Supplementary Information for:

Receptive range analysis of a mouse odorant receptor subfamily

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Supplementary Table 1.
Composition of odorant mixtures (with CAS numbers) used in Figure 1.

Mixture 1	**Mixture 2**	**Mixture 3**	**Mixture 4**
(-)-carvone (6485-40-1) (-)-isopulegol (89-79-2) (+)-citronellal (2385-77-5) benzyl cinnamate (103-41-3) 1,4-cineole (470-67-7) D-Camphor (464-49-3) trans,trans-2,4-octadienal (5577-44-6)	(-)-carvyl acetate (97-42-7) (-)-citronellal (5949-05-3) (-)-dihydrocarveol (20549-47-7) (-)-limonene (5989-54-8) (+)-carvone (2244-16-8) 2,5-dimethylpyrazine (123-32-0) 2-acetylfuran (1192-62-7) 2-acetylpyridine (1122-62-9)	(-)-menthol (2216-51-5) (-)-carveol (99-48-9) (+)-dihydrocarvone (7764-50-3) (+)-isopulegol (104870-56-6) 2-heptanone (110-43-0) 2-isobutylthiazole (18640-74-9) 2-methylanisole (578-58-5) benzyl salicylate (118-58-1)	(-)-menthone (14073-97-3) (+)-limonene (5989-27-5) 2-nonanone (821-55-6) 2-pentanol (6032-29-7) 4-pentenoic acid (591-80-0) 5-methylfurfural (620-02-0) amyl acetate (628-63-7) α-ionone (127-41-3)
Mixture 5	**Mixture 6**	**Mixture 7**	
anisole (100-66-3) α-pinene (80-56-8) cinnamaldehyde (104-55-2) cinnamic acid (140-10-3) citral (5392-40-5) cuminaldehyde (122-03-2) diethyl succinate (123-25-1) ethyl 2-furoate (614-99-3)	ethyl butyrate (105-54-4) ethyl octanoate (106-32-1) geraniol (106-24-1) geranyl acetate (105-87-3) guaiacol (90-05-1) hydrocinnamaldehyde (104-53-0) isoamyl acetate (123-92-2) isopentylamine (107-85-7)	linalool (78-70-6) phenylacetic acid (103-82-2) piperidine (110-89-4) pyrrolidine (123-75-1) trans-2-hexenal (6728-26-3) trans-2-hexen-1-ol (928-95-0) veratrole (91-16-7)	

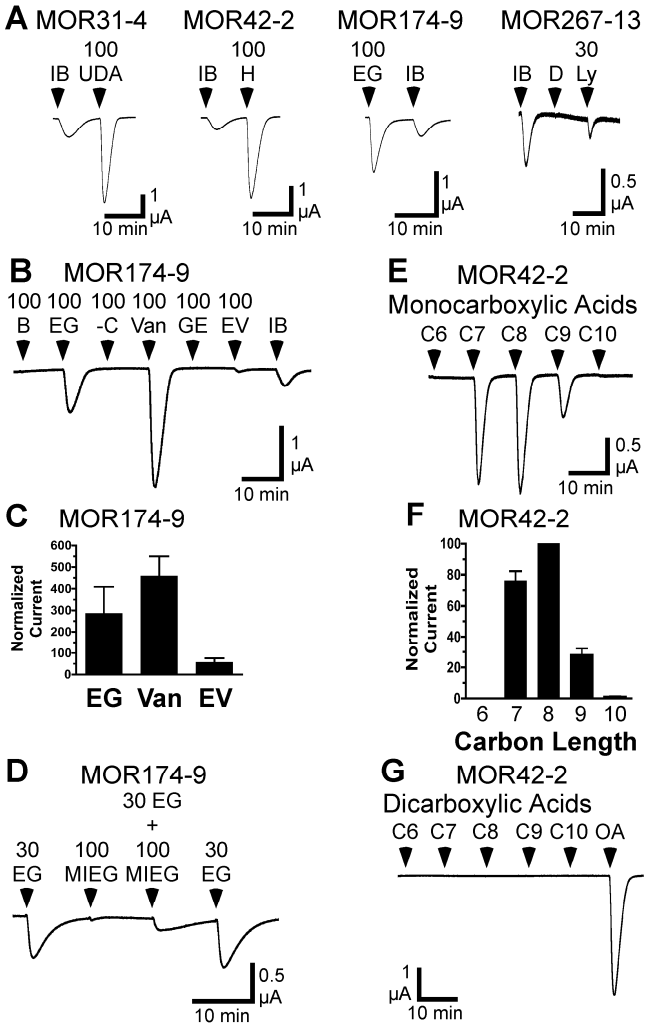
Supplemental Table 2.
Composition of odorant mixtures (with CAS numbers) used in Figure 4. These mixtures contain all of the odorants from Figure 1, plus 101 additional odorants.

