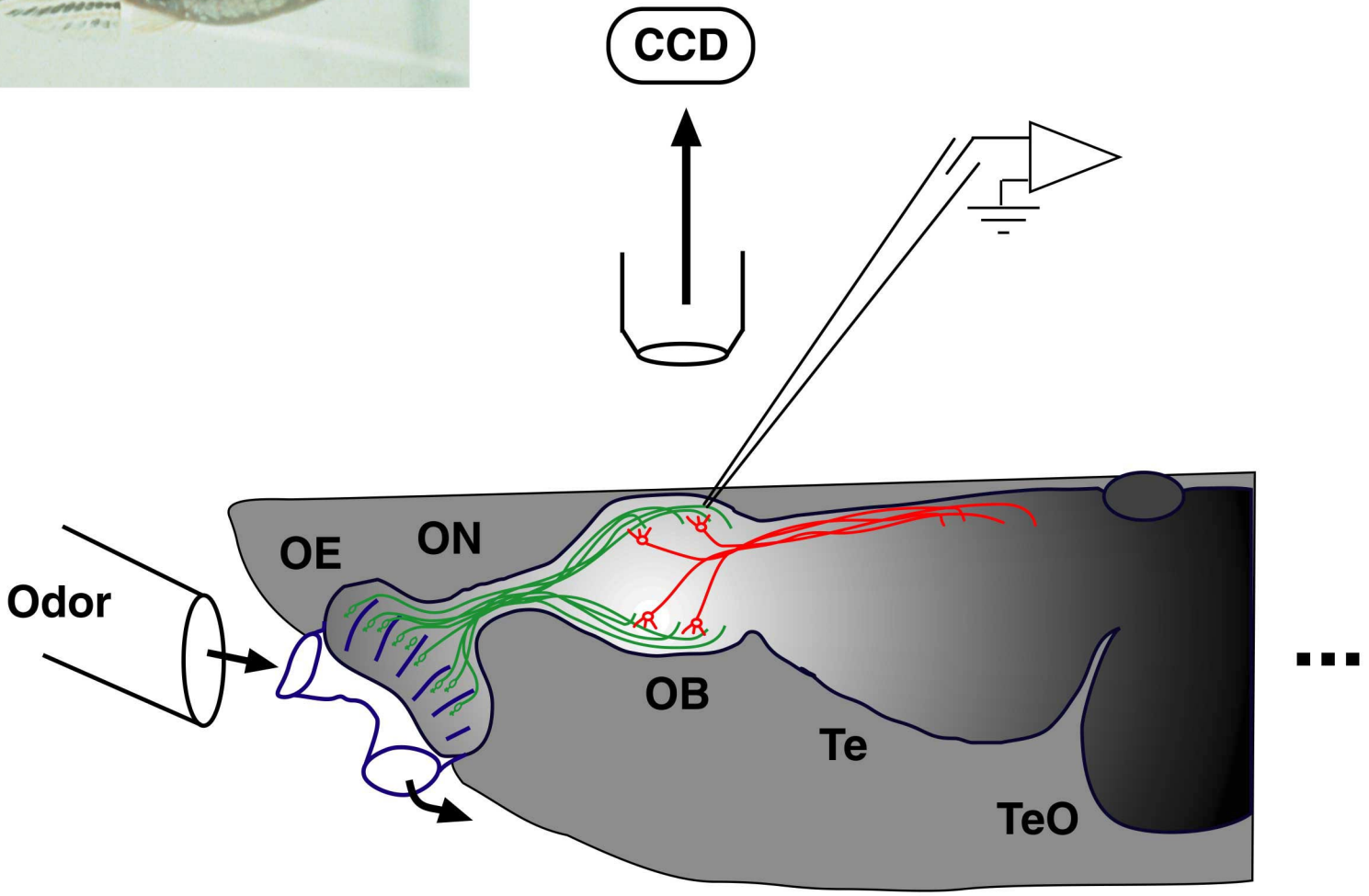


Nose OB Telencephalon


A
ODOR 1
ODOR 2
PN1
PN2
PN3
35
mV
250
ms
B
PN1
PN2
PN3
20
40
20
80
Hz
60
40
20
1
2
3 sec
1
2
3

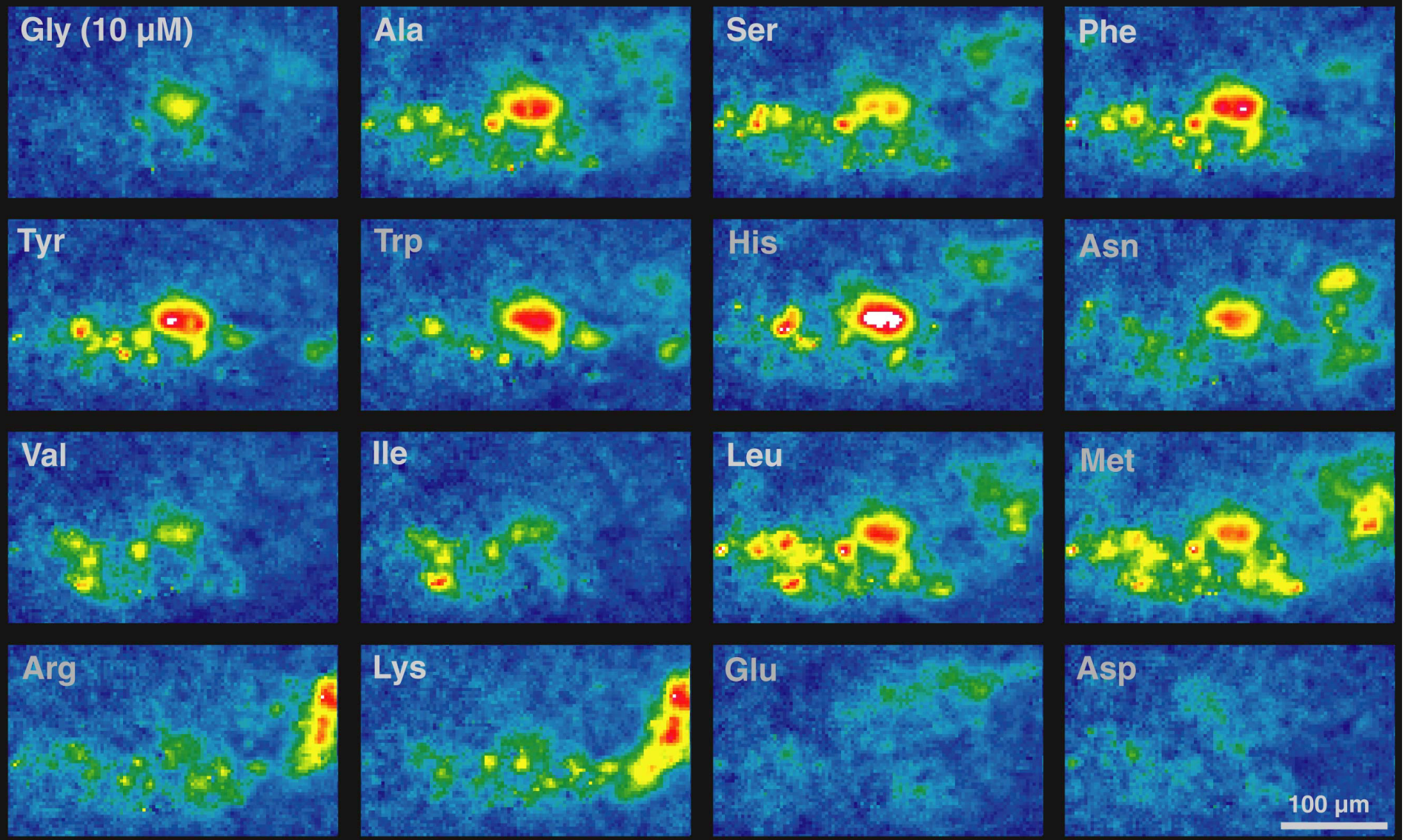

ORNs
OB/AL
Mitral cells/PNs
Telenceph.
Stationary representation
ACTIVE REFORMATTING
Spatio-temporal representation
WHY?
t
t
Removal of uncertainty

