Supplemental Table 1 Odors activating ORNs expressing Or22

	chemical name	mol. formula	MW	vapor pressure	est. ppm EC50 AL	est. ppm EC50 Ant	est. max. AL	est. max. Ant	est. rise time AL [s]	est. rise time Ant [s]	est. fall time AL [s]	est. fall time Ant [s]	est. resp. dur. AL [s]	est. resp. dur. Ant [s]
alcohol	1-butanol	$C_4H_{10}O$	74.10	6.83@23°C[1]	64.62 (58.01; 77.23)	545.02 (489.22; 651.28)	0.613	0.721	0.925	1.405	0.769	2.860	3.245	6.369
	3-methyl-1-butanol	$C_5H_{12}O$	88.12	2@20°C[2]	23.69 (21.26; 28.31)	93.01 (83.49; 111.14)	0.645	0.718	0.909	1.508	0.714	1.801	2.940	4.961
	1-hexanol	$C_6H_{14}O$	102.15	0.98@23°C[1]	20.54 (18.43; 24.54)		0.609	0.725	1.330	3.273	1.810	2.493	4.884	10.490
	E2-hexen-1-ol	$C_6H_{12}O$	100.13				0.607		1.297		1.394		4.898	
	Z3-hexen-1-ol	$C_6H_{12}O$	100.13				0.637		1.437		1.221		0.637	
	4-methyl cyclohexanol (rac)	$C_7H_{14}O$	114.16				0.619		1.843		3.240		7.392	
	1-heptanol	$C_7H_{16}O$	116.17	0.28@23°C[1]	8.53 (7.66; 10.19)		0.614		1.419		1.358		4.567	
	3-octanol	$C_8H_{18}O$	130.20	1@20°C[2]	16.35 (14.67; 19.53)		0.714		1.523		1.824		5.746	
	1-octen-3-ol	$C_8H_{16}O$	128.18	0.46@23°C[3]	1.81 (1.62; 2.16)		0.630	0.750	2.037	4.932	2.595	na	8.057	na
aldehyde	pentanal	$C_5H_{10}O$	86.11	35.63@25°C[3]	1017.27 (913.11; 1215.59)		0.658		0.834		0.649		2.519	
	hexanal	$C_6H_{12}O$	100.13	11.63@25°C[3]	313.76 (281.63; 374.93)		0.728		0.928		0.679		3.120	
	heptanal	$C_7H_{14}O$	114.16	3.89@25°C[3]	0.68 (0.61; 0.82)	10.24 (9.19; 12.23)	0.630	0.692	0.962	1.147	1.321	2.694	4.200	5.207
ester	ethyl acetate	$C_4H_8O_2$	88.08	75.09@23°C[1]	28214.90 (25325.95; 33715.50)		0.597		0.886		0.675		4.308	
	butyl acetate	$C_6H_{12}O_2$	116.12	15@25°C[2]	12.88 (11.56; 15.39)	175.80 (157.80; 210.07)	0.666	0.651	1.213	1.045	0.478	1.614	3.207	4.333
	2-methylbutyl acetate	$C_7H_{14}O_2$	130.15				0.759	0.568	0.965	1.061	0.880	0.409	3.590	2.932
	pentyl acetate	$C_7H_{14}O_2$	130.15	4@20°C[2]	1.20 (1.08; 1.43)	5.10 (4.58; 6.10)	0.726	0.702	1.004	1.280	0.862	1.818	3.560	4.841

