Rat Olfactory Bulb Mitral Cells Receive Sparse Glomerular Inputs

Neuron, Volume 59

Supplemental Data

Rat Olfactory Bulb Mitral Cells Receive Sparse Glomerular Inputs

Antoniu L. Fantana, Edward R. Soucy, and Markus Meister

Figure S1. Response prediction under varying signal detection thresholds

We varied the thresholds for detecting an odor response among glomeruli (A) or among mitral cells (C), and evaluated the resulting predictions for the responsivity of mitral cells (B and D), using the methods of Figure 6 and an integration radius of 880 μm.

(A) Left: Sample intrinsic image of an odor response. (i) The same image clipped with the threshold value obtained from ROC analysis in Figure 5; most bona fide glomerular responses are detected properly with this threshold. (ii) Same image clipped with the threshold that would be required to match the observed number of effective odors in mitral cells; in this case many obvious responses in glomeruli get suppressed.

(B) The predicted number of effective odors for a mitral cell, plotted against the detection threshold for glomerular signals. Open circle: threshold value derived from ROC analysis in Figure 5; all thresholds are normalized to this value. Closed circle: threshold that would be required to match the observed number of effective odors in mitral cells (mean of "actual" distribution in Figure 6B). This exceeds by more than 3-fold the reasonable value from ROC analysis (open circle).

(C) A sample mitral cell recording. The firing patterns were analyzed as in Figure 3B, and different thresholds applied. (i) Gray bars denote odor responses that exceed the threshold value chosen by ROC analysis in Figure 4; the sole bona fide response in this segment is detected correctly at this threshold. (ii) odor responses that exceed the threshold required to match the

predicted number of effective odors in Figure 6; this accepts many firing patterns as responses that are indistinguishable from air control stimuli.

(D) The number of effective odors for a mitral cell, plotted against the detection threshold for mitral cell responses. Open circle: detection threshold derived from ROC analysis (Figure 4); all thresholds are normalized to this value. Closed circle: detection threshold that would be required to match the predicted number of effective odors in mitral cells (mean of "predicted" distribution in Figure 6B). This is more than 3-fold lower than the reasonable value from ROC analysis (open circle).

Figure S2. Mitral cell odor spectra and their component glomerular spectra

We modeled the response of a mitral cell by a linear weighted sum of responses from 4 glomeruli (Figure 8, Equations 3 and 6). Top: For the 3 mitral cells from Figure 8i-iii, this illustrates the odor spectra of the 4 chosen glomeruli, each scaled by the corresponding connection strength, w_i in Equation 3. Bottom: The predicted spectrum of the mitral cell (sum of the 4 spectra at top) and the actual observed spectrum (2 repeats).

Table 1. List of all odors.

An alphabetic list of the 63 odors used in this report, along with the number of glomeruli activated per bulb (average of 6 bulbs). Some odors were used too infrequently for a reliable assessment of the number of glomeruli.

Table 2. Lookup table for odor axes in figures.

The first column lists the number that appears on the odor axis in various figures. The other 3 columns contain the corresponding odor. The 40 odors in List A were used in the vast majority of experiments performed, including Figures 5A, 8Biii, 8Biv. List B is for Figure 8Bii. List C is for Figures 7B, 7C, 8Bi.