Preparation of the zebrafish brain

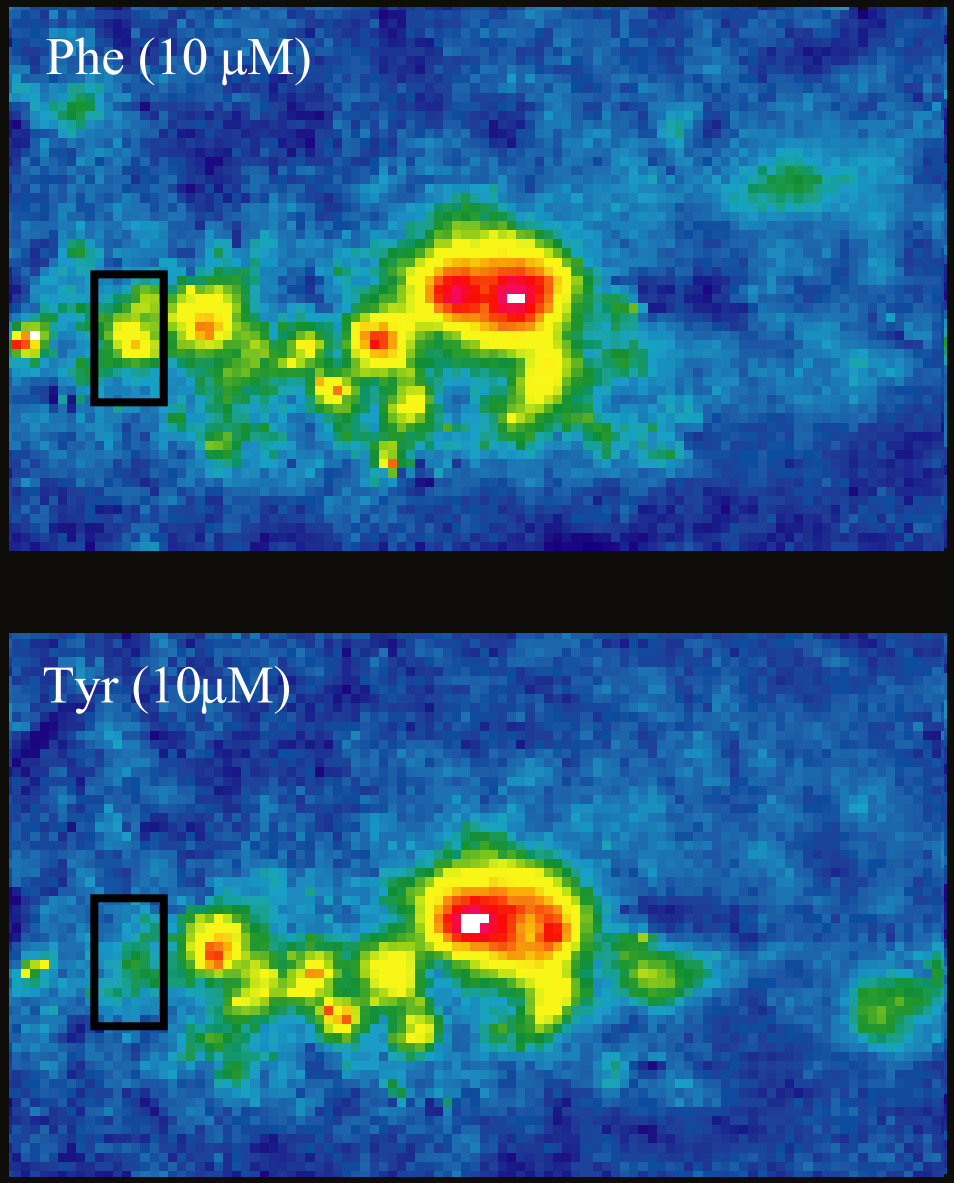


Activity patterns induced by amino acids
(tracing with calcium-sensitive dye)