Mixture 1	Mixture 2	Mixture 3	Mixture 4
(-)-ambroxide (6790-58-5)	(+)-limonene (5989-27-5)	(-)-menthone (14073-97-3)	(-)-fenchone (7787-20-4)
(-)-carvyl acetate (97-42-7)	2-acetylpyrazine (22047-25-2)	(+)-citronellal (2385-77-5)	(-)-β-pinene (18172-67-3)
(-)-limonene (5989-54-8)	2-acetylthiazole (24295-03-2)	2-acetylpyridine (1122-62-9)	(+)-carvone (2244-16-8)
1-hexanethiol (111-31-9)	2-heptanol (543-49-7)	2-ethoxythiazole (15679-19-3)	(+)-isopulegol (104870-56-6)
2-acetylfuran (1192-62-7)	2-methylanisole (578-58-5)	2-methyl butanal (96-17-3)	2-ethylpyrazine (13925-00-3)
2-methylpentanoic acid (97-61-0)	2-pentanone (107-87-9)	2-nonanol (628-99-9)	2-isobutylthiazole (18640-74-9)
2-pentanol (6032-29-7)	2,3,5,6-tetramethylpyrazine (1124-11-4)	2-nonanone (821-55-6)	2-thiophenethiol (7774-74-5)
2,3-dimethylpyrazine (5910-89-4)	4-pentenoic acid (591-80-0)	2-phenylpropionaldehyde (93-53-8)	2,3-pentanedione (600-14-6)
benzyl salicylate (118-58-1)	allyl butyrate (2051-78-7)	2,5-dimethylpyrazine (123-32-0)	3-heptanol (589-82-2)
butylamine (109-73-9)	anisyl alcohol (105-13-5)	3-heptanone (106-35-4)	3-nonanone (925-78-0)
ethyl octanoate (106-32-1)	cinnamyl formate (104-65-4)	4-allylanisole (140-67-0)	3-phenyl-1-propanol (122-97-4)
furfuryl isopropyl sulfide (1883-78-9)	isopentylamine (107-85-7)	allyl heptanoate (142-19-8)	allyl tiglate (7493-71-2)
linalool (78-70-6)	linalyl formate (115-99-1)	cinnamic acid (140-10-3)	anisole (100-66-3)
methyl phenylacetate (101-41-7)	nerolidol (7212-44-4)	cinnamyl alcohol (104-54-1)	cuminaldehyde (122-03-2)
p-cresol (106-44-5)	propyl disulfide (629-19-6)	citral (5392-40-5)	heptyl butyrate (5870-93-9)
phenethylamine (64-04-0)	propyl formate (110-74-7)	furfuryl heptanoate (39481-28-2)	isobutyl phenylacetate (102-13-6)
piperidine (110-89-4)	pyrrolidine (123-75-1)	geranyl acetate (105-87-3)	phenylacetic acid (103-82-2)
	α-pinene (80-56-8)	guaiacol (90-05-1)	γ-Octalactone (104-50-7)
		propyl mercaptan (107-03-9)	trans,trans-2,4-heptandienal (4313-03-5)
		trans-cinnamaldehyde (14371-10-9)	trans,trans-2,4-octadienal (5577-44-6)
Mixture 5	**Mixture 6**	**Mixture 7**	**Mixture 8**
(-)-carvone (6485-40-1)	(-)-carveol (99-48-9)	(-)-dihydrocarveol (20549-47-7)	(S)-(-)-perillyl alcohol (18457-55-1)
(-)-isopulegol (89-79-2)	(-)-citronellal (5949-05-3)	(-)-menthol (2216-51-5)	1,4-cineole (470-67-7)
(+)-dihydrocarvone (7764-50-3)	(+)-menthone (3391-87-5)	1-octene-3-one (4312-99-6)	2-heptanone (110-43-0)
1-nonanol (143-08-8)	2,4-dimethylthiazole (541-58-2)	4-ethylguaiacol (2785-89-9)	2-methyl pentanal (123-15-9)
1,9-nonanedithiol (3489-28-9)	3-methylthio butanal (16630-52-7)	4-oxoisophorone (1125-21-9)	6-methyl-5-hepten-2-one (110-93-0)
2-mercaptopropionic acid (79-42-5)	3-penten-2-one (625-33-2)	5-methylfurfural (620-02-0)	allyl sulfide (592-88-1)
2-pentylfuran (3777-69-3)	allyl-2-furoate (4208-49-5)	allyl mercaptan (870-23-5)	benzyl cinnamate (103-41-3)
3-octen-2-one (18402-82-9)	anisyl acetate (104-21-2)	benzyl butyrate (103-37-7)	carvacrol (499-75-2)
5-methyl-2-phenyl-2-hexenal (21834-92-4)	cis-4-decenal (21662-09-9)	D-Camphor (464-49-3)	dimethyl anthranilate (85-91-6)
5-phenyl-1-pentanol (10521-91-2)	citronellol (106-22-9)	diethyl succinate (123-25-1)	ethyl butyrate (105-54-4)
amyl acetate (628-63-7)	citronellyl valerate (7540-53-6)	ethyl 2-furoate (614-99-3)	geraniol (106-24-1)
diphenyl ether (101-84-8)	eucalyptol (470-82-6)	farnesol (4602-84-0)	hexyl isobutyrate (2349-07-7)
farnesal (19317-11-4)	heptyl acetate (112-06-1)	hydroxycitronellal (107-75-5)	indole (120-72-9)
isobornyl propionate (2756-56-1)	hydrocinnamaldehyde (104-53-0)	isoamyl acetate (123-92-2)	isopropyl tiglate (1733-25-1)
myrcene (123-35-3)	phenylacetaldehyde (122-78-1)	methyl-2-nonenoate (111-79-5)	o-methoxycinnamaldehyde (1504-74-1)
nonyl acetate (143-13-5)	pinacol (76-09-5)	p-cymene (99-87-6)	p-tolyl acetate (140-39-6)
octyl isobutyrate (109-15-9)	prenyl acetate (1191-16-8)	p-tolyl phenylacetate (101-94-0)	terpinyl formate (2153-26-6)
trans-2-hexenal (6728-26-3)	skatole (83-34-1)	safranal (116-26-7)	thymol (89-83-8)
trans-2-hexenoic acid (13419-69-7)	theaspirane (36431-72-8)	trans-2-methyl-2-pentenoic acid (16957-70-3)	trans-3-hexenoic acid (1577-18-0)
α-ionone (127-41-3)	trans-2-heptenal (18829-55-5)	veratrole (91-16-7)	γ-terpinene (99-85-4)