Figure S1

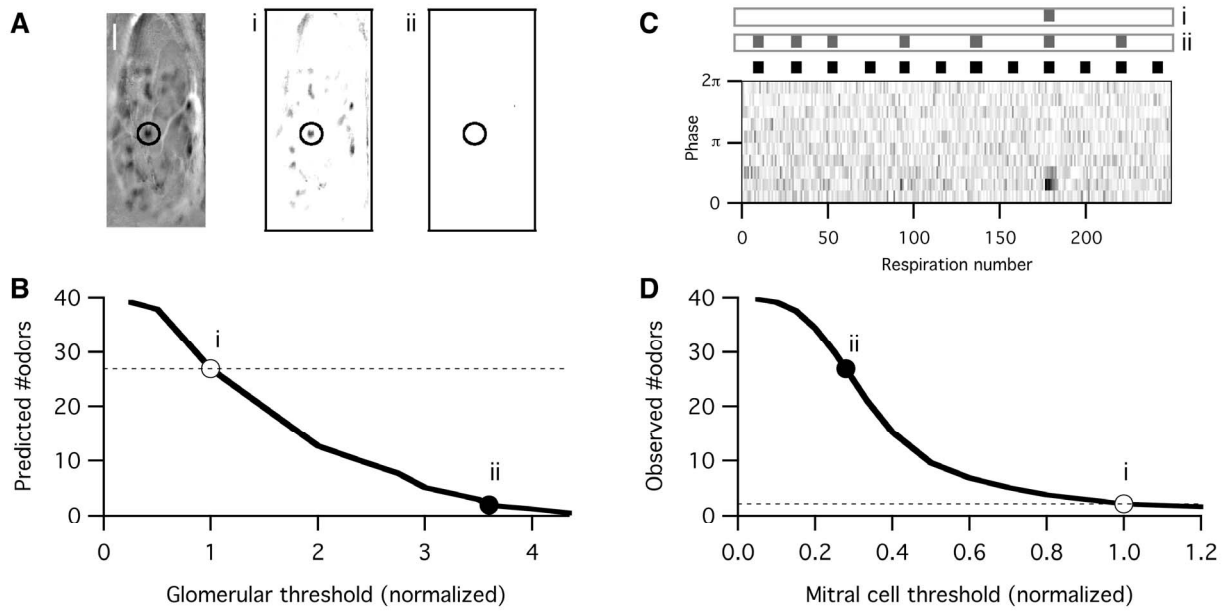

Figure S2

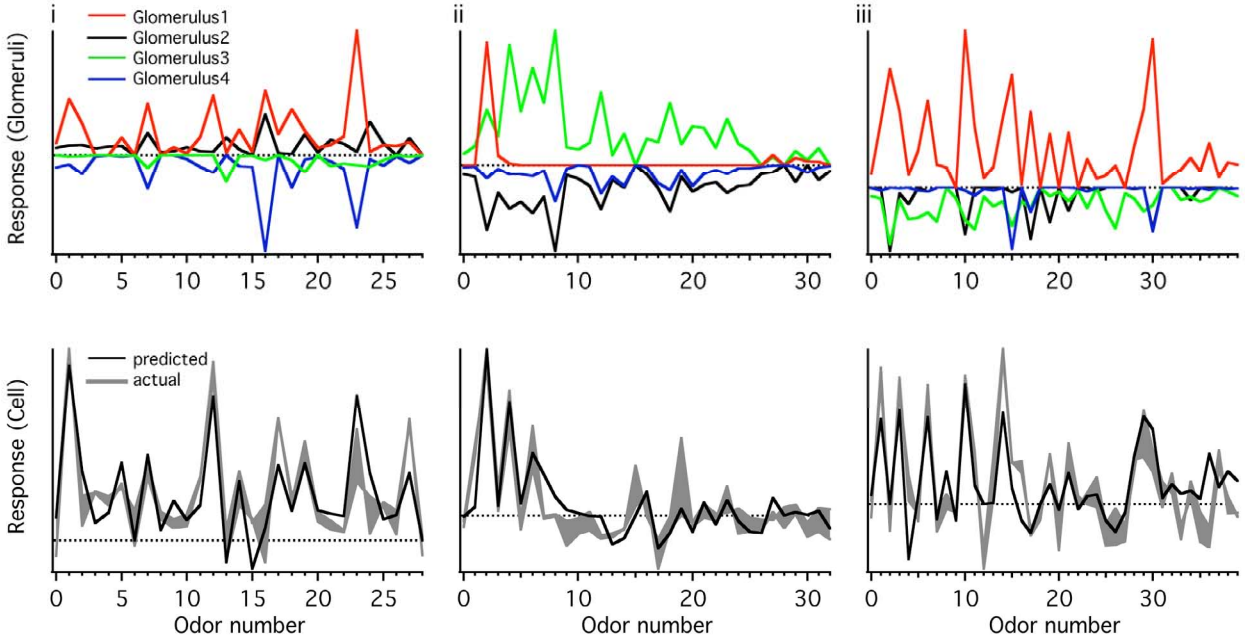

Table S1

Odor Name	Glomeruli
1-butanol	
2,3-diethylpyrazine	
2-ethoxy thiazole	4.3
2-heptanone	20.8
2-hexanone	
2-hexenal	9.3
2-isobutyl thiazole	12.0
2-methyl 3-ethyl pyrazine	1.5
3-acetyl 2,5-dimethyl furan	1.5
3-hexanone	12.8
3-methyl pyrazine	
4-heptanone	17.0
4-methoxyacetophenone	
butyl acetate	10.5
butyl formate	5.0
butyl sulfide	
butyraldehyde	5.0
butyric acid	
camphor	
cineole	1.3
citral	1.2
citronellal	4.5
cyclohexylacetate	3.5
ethyl 2-methyl butyrate	2.5
ethyl butyrate	14.0
ethyl hexanoate	10.5
ethyl octanoate	0.5
ethyl valerate	
fencone	
furfuryl hexanate	
ginger	
heptanal	

Odor Name	Glomeruli
heptanoic acid	
heptanol	
hexanal	
hexanoic acid	1.3
hexanol	1.2
hexyl butyrate	2.3
hexyl tiglate	1.8
isoamyl acetate	13.5
isoamylamine	0.7
isobutyl proprionate	21.0
isopropyl butyrate	
lemon	
methoxy pyrazine	0.8
methyl butyrate	8.5
methyl tiglate	14.0
mineral oil	0.0
nonanal	3.2
nonanoic acid	1.2
nonanol	3.8
nutmeg	
octanal	11.8
octanoic acid	0.2
octanol	6.5
pentanol	
peppermint (10%)	5.5
pine	
propyl tiglate	5.5
pyrrolidine	0.7
valeraldehyde	4.5
valeric acid	0.7
verenone	

Table S2

Odor Number	Odor Name		
	List A	**List B**	**List C**
0	mineral oil	mineral oil	mineral oil
1	peppermint (10%)	peppermint (10%)	peppermint (10%)