Friedrich and Korshing, 1997

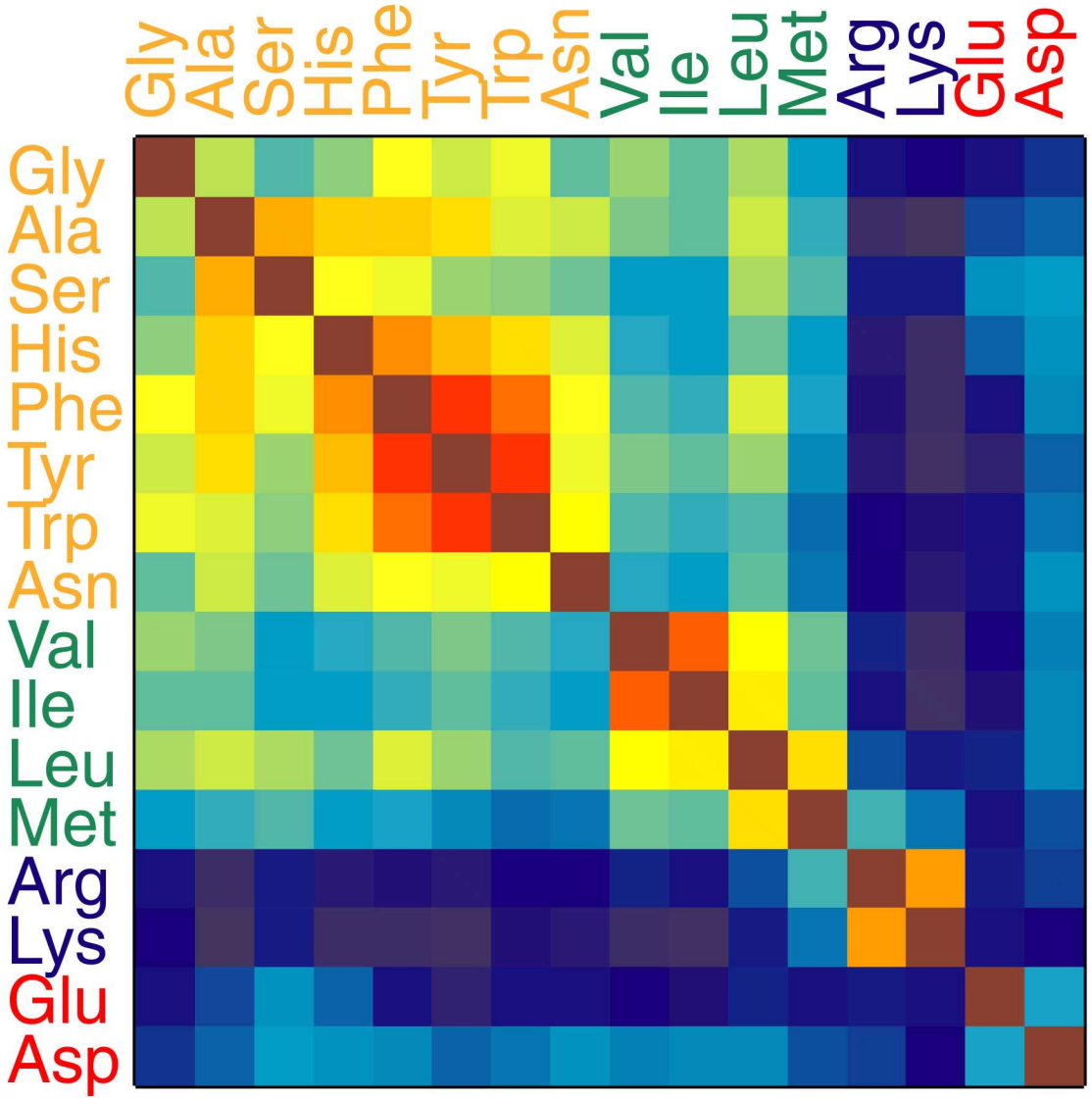


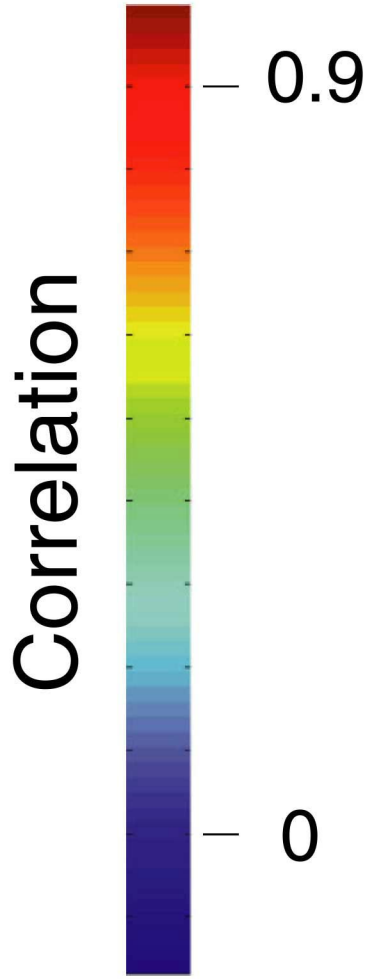
Glomerular activity patterns



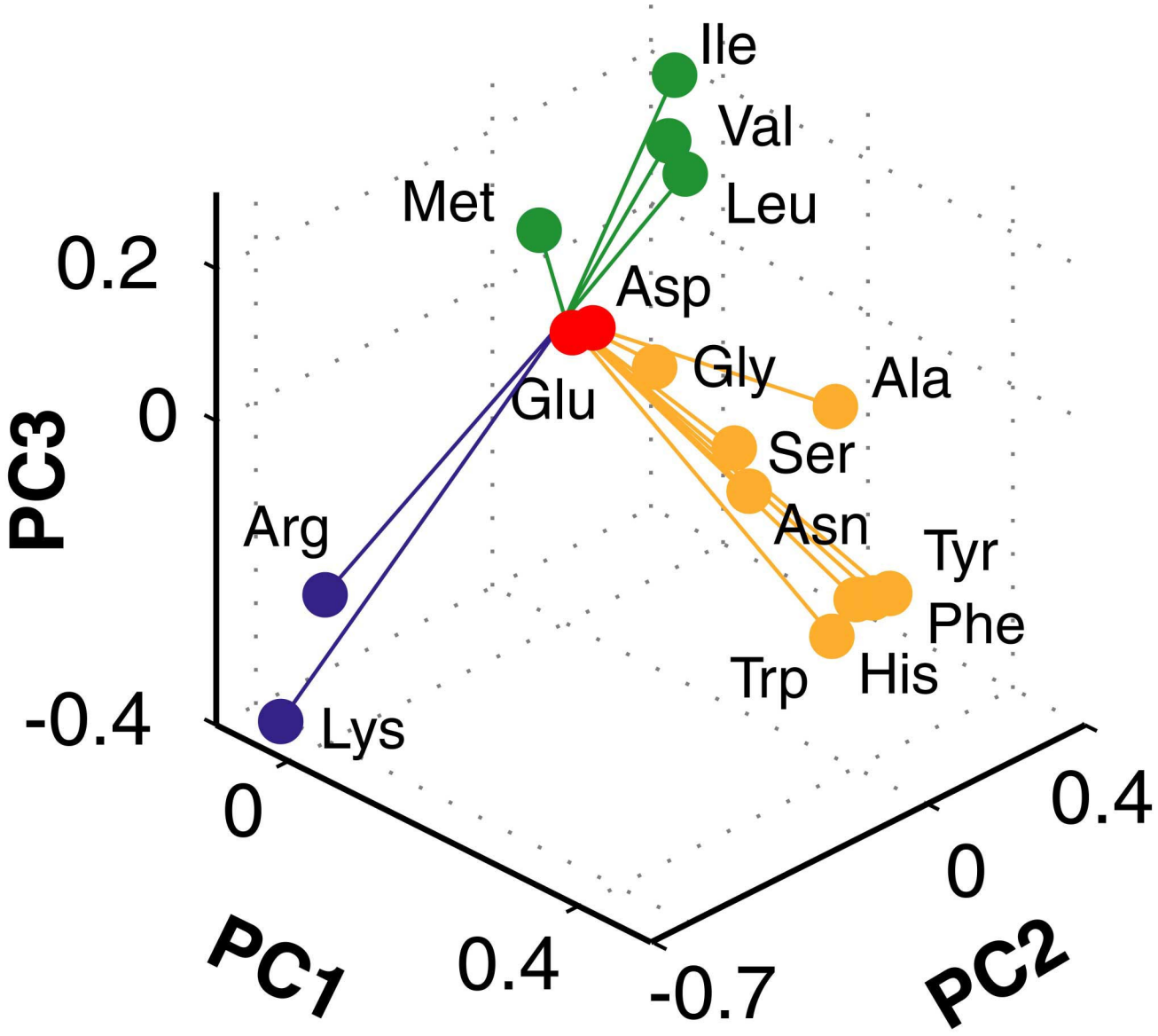
Friedrich and Korching, 1997

Correlation matrix: afferents

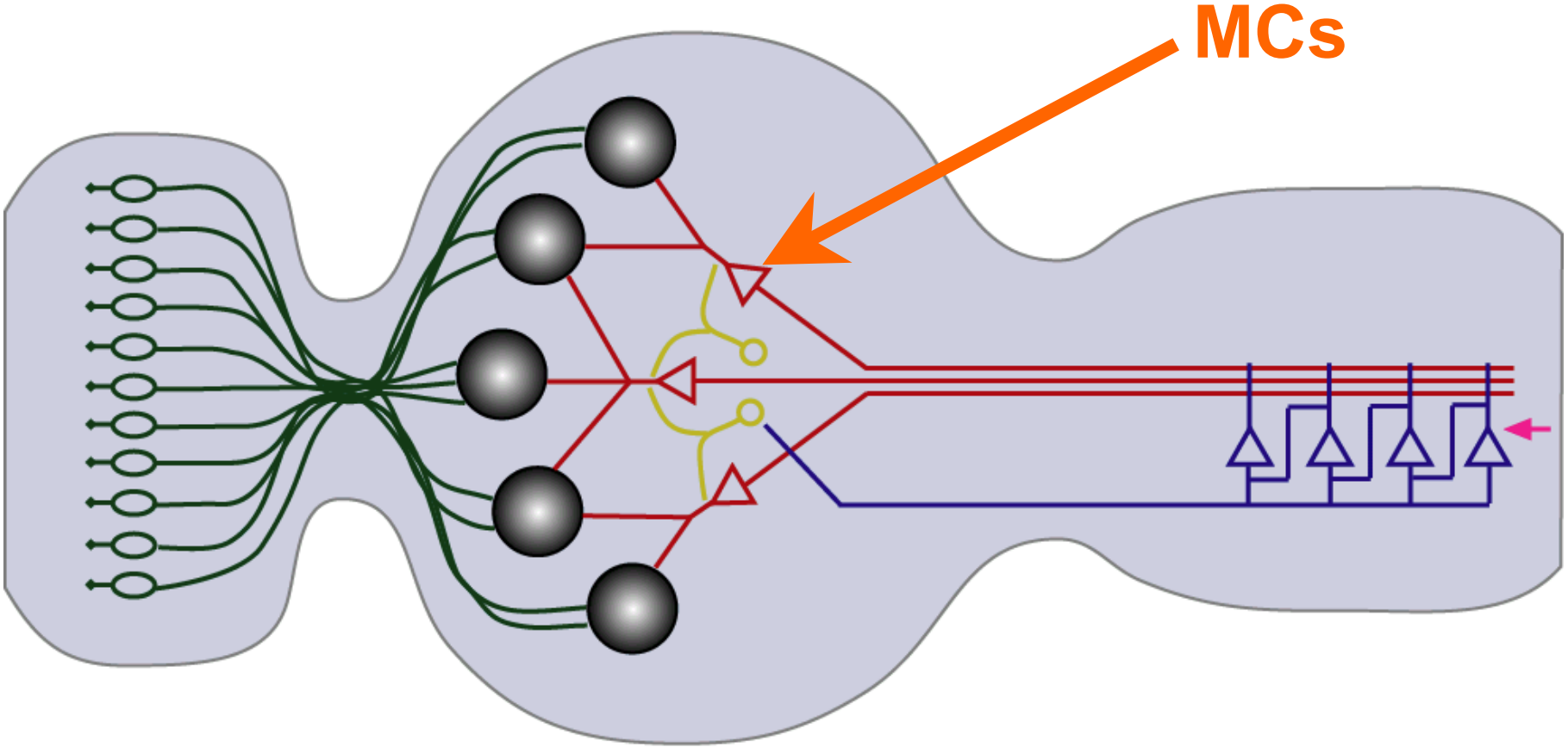