Supplemental Table 3.
Sequence comparisons for MORs in this study. Amino acid sequences were aligned using ClustalW. Amino acid identity (or identity + similarity) is presented as a percentage for each pair of receptor sequences.

	263-3	**263-9**	**263-10**	**104-2**	**165-2**	**171-17**
263-2	48 (62)	48 (62)	48 (62)	42 (62)	41 (61)	43 (61)
263-3		90 (93)	91 (94)	40 (57)	38 (55)	39 (54)
263-9			90 (93)	39 (57)	38 (54)	39 (55)
263-10				40 (58)	38 (55)	40 (55)
104-2					38 (58)	40 (61)
165-2						60 (72)

Supplementary Figure 1. Functional expression of MORs without an N-terminal extension. A, Oocytes expressing MOR31-4, MOR42-2, MOR174-9, or MOR267-13, as well as $G\alpha_{olf}$ and CFTR, were challenged with 15 sec applications of 1 mM IBMX (IB) and a cognate ligand: 100 µM undecanedioic acid (UDA) for MOR31-4, 100 µM heptanoic acid (H) for MOR42-2, 100 µM eugenol (EG) for MOR174-9, 30 µM lyral (Ly) for MOR267-13. The oocyte expressing MOR267-13 was also exposed to 0.06% DMSO (D). **B)** An oocyte expressing MOR174-9, $G\alpha_{olf}$ and CFTR was challenged with 100 µM butanol (B), eugenol (EG), (-)-carvone (-C), vanillin (Van), Geraniol (GE), ethyl vanillin (EV) and 1mM IBMX. **C)** Responses of MOR174-9 expressing oocytes to eugenol, vanillin and ethyl vanillin (each at 100 µM) are normalized to the response of the same oocyte to 1 mM IBMX (mean ± SEM, n=6-10). **D)** An oocyte expressing MOR174-9, $G\alpha_{olf}$ and CFTR was challenged with 30 µM eugenol (EG), 100 µM methylisoeugenol (MIEG), 30 µM eugenol plus 100 µM methylisoeugenol, followed by 30 µM eugenol again. Responses to eugenol in the presence of 100 µM methylisoeugenol were 36 ± 3% of the response to eugenol alone (mean ± SEM, n=5). **E)** An oocyte expressing MOR42-2, $G\alpha_{olf}$ and CFTR was challenged with 100 µM of monocarboxylic acids of varying carbon length (C6-C10). **F)** Responses of MOR42-2 expressing oocytes to 100 µM of monocarboxylic acids (C6-C10) are normalized to the response of the same oocyte to 100 µM octanoic acid (mean ± SEM, n=4). **G)** An oocyte expressing MOR42-2, $G\alpha_{olf}$ and CFTR was challenged with 100 µM of dicarboxylic acids of varying carbon length (C6-C10) and octanoic acid (OA).



Supplementary Figure 2. Concentration–response analysis of MOR263-3 activation by *trans*,*trans*-2,4-octadienal (ODL).

Current responses of oocytes expressing MOR263-3, $G\alpha_{olf}$ and CFTR to a range of ODL concentrations were normalized to the response of the same oocyte to application of 1 µM ODL. Normalized data were then fit as described in Experimental Procedures (EC_{50} = 21 ± 6 µM, Hill coefficient = 0.98 ± 0.17, n = 4).