	chemical name	mol. formula	MW	vapor pressure	est. ppm EC50 AL	est. ppm EC50 Ant	est. max. AL	est. max. Ant	est. rise time AL [s]	est. rise time Ant [s]	est. fall time AL [s]	est. fall time Ant [s]	est. resp. dur. AL [s]	est. resp. dur. Ant [s]
ester	iso-amyl acetate	$C_7H_{14}O_2$	130.15	4.8@23°C[1]	2.61 (2.34; 3.11)	8.49 (7.62; 10.14)	0.734	0.702	0.877	1.159	0.767	1.585	3.351	4.054
	hexyl acetate	$C_8H_{16}O_2$	144.17				0.708	0.651	0.930	1.415	1.608	2.288	4.234	5.795
	E2-hexenyl acetate	$C_8H_{14}O_2$	142.16				0.648	0.689	1.376	1.524	2.045	3.051	5.456	6.563
	ethyl propionate	$C_5H_{10}O_2$	102.10	36@23°C[3]	42.01 (37.71; 50.20)	936.14 (840.28; 1118.64)	0.668	0.720	0.627	1.112	0.537	0.911	2.502	3.579
	ethyl butanoate	$C_6H_{12}O_2$	116.12	17.3@25°C[3]	0.33 (0.30; 0.40)	20.82 (18.69; 24.88)	0.660	0.688	0.676	0.958	0.410	1.313	2.790	3.585
	ethyl (R)-(-)-3-hydroxy butanoate	$C_6H_{12}O_3$	132.11				0.641	0.732	1.293	1.503	1.839	3.850	4.821	9.288
	ethyl (S)-(+)-3-hydroxy butanoate	$C_6H_{12}O_3$	132.11				0.620	0.780	1.610	4.341	3.139	na	7.472	na
	ethyl 2-methyl butanoate	$C_7H_{14}O_2$	130.15				0.787	0.700	0.842	1.283	0.688	1.843	3.154	4.785
	butyl butanoate	$C_8H_{16}O_2$	144.17				0.752	0.665	1.074	1.449	1.492	1.491	4.275	4.882
	methyl hexanoate	$C_7H_{14}O_2$	130.15	5@30°C[4]	0.004 (0.004; 0.005)	0.10 (0.08; 0.11)	0.682	0.765	1.031	1.796	0.797	3.406	3.654	6.889
	methyl hydroxy hexanoate	$C_7H_{14}O_3$	146.14				0.631		1.435		2.339		6.968	
	ethyl hexanoate	$C_8H_{16}O_2$	144.17	1.68@25°C[3]	0.002 (0.001; 0.002)	0.005 (0.005; 0.006)	0.680	0.613	1.136	0.939	1.587	2.655	4.522	5.947
	ethyl 3-hydroxy hexanoate	$C_8H_{16}O_3$	160.16				0.681	0.792	1.888	4.558	16.953	na	21.877	na
ketone	2-propanone	C_3H_6O	58.06	185.37@20°C[3]	27096.49 (24322.06; 32379.05)		0.728		0.878		0.522		2.834	
	2-butanone	C_4H_8O	72.09	71@20°C[2]	1704.01 (1529.53; 2036.21)		0.699		0.792		0.531		2.553	
	3-hydroxy-2-butanone	$C_4H_8O_2$	88.08	3.75@20°C[2]			0.716		1.355		1.490		4.425	

	chemical name	mol. formula	MW	vapor pressure	est. ppm EC50 AL	est. ppm EC50 Ant	est. max. AL	est. max. Ant	est. rise time AL [s]	est. rise time Ant [s]	est. fall time AL [s]	est. fall time Ant [s]	est. resp. dur. AL [s]	est. resp. dur. Ant [s]
ketone	2,3-butanedione	$C_4H_6O_2$	86.06	52.2@20°C[2]	1939.47 (1740.88; 2317.57)		0.593		1.330		3.059		7.238	
	3-penten-2-one	C_5H_8O	84.10				0.643	0.773	1.045	1.066	0.924	0.679	3.554	3.278
	2-hexanone	$C_6H_{12}O$	100.13	3.34@23°C[1]	39.32 (35.29; 46.98)		0.679		0.763		0.649		2.871	
	3-hexanone	$C_6H_{12}O$	100.13				0.656	0.673	0.941	1.012	0.637	1.007	2.846	3.747
	cyclohexanone	$C_6H_{10}O$	98.12				0.627		0.979		1.234		4.080	
	2-heptanone	$C_7H_{14}O$	114.16	1.25@23°C[1]	8.65 (7.76; 10.33)	97.93 (87.90; 117.02)	0.584	0.663	1.042	1.481	0.842	0.768	3.480	3.661
O	β-butyrolactone	$C_4H_6O_2$	86.06				0.638	0.610	1.247	1.287	1.554	3.352	4.356	7.878
	γ-valerolactone	$C_5H_8O_2$	100.09				0.721	0.823	1.888	5.206	4.912	na	9.849	na