Clustering: PCA



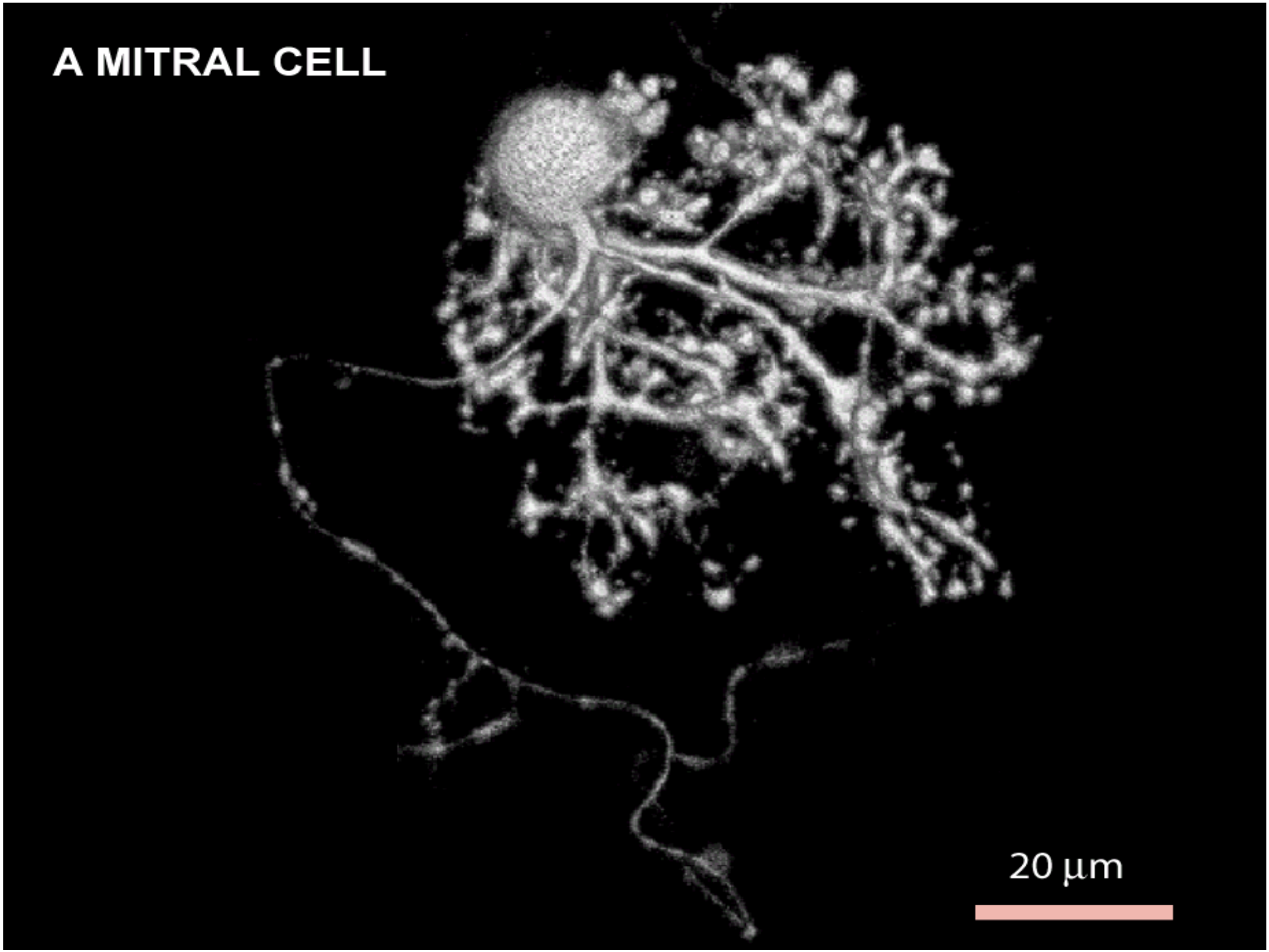
The olfactory pathway



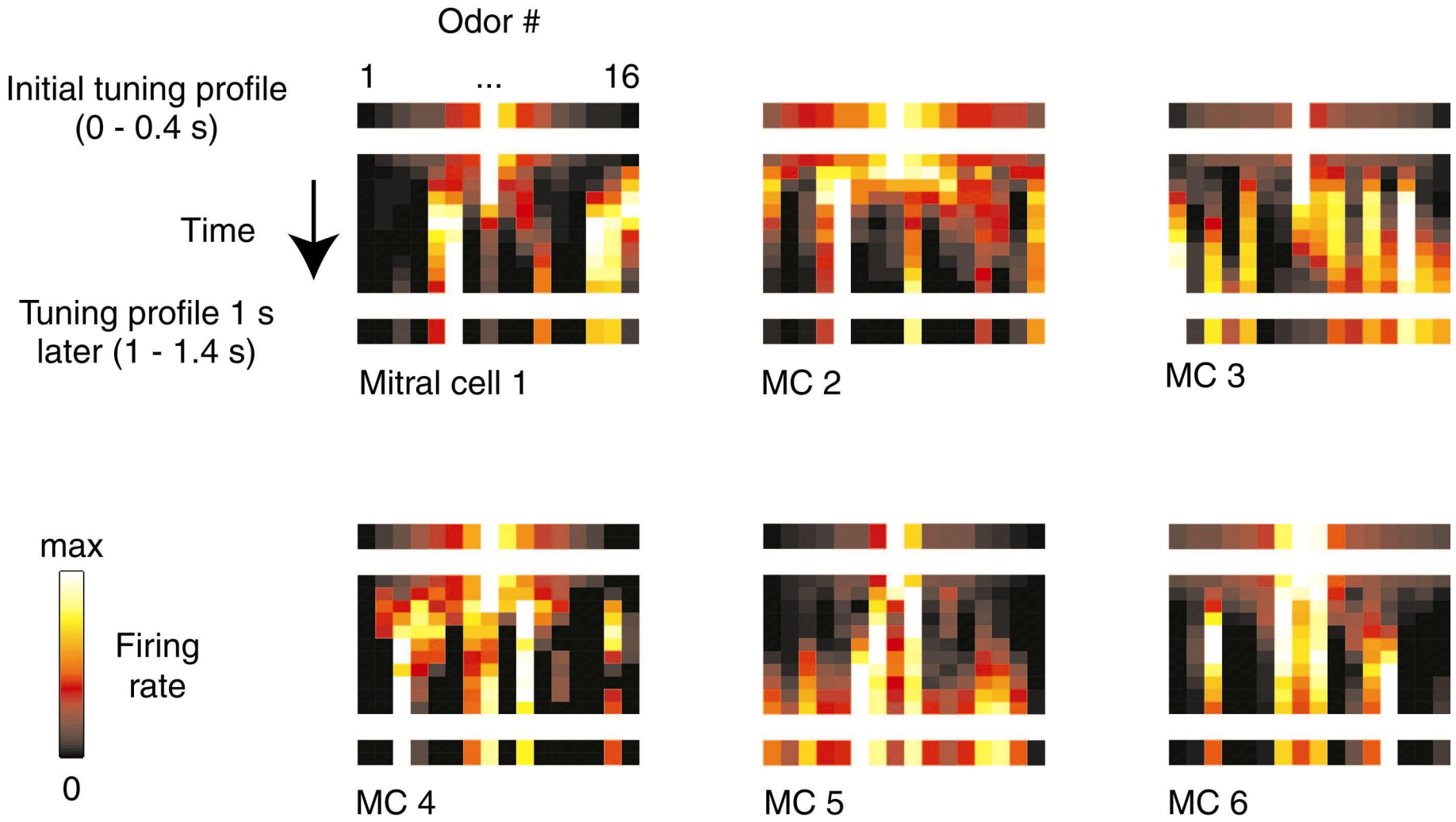
Nose

OB

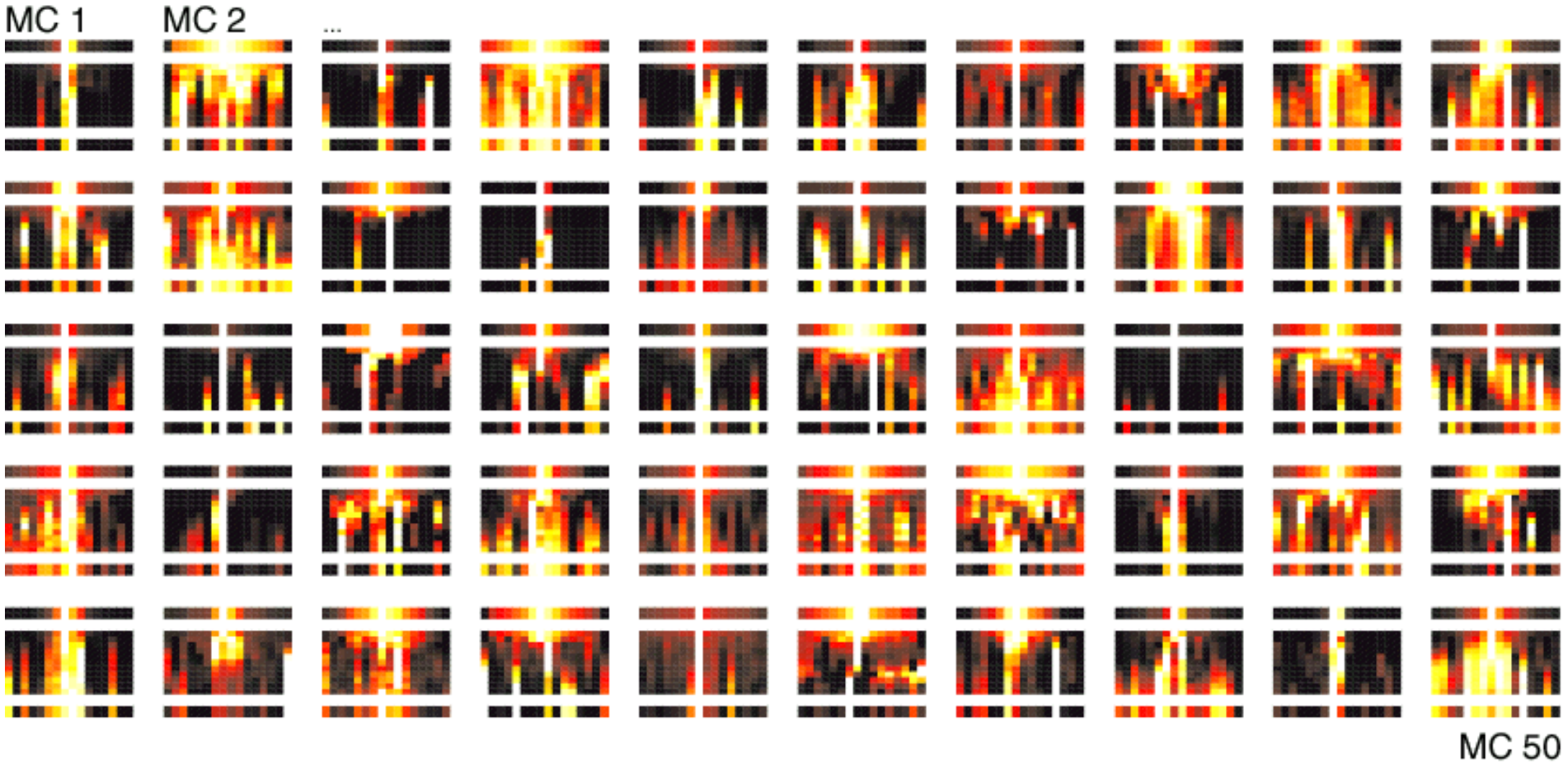
Telencephalon


A MITRAL CELL
20 µm

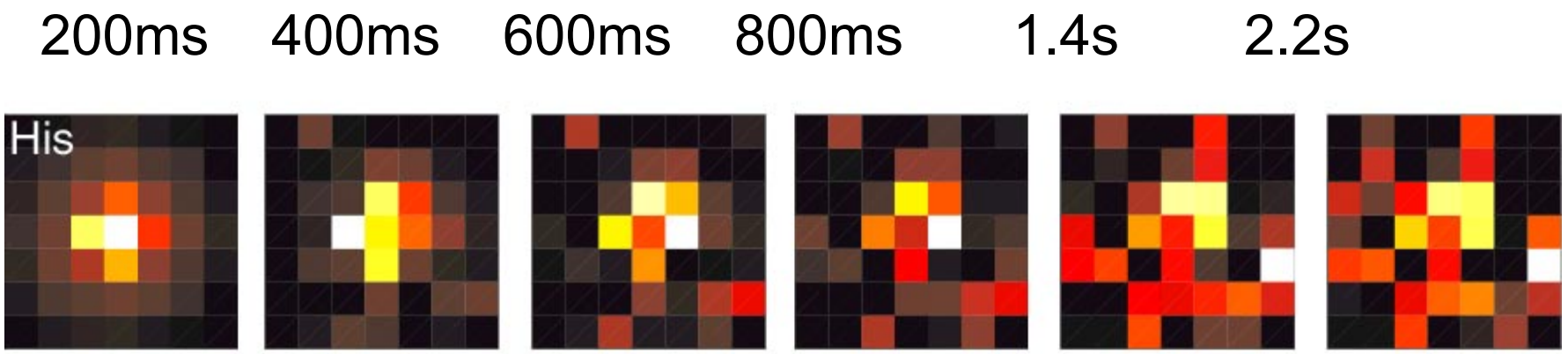
MC tuning changes over time