2	methyl tiglate	methyl tiglate	butyraldehyde
3	ethyl butyrate	propyl tiglate	butyric acid
4	methyl butyrate	ethyl valerate	pentanol
5	butyraldehyde	isobutyl proprionate	valeric acid
6	propyl tiglate	ethyl hexanoate	hexanol
7	valeraldehyde	isopropyl butyrate	ethyl hexanoate
8	valeric acid	2,3-diethylpyrazine	hexanal
9	hexanol	hexanoic acid	hexanoic acid
10	isobutyl proprionate	heptanol	heptanol
11	ethyl hexanoate	hexyl tiglate	hexyl tiglate
12	hexanoic acid	2-isobutyl thiazole	hexyl butyrate
13	hexyl tiglate	2-heptanone	2-heptanone
14	hexyl butyrate	octanol	heptanal
15	2-isobutyl thiazole	ethyl octanoate	heptanoic acid
16	2-heptanone	3-hexanone	octanol
17	octanol	octanal	2-hexanone
18	ethyl octanoate	2-hexenal	3-hexanone
19	3-hexanone	citronellal	octanal
20	isoamylamine	isoamyl acetate	octanoic acid
21	2-ethoxy thiazole	4-heptanone	nonanol
22	citral	nutmeg	2-hexenal
23	octanal	ginger	4-heptanone
24	octanoic acid	lemon	nonanal
25	nonanol	pine	nonanoic acid
26	2-hexenal	fencone	1-butanol
27	pyrrolidine	butyl sulfide	3-methyl pyrazine
28	citronellal	verenone	furfuryl hexanate
29	isoamyl acetate	ethyl 2-methyl butyrate	
30	4-heptanone	butyl acetate	
31	nonanal	camphor	
32	nonanoic acid	4-methoxyacetophenone	
33	cineole		
34	3-acetyl 2,5-dimethyl furan		
35	butyl formate		
36	cyclohexylacetate		
37	butyl acetate		
38	2-methyl 3-ethyl pyrazine		
39	methoxy pyrazine		