mol. fornula = molecular formula; MW = molecular weight; est. ppm EC50 AL/ant = estimated number of molecules [ppm] eliciting a halfmaximal response in the antennal lobe/on the antenna; est. max. AL/ant = estimated maximum of putative time traces elicited by EC50 for the antennal lobe/antenna; est. rise time AL/ant [s] = estimated rise time of putative time traces elicited by EC50 for the antennal lobe/antenna in seconds; est. fall time AL/ant [s] = estimated fall time of putative time traces elicited by EC50 for the antennal lobe/antenna in seconds; est. resp. dur. AL/ant [s] = estimated response duration of putative time traces elicited by EC50 for the antennal lobe/antenna in seconds; [1] http://www.wcrl.ars.usda.gov/cec/java/jav-vp.htm based on CRC Handbook of Chemistry and Physics, of US Department of Agricultur ; [2] MSDS sheets by Sigma-Aldrich; [3] Beilstein Database; [4] http://physchem.ox.ac.uk/MSDS/ of The Physical and Theoretical Chemistry Laboratory Oxford University

Supplemental Table 2 Non-activating odors of ORNs expressing Or22a

	chemical name	molecular formula	MW	res @ 10^{-2} AL(n)	res @ 10^{-2} Ant(n)
acid	propanoic acid	CH_3CH_2COOH	74.05	0.472±0.045(7)	0.129±0.070(5)
	2-methyl propanoic acid	$(CH_3)_2CHCOOH$	88.08	0.291±0.077(7)	0.118±0.038(5)
	butanoic acid	$CH_3CH_2CH_2COOH$	88.08	0.192±0.042(7)	0.071±0.031(5)
	3-methylbutanoic acid	$(CH_3)_2CHCH_2COOH$	102.10	0.237±0.040(7)	0.016±0.040(7)
	pentanoic acid	$CH_3(CH_2)_3COOH$	102.10	0.134±0.018(7)	0.080±0.027(5)
	heptanoic acid	$CH_3(CH_2)_5COOH$	130.15	0.223±0.034(7)	0.030±0.015(5)
	nonanoic acid	$CH_3(CH_2)_7COOH$	158.20	0.069±0.037(7)	0.033±0.023(5)
alcohol	2,3-butanediol	$CH_3CH(OH)CH(OH)CH_3$	90.09	0.308±0.016(2)	0.021±0.023(5)
	cyclohexanol	$C_6H_{11}OH$	100.13	0.426±0.090(8)	0.474±0.041(16)
	octanol	$CH_3(CH_2)_7OH$	130.20	0.417±0.121(4)	-0.002±0.023(5)
	decanol	$CH_3(CH_2)_9OH$	158.24	0.197±0.055(4)	0.005±0.026(5)
aldehyde	propanal	CH_3CH_2CHO	58.06	0.557±0.097(4)	0.200±0.063(5)
	E2-hexenal	$CH_3CH_2CH_2CH=CHCHO$	98.12	0.320±0.099(5)	-0.006±0.067(4)
	octanal	$CH_3(CH_2)_6CHO$	128.18	0.335±0.093(5)	-0.013±0.025(4)
	decanal	$CH_3(CH_2)_8CHO$	156.23	0.229±0.025(8)	-0.009±0.028(4)
aromatic	phenylacetaldehyde	$C_6H_5CH_2CHO$	120.13	0.065±0.042(3)	0.166±0.032(6)
	salicyl aldehyde	$2\text{-}(HO)C_6H_4CHO$	122.09	0.265±0.038(6)	0.166±0.038(7)
	2-hydroxy-anisole	$2\text{-}(CH_3O)C_6H_4OH$	124.11	0.224±0.073(8)	-0.047±0.052(3)
	4-propenyl anisole	$4\text{-}(CH_3CH=CH)C_6H_4OCH_3$	148.17	0.236±0.050(8)	0.019±0.040(4)
	benzaldehyde	C_6H_5CHO	106.10	0.057±0.034(8)	-0.294±0.162(4)
	4-methoxybenzaldehyde	$CH_3OC_6H_4CHO$	136.12	0.274±0.042(8)	-0.032±0.019(4)
	4-isopropylbenzaldehyde	$(CH_3)_2CHC_6H_4CHO$	148.17	0.246±0.063(8)	-0.009±0.026(4)
	4-methoxybenzene	$CH_3OC_6H_5$	108.12	0.108±0.060(8)	-0.380±0.067(4)
	4-allyl-1,2-dimethoxybenzene	$H_2C=CHCH_2C_6H_3(OCH_3)_2$	178.19	0.203±0.047(6)	0.339±0.040(7)
	2,4,5-trimethoxy-1-propenylbenzene (trans)	$(CH_3O)_3C_6H_2CH=CHCH_3$	208.20	0.298±0.114(6)	0.316±0.053(7)
	benzyl cyanide	$C_6H_5CH_2CN,$	117.13	0.437±0.111(3)	0.026±0.035(14)
	2-phenylethanol	$C_6H_5CH_2CH_2OH$	122.14	0.561±0.071(3)	0.039±0.049(8)
	phenylethanone	$CH_3COC_6H_5$	120.13	0.101±0.032(3)	0.107±0.113(6)