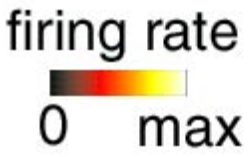


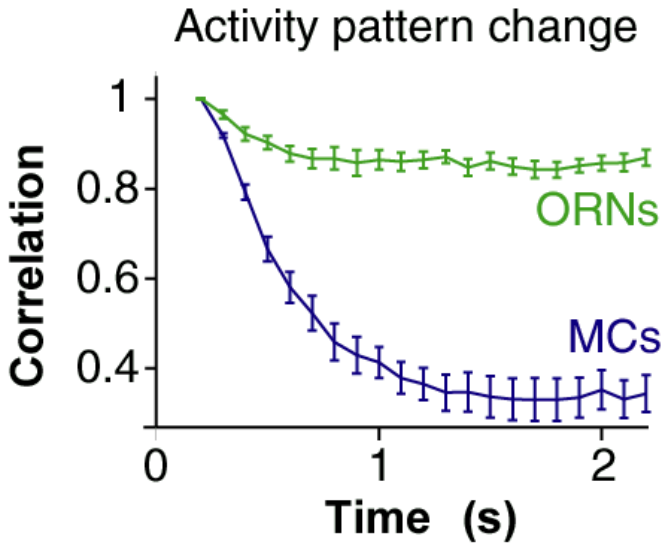
Mitral Cell Dynamic Tuning



Odor Representations by MC Assemblies:
Redistribution of Activity



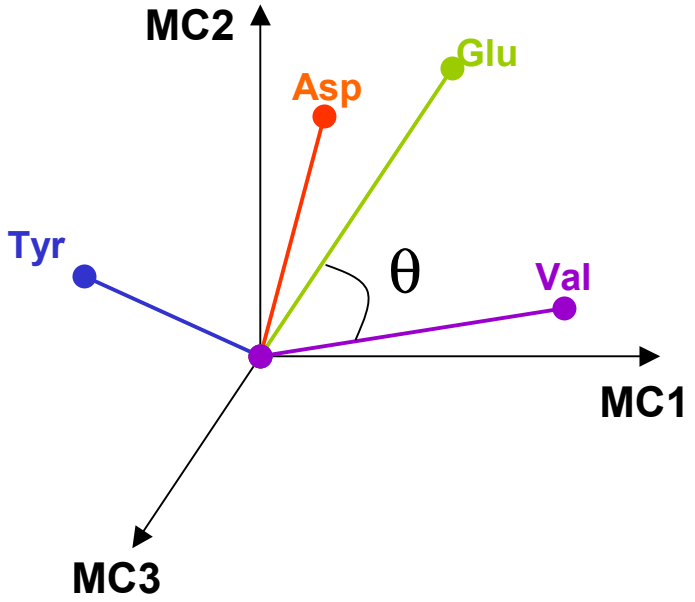




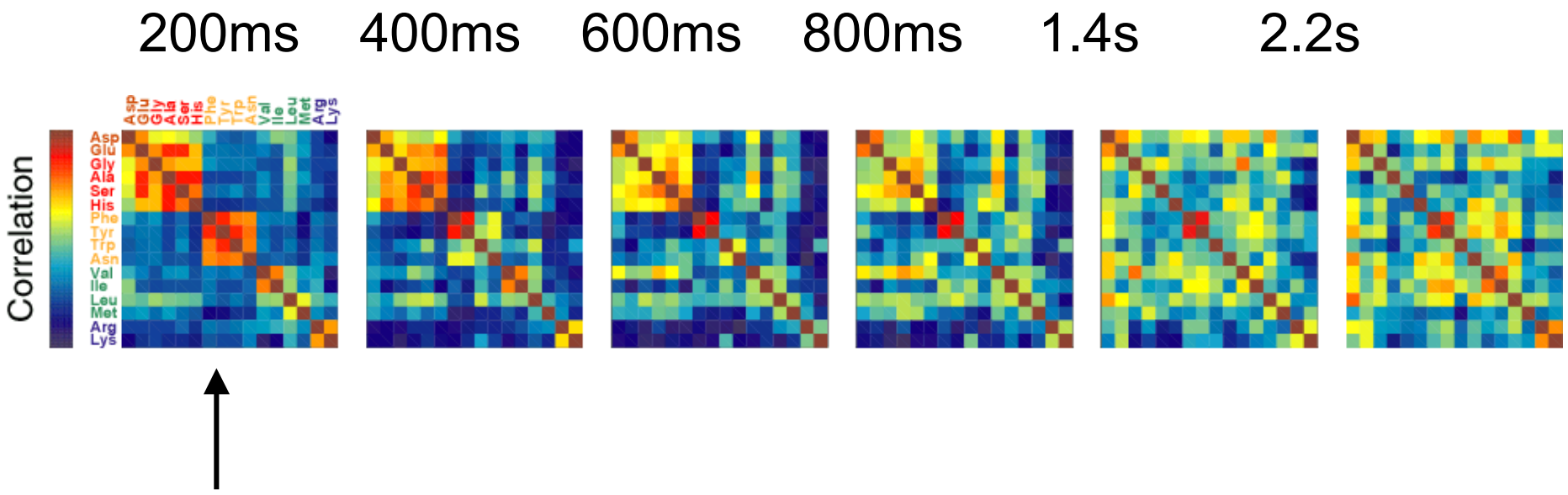
ODOR REPRESENTATIONS BY MCs

50 MCs x 16 AA odorants

1 odor: 50-D vector



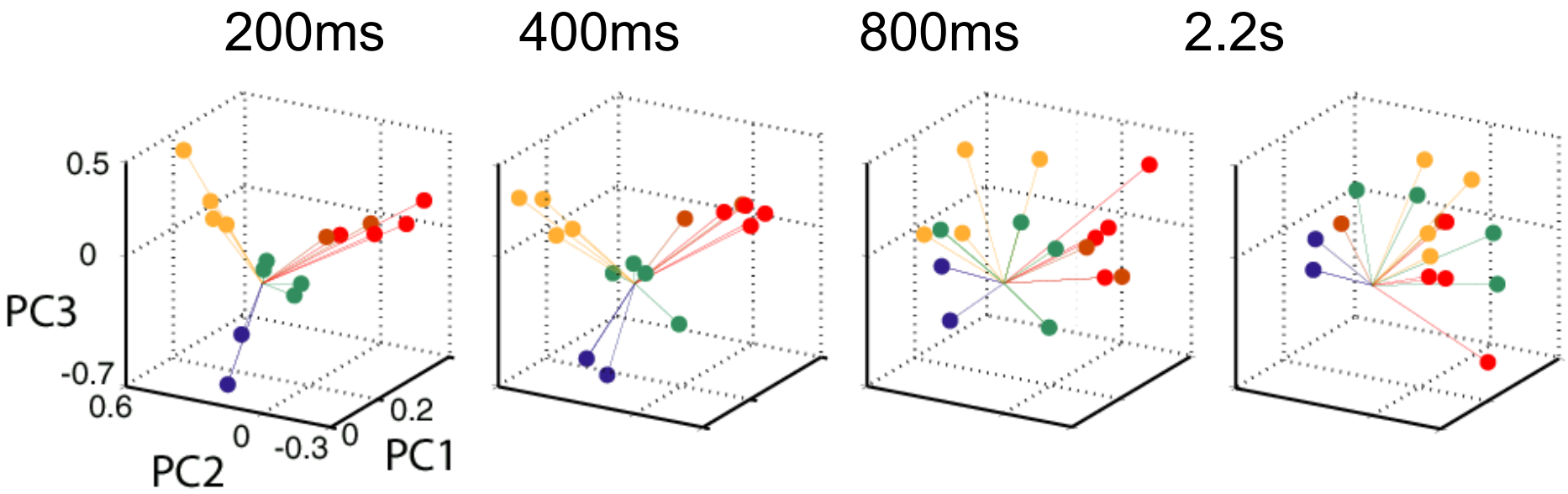
Representations across time: Declustering



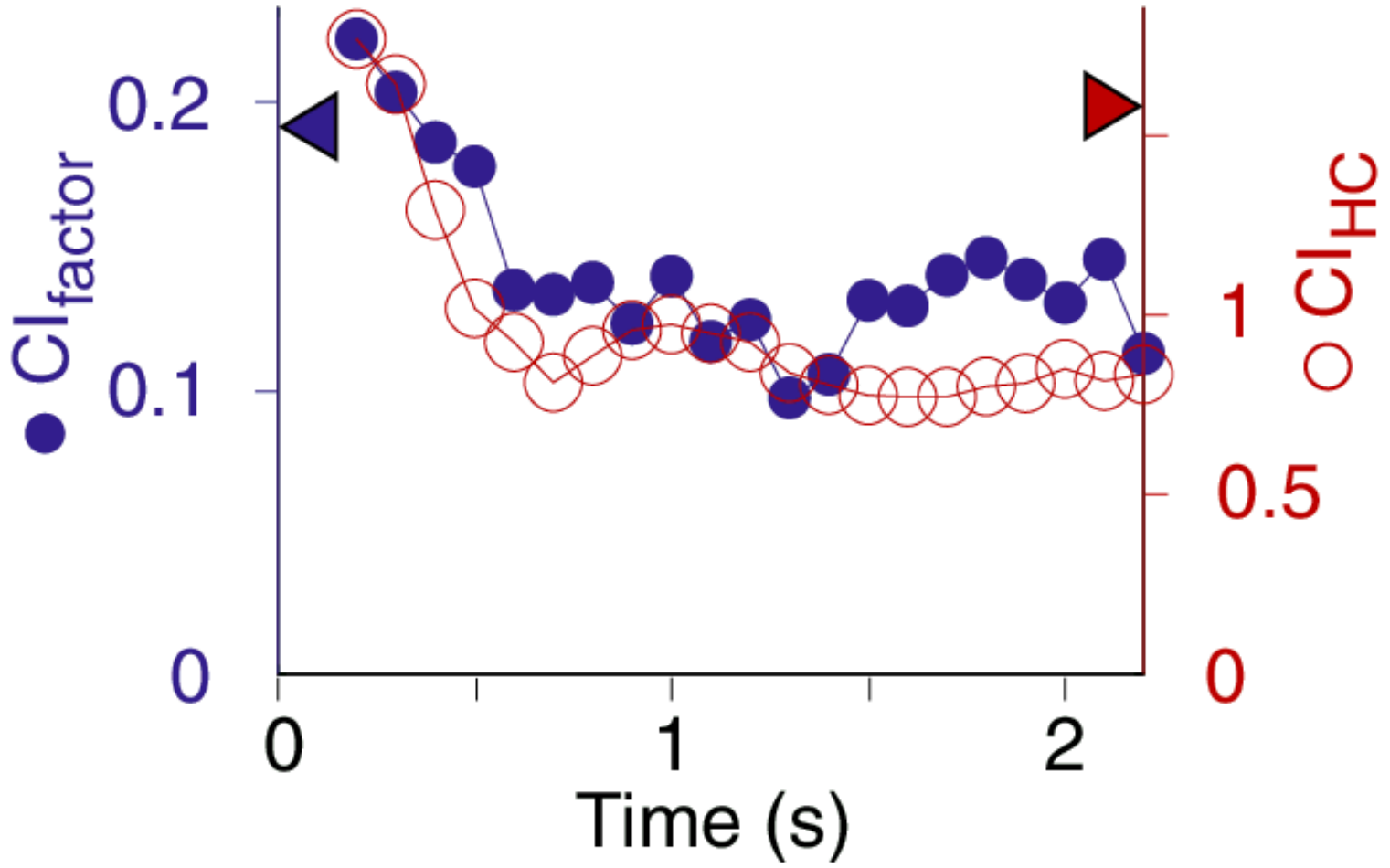
Clusters:

Chemical grouping

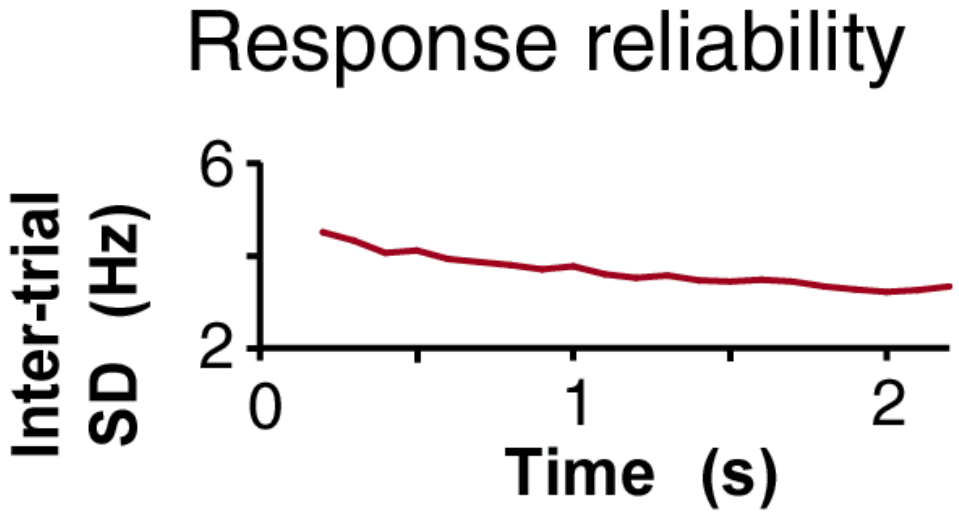
Declustering of odor representations by MCs: PCA