	chemical name	molecular formula	MW	res @ 10^{-2} AL(n)	res @ 10^{-2} Ant(n)
aromatic	eugenol	$4\text{-}(H_2C{=}CHCH_2)C_6H_3\text{-}2\text{-}(OCH_3)OH$	164.16	0.261±0.057(11)	0.274±0.056(7)
	iso-eugenol	$CH_3OC_6H_3(CH{=}CHCH_3)OH$	164.16	0.242±0.057(6)	0.236±0.063(7)
	4-methylphenol	$CH_3C_6H_4OH$	108.12	0.218±0.057(12)	0.321±0.046(7)
	4-ethylphenol	$C_2H_5C_6H_4OH$	122.14	0.261±0.039(6)	0.311±0.063(7)
	2-propylphenol	$CH_3CH_2CH_2C_6H_4OH$	136.16	0.176±0.053(6)	0.300±0.048(7)
	methylsalicylate	$2\text{-}(HO)C_6H_4CO_2CH_3$	152.11	0.153±0.045(4)	0.315±0.051(6)
	3-phenyl-2E-propenal	$C_6H_5CH{=}CHCHO$	132.14	0.271±0.036(3)	0.318±0.055(6)
ester	hexylbutanoate	$CH_3CH_2CH_2CO_2(CH_2)_5CH_3$	172.22	0.176±0.057(9)	0.252±0.061(12
	octyl acetate	$CH_3CO_2(CH_2)_7CH_3$	172.22	0.177±0.023(2)	0.187±0.024(10)
	decyl acetate	$C_{12}H_{24}O_2$	200.27	0.088±0.043(2)	0.141±0.043(12)
K	nonanone	$CH_3(CH_2)_6COCH_3$	142.21	0.109±0.043(7)	0.256±0.049(5)
N	Indole	C_8H_7N	117.13	0.239±0.036(3)	0.135±0.041(8)
O-ring	furfural	$C_5H_4O_2$	96.06	0.129±0.083(6)	0.103±0.052(13)
	acetyl furan	$C_6H_6O_2$	110.08	0.422±0.106(7)	0.491±0.025(15)
	γ-pentyl-γ-butyrolactone	$C_9H_{16}O_2$	156.18	0.115±0.032(8)	0.016±0.034(13)
terpene	(R)-(-)-carvone	$C_{10}H_{14}O$	150.19	0.143±0.045(9)	0.102±0.043(12)
	(S)-(+)-carvone	$C_{10}H_{14}O$	150.19	0.274±0.135(8)	0.045±0.042(13)
	1,8-cineole	$C_{10}H_{18}O$	154.22	0.216±0.070(10)	0.031±0.034(16)
	β-citronellol	$(CH_3)_2C{=}CHCH_2CH_2CH(CH_3)CH_2CH_2OH$	156.23	0.193±0.045(8)	0.159±0.132(4)
	citral	$(CH_3)_2CCHCH_2CH_2C(CH_3)CHCHO$	152.20	0.287±0.035(7)	0.323±0.039(9)
	(S)-(-)-citronellal	$C_{10}H_{18}O$	154.22	0.072±0.017(10)	0.206±0.102(4)
	(1R)-(-)fenchone	$C_{10}H_{16}O$	152.20	0.065±0.041(7)	-0.084±0.057(7)
	geraniol	$(CH_3)_2C{=}CHCH_2CH_2C(CH_3){=}CHCH_2OH$	154.22	0.896± na(1)	0.072±0.043(9)
	geranyl acetate	$C_{12}H_{20}O_2$	196.24	0.178±0.054(7)	0.084±0.056(7)
	(R)-(+)-limonene	$C_{10}H_{16}$	136.21	0.166±0.075(8)	-0.013±0.041(10)
	linalool	$(CH_3)_2C{=}CHCH_2CH_2C(CH_3)(OH)CH{=}CH_2$	154.22	0.146±0.121(9)	0.074±0.040(14)
	(-)-menthone	$C_{10}H_{18}O$	154.22	0.408±0.245(3)	0.008±0.034(9)
	(1R)-(-)-myrtenal	$C_{10}H_{14}O$	150.19	0.496±0.053(3)	0.136±0.035(9)
	(+)-α-pinene	$C_{10}H_{16}$	136.21	0.061±0.023(8)	0.038±0.043(7)