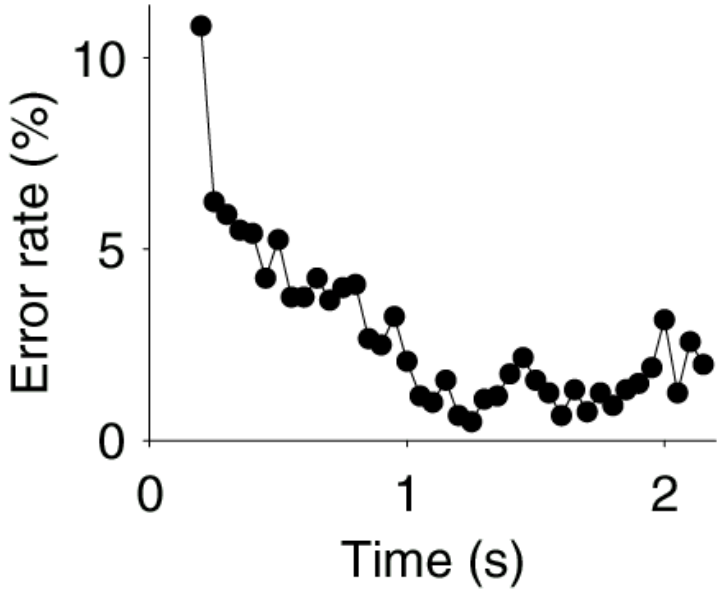


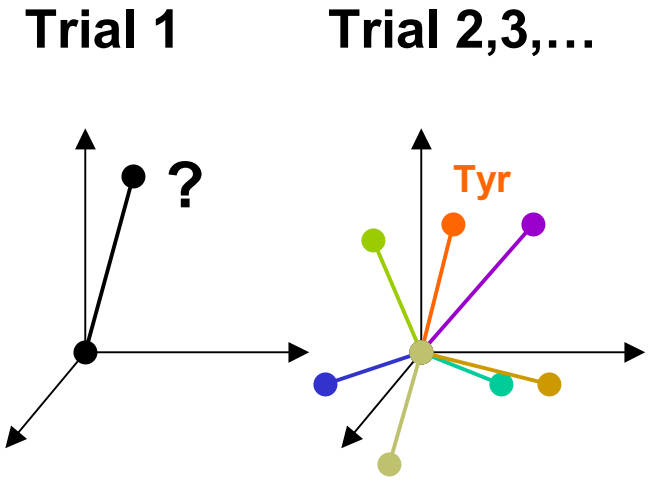
De-clustering over time

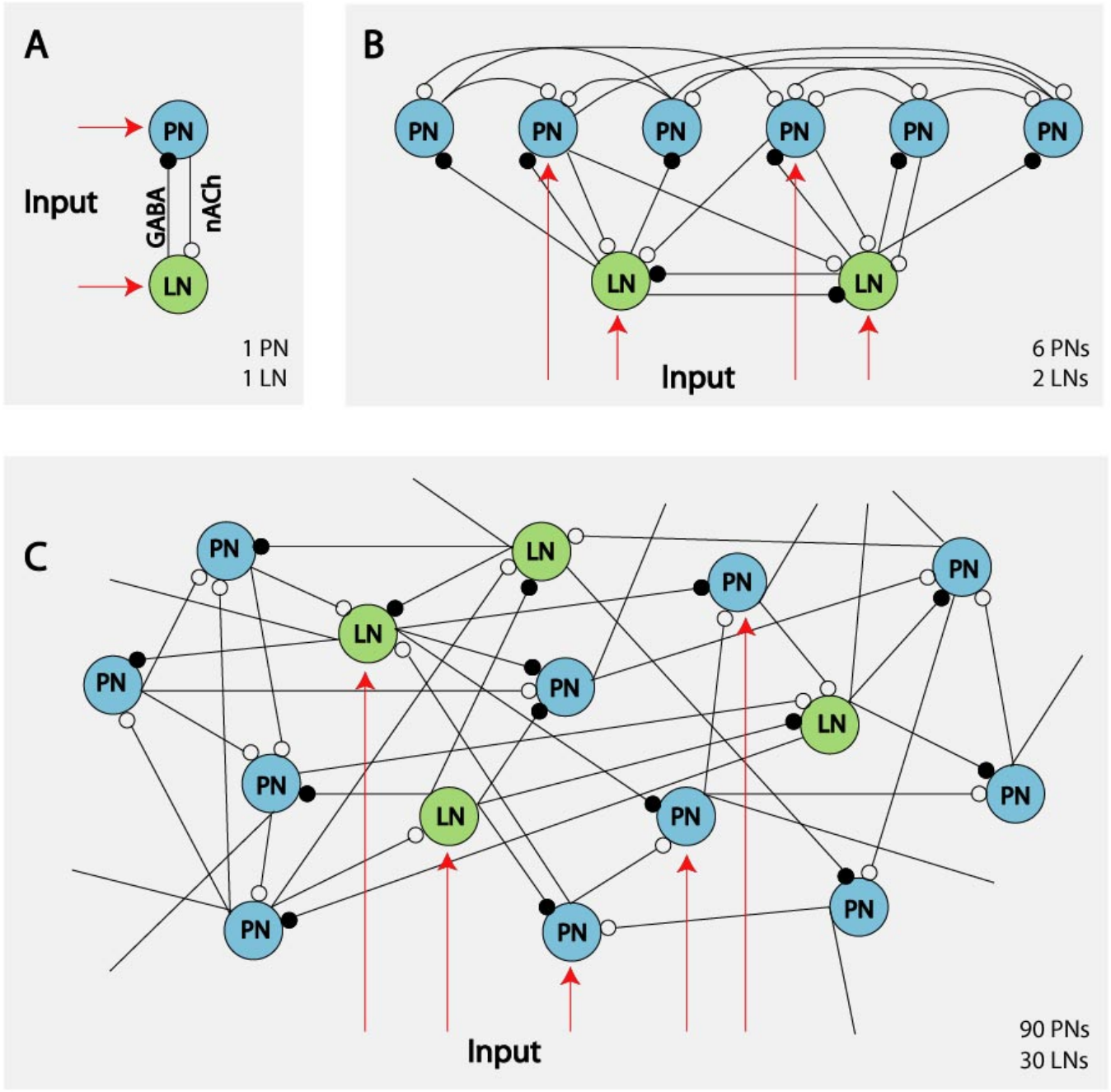


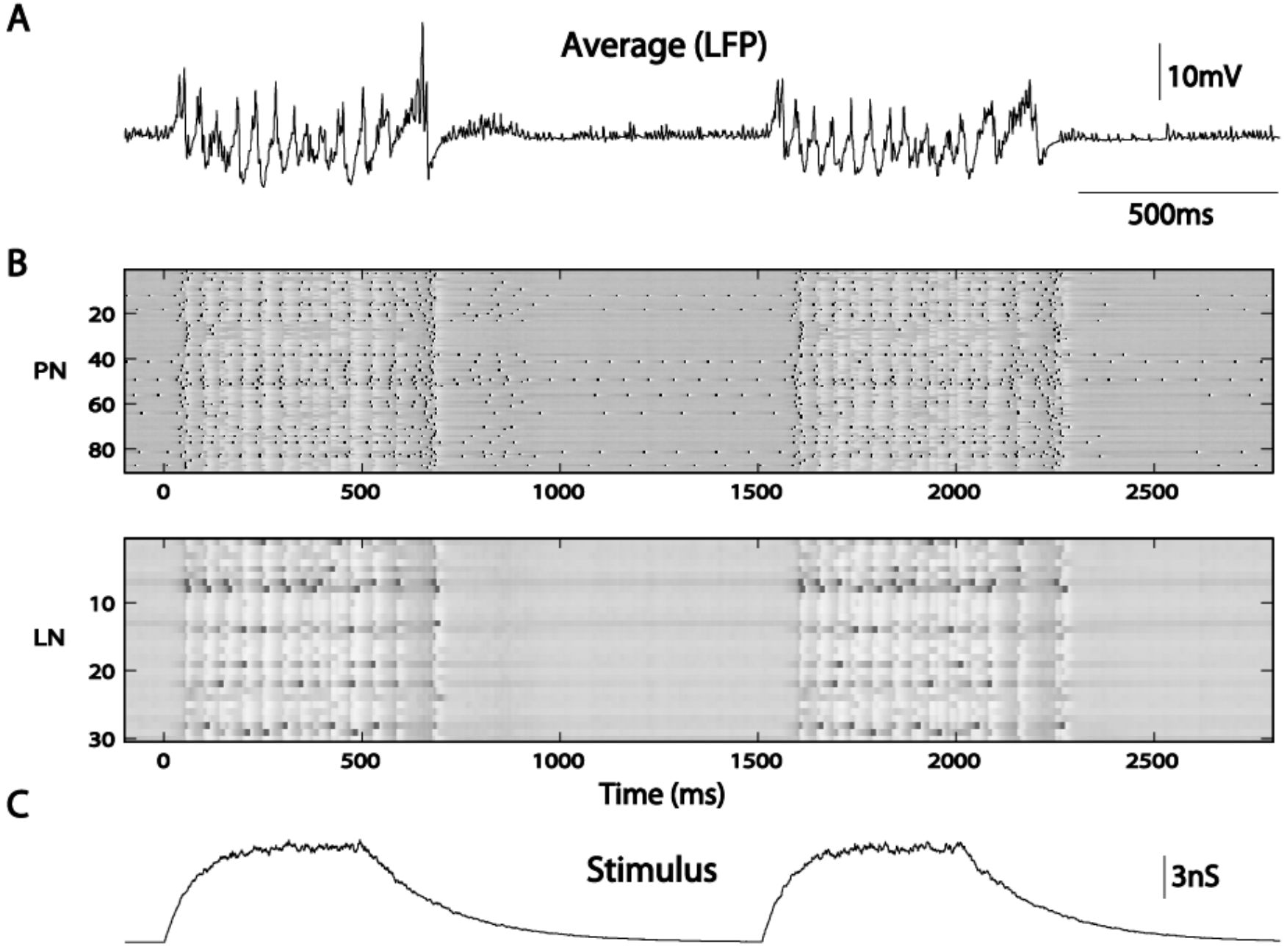
Improvement of odor identification over time



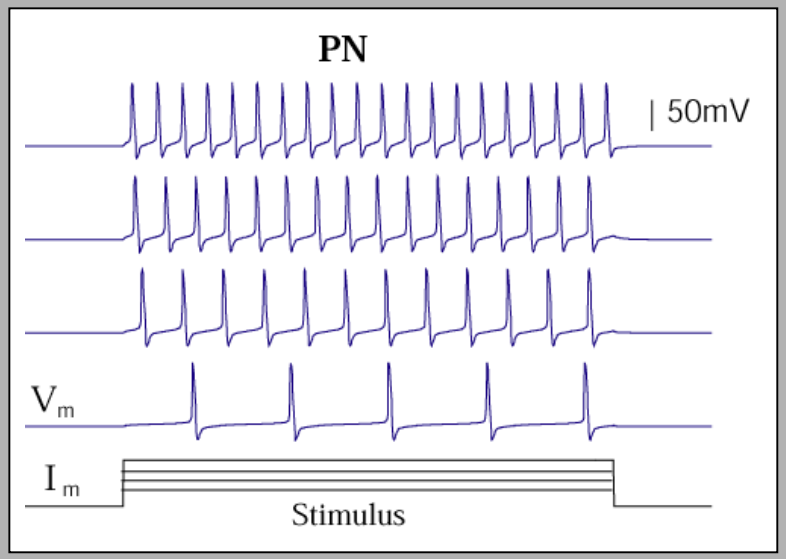


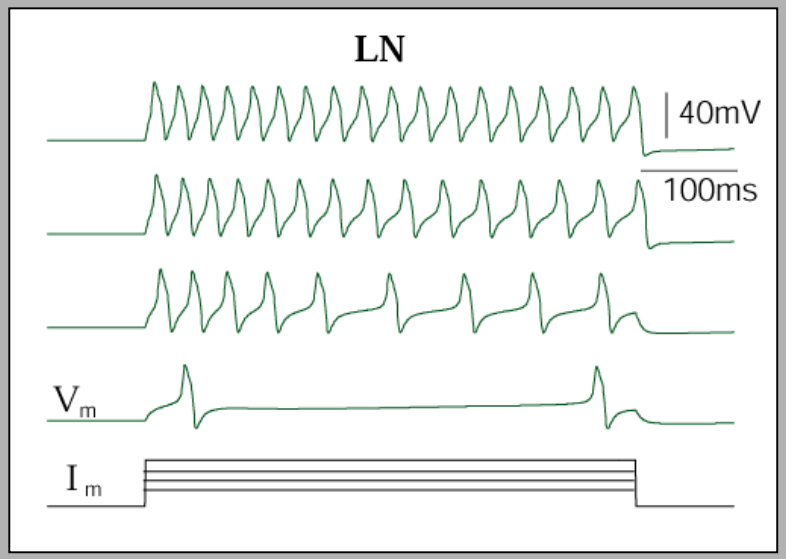



A
PN
Input
GABA
nACh
LN
1 PN
1 LN
B
PN
PN
PN
PN
PN
PN
LN
LN
Input
6 PNs
2 LNs
C
PN
LN
PN
PN
LN
PN
PN
LN
PN
PN
LN
PN
PN
PN
PN
Input
90 PNs
30 LNs


A