	chemical name	molecular formula	MW	res @ 10^{-2} AL(n)	res @ 10^{-2} Ant(n)
terpene	(R)-(+)-pulegon	$C_{10}H_{16}O$	152.20	0.734±0.112(2)	0.076±0.031(13)
	α-terpineole	$C_{10}H_{18}O$	154.22	0.541±0.084(2)	-0.012±0.030(13)
	(-)-α-thujone	$C_{10}H_{16}O$	152.20	0.283±0.226(3)	0.471±0.041(9)
	α-bisabolol	$C_{15}H_{26}O$	222.32	0.114±0.028(7)	0.152±0.076(9)
	β-caryophyllene	$C_{15}H_{24}$	204.32	0.494±0.059(7)	0.347±0.040(10)
	E,E-farnesol	$(CH_3)_2C=CHCH_2CH_2C(CH_3)=CHCH_2CH_2C(CH_3)=CHCH_2OH$	222.32	0.144±0.053(7)	0.195±0.071(10)
other	heptane	$CH_3(CH_2)_5CH_3$	100.18	0.058±0.029(7)	0.053±0.025(13)
	octane	$CH_3(CH_2)_6CH_3$	114.21	0.112±0.046(7)	0.051±0.040(14)
	nonane	$CH_3(CH_2)_7CH_3$	128.23	0.159±0.048(6)	0.051±0.050(10)
	Z11-hexdecenyl acetate	$C_{18}H_{34}O_2$	282.47	0.053±0.043(7)	0.083±0.025(19)
	Z11-octadecenyl acetate	$C_{20}H_{38}O_2$	310.52	0.161±0.0157 (7)	0.106±0.034(16)
ctrl	mineral oil			0.161±0.016(100)	0.047±0.009(121)
	air			0.130±0.014(100)	0.029±0.007(121)

MW = molecular weight; res @ 10^{-2} AL/ant = normalized mean response ± SEM (n) at a concentration of 10^{-2} [vol/vol] in the AL or on the antenna