Average (LFP)
10mV
500ms
B
PN
20
40
60
80
0
500
1000
1500
2000
2500
LN
10
20
30
0
500
1000
1500
2000
2500
Time (ms)
C
Stimulus
3nS

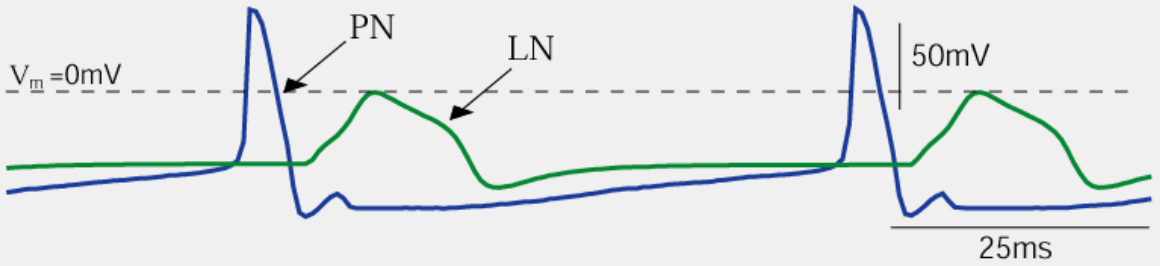
Isolated neurons respond to current pulses



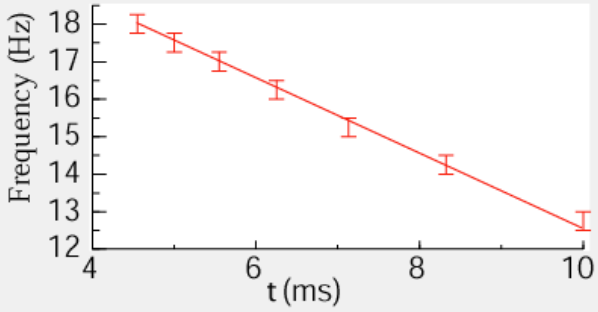


Oscillations in reciprocally connected LN-PN pairs

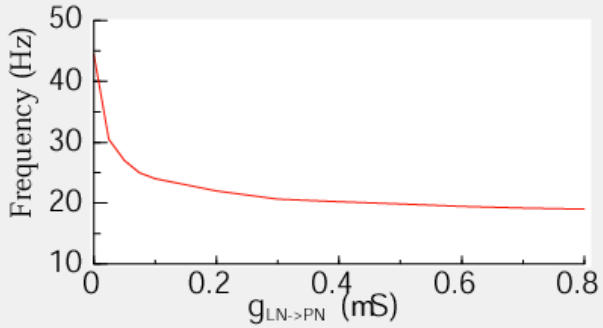
LN-PN pair



LN-PN inhibitory synapse



decay time



conductance

LN-LN inhibition contributes to slow temporal pattern complexity